4.5 Environmental Evaluation

4.5.1 General

This chapter focuses on the understanding of the environmental legal framework in the Philippines, compliance with environmental requirements for project approval and initial findings on the Case study Expressway.

4.5.2 Legal Framework of Environmental Protection in the Philippines

In the Philippines, environmental legislations are well enacted. Presidential Decree (PD) 1151, 1977, represents the basis of the environmental policy in the country. Known as the Philippine Environmental Policy, it is the first policy in the country that institutionalized the Environmental Impact Assessment (EIA) system. It introduced the concepts of environmentally critical projects (ECPs) and projects within environmentally critical areas (ECAs) which required that these projects should submit an Environmental Impact Statement (EIS) report to the Department of Environment and Natural Resources (DENR). Furthermore, PD 1151 provides that projects declared as an ECP, or projects within an ECA, could not be undertaken or operated without first securing an Environmental Compliance Certificate (ECC). An ECC, therefore, can only be issued to a project which complies with the EIS requirements. In 1982, PD 1586 formally established the EIS system.

In 1996, the DENR issued the EIS procedural manual in its Department Administrative Order No. 37 (DAO 96-37) for a more effective planning and management of environmental issues in the country and to act as a regulatory tool. The manual outlines the required process to proceed with the EIS system and the requirement for the issuance of an ECC for projects approved by the DENR. It was primarily drafted for use by the DENR staff, project components, EIA planners, LGUs, and other concerned groups for smooth implementation of the EIS system.

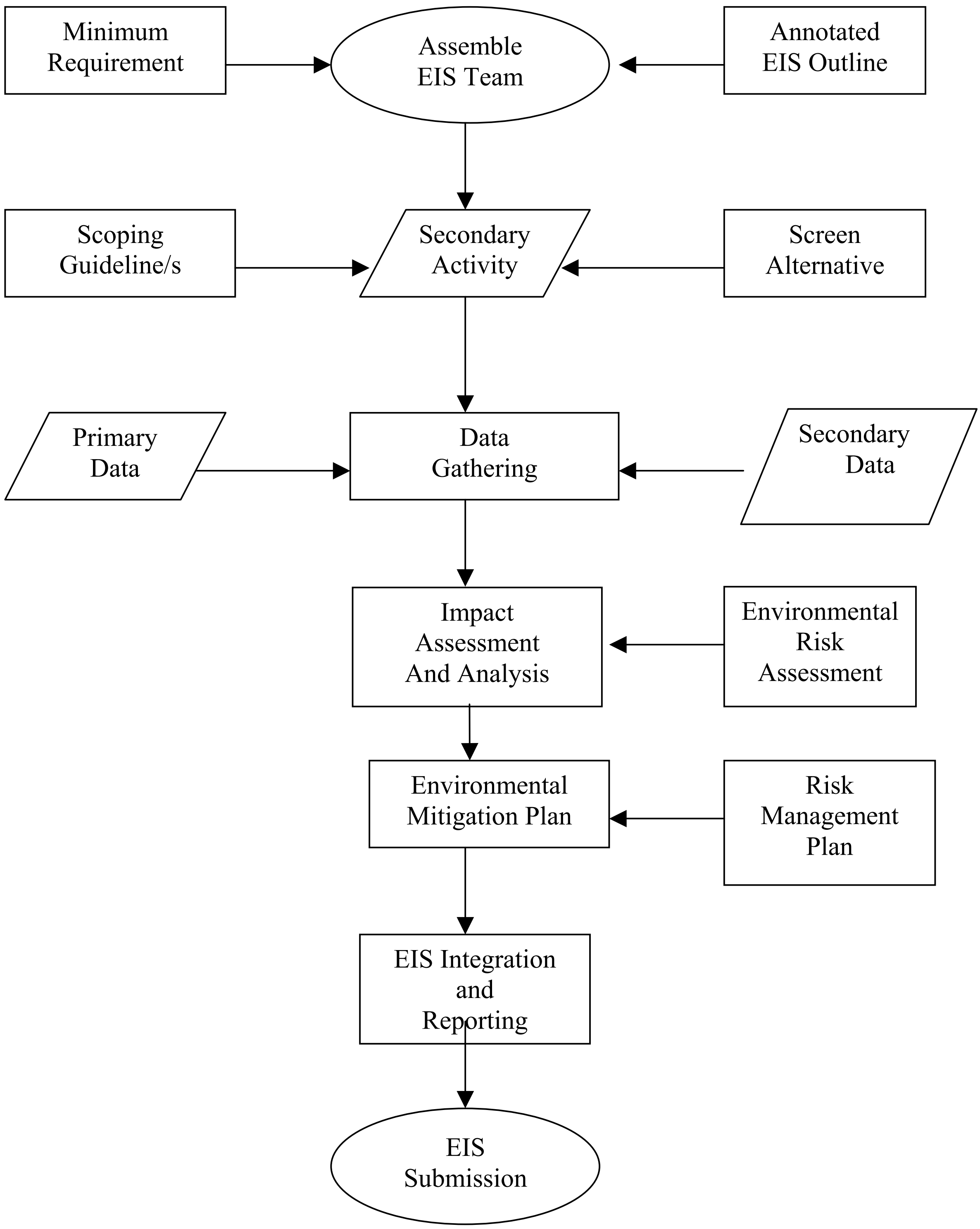
DAO 96-37 was promulgated to address key environmental issues by attaining the following objectives:

1) To ensure that environmental considerations are incorporated at the earliest possible stage of project development.
2) To streamline the current procedures in the conduct of the EIA to improve its effectiveness as a planning, regulatory and management tool.
3) To enhance public participation in the EIA process.

The key features of DAO 96-37 are as follows:

1) Formalization of the scoping process
2) Strengthening of public participation
3) Standardization of the EIS document
4) Standardization of review procedures by establishing the procedural and substantive review criteria
5) Strengthening of environmental monitoring
4) Strengthening of the Environmental Risk Assessment (ERA) for projects that pose significant environmental public risks
5) Accreditation system for EIA preparation (see Figure 4.41)

Figure 4.41 EIS Procedure in the Philippines



Source: DENR

4.5.3 EIA Project Office of the DPWH

The DPWH should conduct the environmental influence survey and measures because environmental impacts could not be disregarded even if a project is small.

On 27 May 1998, the DPWH and the DENR signed the first Memorandum of Agreement (MOA) on mutual cooperation for the implementation of an Initial Environmental Examination (IEE) or an EIS, the appropriate acquisition of an ECC and the monitoring of environmental impacts of DPWH projects.

The importance of the first MOA is that, in accordance with EO 291, series of 1996, the DPWH established the Environmental Impact Assessment Project Office (EIAPO) with a mandate to lead in the preparation, coordination and review of all EIA documents in the DPWH and provide assistance to DPWH central, regional and district offices in the implementation of the EIA process.

In November 2001, an improved MOA was signed between the DPWH and the DENR. This MOA states that for purposes of processing applications for ECCs all DPWH projects shall be screened accordingly to determine the coverage or non-coverage of projects under the EIS System. The coverage of projects shall be guided by the following categories:

a. Projects exempted from the EIS System (such as emergency projects, etc.);
b. Projects that require an IEE (such as the rehabilitation of major/national roads with a length of less than 3 km traversing an area with critical slopes, etc.);
c. Projects that require an IEE (such as the rehabilitation of major/national roads with a length of more than 25 km whose effective width will be increased by 50% without requiring additional ROW, etc.); and,
d. Projects that require a comprehensive environmental impact study (such as the construction of major/national roads with a length of more than 25 km traversing an area with critical slopes, etc.).

This improved MOA mandates the DPWH EIAPO to be responsible for the planning, preparation and development of all EIS system documents, their timely submission to, and coordination with, the appropriate regional DPWH and DENR offices, LGUs and other relevant institutions.

4.5.4 Compliance with the Government of the Philippines' and Donor Agencies' Requirements for Environmental Assessment

(1) Compliance with Investment Coordination Committee Requirements for Projects Requiring Overseas Development Assistance

The Investment Coordination Committee (ICC) is the GOP's inter-agency project appraisal committee under the NEDA. This Committee reviews all proposed projects for ODA financing and recommends them to the President.

(2) Compliance with the Japan Bank for International Cooperation Loan

The Japan Bank for International Cooperation (JBIC) has developed environmental guidelines for ODA loans to guide self-help efforts of developing countries directed toward attaining sustainable development. It is JBIC's policy that the responsibility for environmental protection of a project rests ultimately with the recipient country.

The JBIC guidelines have classified proposed projects into three categories, with the Case Study Expressway falling under Category A which requires an EIA Report. The project will then be evaluated according to the guideline.

Thus, this case-studied project will have to be subjected to an EIA. However, if a conditional EIS approval by the GOP is already acceptable for purposes of JBIC loan application, this will be a precedent.

4.5.5 Initial Environmental Findings on the Case Study Expressway

This section presents preliminary environmental consideration based on a reconnaissance of the Case Study Expressway. Figure 4.42 shows the present situation of these roads. Figure 4.43 shows the location of these pictures.

Figure 4.42 Current Environmental Situation along the Case Study Expressway


Informal houses – R10


Flood – R10


Smoky Mountain – R10


Informal houses – R10


Near the intersection of C3 from R10


Informal houses – C3


Central green belt – C3


PNR-C3 Crossing

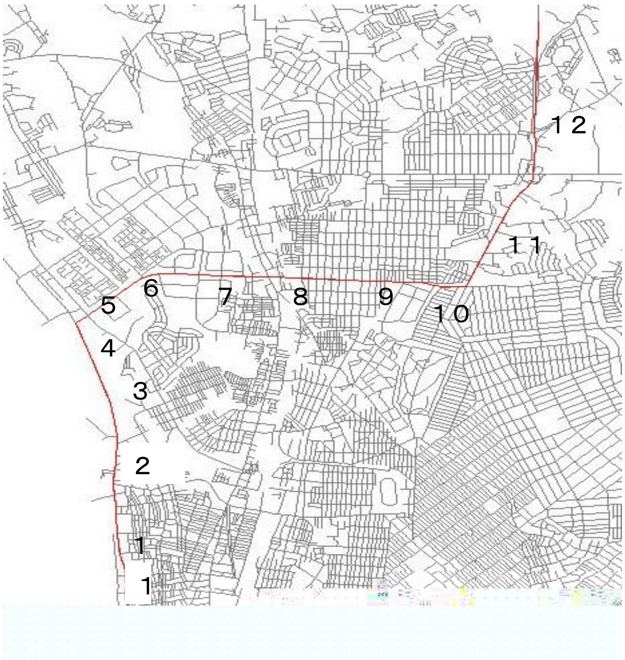

Narrow road - W-5h of C3


Central green belt – C3


Central green belt – R9


Near bus stop – R9

Figure 4.43 Location of Figure 4.42



(1) Route R10

Zaragoza Street to C2

Landside - Squatter houses are built along the roadside. The R10 roadside has doorways, laundry area and storefronts of informal houses. If the improvement project of R10 is executed, the resettlement of these squatters is needed.

Seaside - The red brick wall of the Manila North Port and trees of about 3 m in height are planted along the wall. Inside the walled area are many container yards and port facilities.

C2 to Estero de Vitas Bridge

Landside - An area about 10 m wide along R10 was cleared of informal dwellers, although many remain in the vicinity of the C2 road intersection. The open area where they were removed is now used as a parking area for jeepneys and trucks, and in some portions, informal dwellers have begun to settle again. Behind areas previously occupied by informal dwellers are apartment buildings for resettled families constructed by the Smoky Mountain Development and Reclamation Project (SMDRP) of the National Housing Authority (NHA). But the road in some places gets flooded during heavy rains because of bad road drainage.

Seaside – Scavengers' huts line the roadside. About 100 m from the roadside are container yards and apartment buildings for resettled informal dwellers from the Smoky Mountain.

Estero de Vitas Bridge to Marala River Bridge

Landside - The SMDRP is under construction. It targets to develop industrial and residential areas in the Smoky Mountain and a new reclamation on the seaside. The Smoky Mountain is a mountain heap formed from garbage. Although there are no informal houses, rainwater including heavy metal effuses from the Smoky Mountain flood the roadside during heavy rains.

Seaside - There is no impediment problem. Located here is a warehouse and a Makro Supermarket enclosed by a fence. The warehouse belongs to the Manila Harbor Center, a private cargo distribution center.

Marala River Bridge to C3

Landside - Informal houses are built along the roadside from the bridge down. A pond forms from about 100 m to the C3 entrance where drain water gathers. During heavy rains the road gets flooded when the pond overflows.

Seaside - Some factories are located here and an electric transformer substation enclosed by walling.

(2) Route C3

R10 to Navotas River Bridge

For this segment, a central separation and a vegetation belt exist, and street trees of about 5 m in height are planted. During implementation of the Case Study Expressway the trees may have to be relocated. There are few problems on the environmental maintenance of the road, although the maintenance of the pavement and street trees is necessary.

South side - A factory site and a container yard are located here.
North side - There are some informal houses from the intersection of R10 and C3 to about 50 m ahead. After this there is level land and warehouses.

Navotas River Bridge to Dagat-dagatan Avenue

A central separation and a vegetation belt exist here. Trees of about 3 m in height are also planted. From the bridge to about 200m on both sides of the road up to its edge informal houses exist.

From the area occupied by informal dwellers to Dagat-dagatan Avenue and at both sides of the road there exist many commercial shops, factories and warehouses.

Dagat-dagatan Avenue to A. Mabini Avenue

A central separation and a vegetation belt exist, and trees of about 3 m in height are planted. At both sides of the road are commercial shops, factories, warehouses, and private houses.

There are no environmental issues in this segment.

Mabini Avenue to PNR Crossing

Informal houses exist even up to the road edge but the road is wide. The vicinity of the PNR crossing is lower than its surrounding area. During heavy rains the area gets flooded up to waist level due to the inflow of rainwater from surrounding areas and poor drainage system.

PNR Crossing to LRT 1 Crossing (including 5th Avenue)

Although the road is wide (six lanes) from the railway crossing to about 100 m ahead, informal houses are built up to the road edge, narrowing the road width to only two lanes from thereon. Shops, small repair factories and private houses are built up to the road edge. If C3 will be improved, the resettlement of these houses and their habitants will be needed.

LRT Crossing (Rizal Avenue) to R9 (A. Bonifacio Avenue)

The six-lane road and its pavement are maintained and in good condition. Trees of about 3 m in height are planted in the central separation and vegetation belt. Environmental problems are few except for air pollution and noise. Shops and private houses are located at both sides of the road and some pavement sections are used as storefronts and cargo loading areas.

(3) Route R9

C3 Road to Epifanio de los Santos Avenue

The eight-lane road is maintained and in good condition. There is a central separation and vegetation belt. Buildings of about 20 to 30m tall line both sides of the road in the commercial zone. Maintenance of the right and left pavements is insufficient and in some areas the pavement is used as storefront and cargo loading areas. In this segment the road width is insufficient to accommodate traffic demand; thus, traffic jams regularly occur. Environmental problems are few except for air pollution and noise.

Epifanio de los Santos Avenue to Toll Gate

The eight-lane road is maintained and in good condition. There is a central separation and a vegetation belt. A fence exists on the right side towards the toll gate. Inside the fence, private houses and shops exist. In this segment the road width is insufficient compared with traffic demand. Traffic jams often occur especially because of the disorderly stopping of buses at a bus stop. A market, small shops and squatter houses exist in the vicinity of the bus stop. A concrete wall exists on the left side towards the toll gate. Inside are warehouses, factories and private houses.

(4) R10/C5 Link

C3 to Navotas River Bridge

Roadside - Many informal houses along R10 have already been leveled for road expansion.

Seaside - Well-maintained walls exist and the pavement is well maintained. A lot of trees are planted up to about 200 m up to the Navotas River Bridge.

Navotas River Bridge to Tonsuya River Bridge

Fishermen’s informal houses exist along the Navotas River. Many commercial shops and maintenance factories are located along the road. The road and pavement are maintained and in good condition. Retail stores on pedestrian passes are now few.

Tonsuya River Bridge to Dagat-dagatan Avenue

Some areas along the road edge are occupied by squatter houses. The environment of this road is roughly good. There is a central green belt and a lot of trees of about 5 m height planted up to about 300 m to the crossing with Dagat-dagatan Avenue. Table 4.29 shows the initial environmental findings and impacts of the proposed segment along route R10/C3/R9 including the R10/C5 link.

Table 4.29 Initial Environmental Findings on and Impacts by the Case Study Expressway

Route	Segment	Initial Findings	Impacts
R10	Zaragoza St. to C-2	Landside - The informal houses are built along the roadside.	• Relocation • Traffic • Air pollution, noise
	C-2 to Estero de Vitas Bridge	Landside - Informal houses were removed from an area of about 10m in width along the road, but others remain in the vicinity of the C2 road intersection. The road in some places is flooded during heavy rains. Seaside - Informal houses of scavengers are built along the roadside.	• Relocation • Flood • Traffic • Air pollution, noise
	Estero de Vitas Bridge to Marala River Bridge	Landside - There is open landfill for reclamation. This mountain is formed by garbage erosion. Rainwater including heavy metals flow into the roadside.	• Erosion • Pollution from heavy metals • Traffic • Air pollution, noise
C3	Marala River Bridge to C-3	Landside - Informal houses stand along the roadside. There is a pond where drain gathers from about 100m in this side to the C3 road entrance. During heavy rains flooding occurs when the pond overflows.	• Relocation • Flood • Traffic • Air pollution, noise
	Navotas River Bridge to Dagat-dagatan Ave.	From the bridge to about 200m, informal houses are built up to the road edge and the pavement does not function in this section. There is a central separation belt, and street trees of about 3m in height are planted.	• Relocation • Flora (trees)
	Dagat-dagatan Ave. to A. Mabini Ave.	There is a central separation belt, and street trees of about 3m in height are planted. There are commercial shops, factories, warehouses, and private houses. There are no environmental problems except for air pollution and noise.	• Flora (trees) • Traffic • Air pollution, noise
	A. Mabini Ave. to PNR Crossing	Informal houses are built up to the road edge. The vicinity of the national railway crossing in heavy rains gets flooded up to the waist.	• Relocation • Flood • Traffic • Air pollution, noise
	PNR Crossing to LRT Crossing (Rizal Ave.), W 5th Ave.	Though the width of road is wide (6 lanes) from the railway crossing to about 100m ahead, the informal houses are built to the road edge. The width of road has narrowed rapidly (2 lanes) from the place ahead. The shops, small repair factories and private houses are built on the edge of road.	• Relocation • Flora (trees) • Traffic • Air pollution, noise
	LRT Crossing (Rizal Ave.) to R9 (A. Bonifacio Ave.), E 5th Ave.	The road and pavement are maintained in good condition. The street trees of about 3m height are planted in the central separation belt and issues on environment are few except for air pollution and noise.	• Flora (trees) • Air pollution, noise
R9	C-3 to EDSA	The road width is insufficient compared with traffic demand, traffic jams often occur. The issues on environment are few except for traffic jam, air pollution and noise.	• Traffic • Air pollution, noise
	EDSA to Toll Gate	The width of road is insufficient compared with traffic demand. Traffic jams often occur, especially in the vicinity of a bus stop.	• Traffic • Air pollution, noise
R10/C5 Link	C3 to Navotas River Bridge	Roadside - There are many informal houses along R10, although the part is leveled for road expansion. Seaside - There are beautiful walls in good condition and the pavement is maintained.	
	Navotas River Bridge to Tonsuya River Bridge	There are fishermen's informal houses along Navotas River and many commercial shops and maintenance factories along the road. The road is maintained and in good condition.	
	Tonsuya River Bridge to Dagat-dagatan Avenue	Informal houses occupy a part up to the road edge. There is a central green belt and a lot of street trees of about 5m in height.	

4.5.6 Environmental Screening and Scoping According To JICA/JBIC Guideline

The JICA prepared the "JICA Guidelines for Environmental Consideration in Social Development Study" as a guide for determining the necessity of a detailed EIA whenever a development study is conducted. The contents of JICA's guidelines cover a project's initial stages up to the preliminary environmental survey which focuses on screening and scoping. The guidelines are designed as reference for drawing up pre-survey (Scope of Work or SW) reports and work instructions to be used when participants of JICA SW teams consolidate their findings on the short-term preparatory studies. The work instruction report gives instructions on how to conduct the IEE and the EIA which reflects evaluation results from screening and scoping and concretely states the items subjected to environmental surveys.

The contents of the JBIC guidelines include environmental items that borrowers need to consider in planning and preparing for loan application when they examine the case as a subject for investment and lending after the EIA has been conducted during the full-scale survey. The guidelines focus on environmental items to be checked and their explanations.

Therefore, the IEE based on the JICA environmental guidelines differ from the IEE or the EIS system in the Philippines. According to the Philippines' EIS system, the IEE is not required in ECPs like this case study project and the EIA (EIS in the Philipines) shall be carried out directly.

(1) Environmental Screening

Screening is defined as "the determination whether the development project requires the performance of an environmental impact assessment". Since screening is the first evaluation, this examination should be done at the earliest stage. Screening investigations must be carried out for each and every environmental component. Table 4.30 lists the existence of impact, the necessity of EIA for overall assessment and the background which leads to the judgement.

Table 4.30 Results of Initial Environmental Screening Using JICA Guidelines

Screening (JICA-IEE)

No.	Environmental Item	Description	Evaluation	Remarks (reason)
Social Environment				
1	Resettlement	Resettlement by occupancy of proposed land	Yes	Informal houses on R10 and private houses on C3 exist
2	Economic Activities	Loss of productive opportunity such as land	Yes	Various economic activities exist in the Case Study Expressway
3	Traffic and Public Facilities	Effect on existing traffic such as congestion	Yes	Narrow section of 5th Avenue segment of C3, traffic jam on all roads
4	Split of Communities	Split of communities as a result of obstruction of traffic	Unknown	Scavenger union along R10
5	Cultural Property	Loss of cultural property and falling of values	No	No cultural heritage is identified in the Case Study Expressway
6	Water Rights and Rights of Common	Obstruction of fishing rights, water rights, and common rights of forest	Unknown	Right of scavenger union along R10
7	Public Health Condition	Deterioration of a hygienic environment by production of refuse and noxiousness	No	Large refuse amount will not be produced
8	Waste	Occurrence of waste dumps and solid waste	Yes	Some construction waste of dumps will be produced
9	Hazards	Increased possibility of danger of landslide and accident	Yes	Measures for flooded roads in heavy rain along R10/C3
Natural Environment				
10	Topography and Geology	Change of topography and geology by excavation or filing works	No	No large scale structure or earthwork
11	Soil Erosion	Surface soil erosion by rainwater after land development (vegetation removal)	Unknown	Influence of soil erosion from Smoky Mountain to R10
12	Ground Water	Change of distribution of ground water by large scale excavation	No	There is no earthwork with large scale excavation
13	Hydrological Situation	Change of river discharge and riverbed condition due to landfill and drainage	No	No earthwork affected to hydrological situation
15	Flora and Fauna	Obstruction of breeding and extinction of spices due to change of habitat condition	Yes	Existing of street trees to be cut or replanted along C3/R9
16	Meteorology	Change of temperature, precipitation, wind, etc., due to large-scale development	No	No large-scale development affecting meteorology
17	Landscape	Change of topography by development and harmonious obstruction by structure	Unknown	Existing urban landscape may be affected by project
Pollution				
18	Air Pollution	Pollution caused by exhaust gas or toxic gas from vehicles and factories	Yes	Impact by exhaust gas from increasing traffic
19	Water Pollution	Pollution by inflow of silt, and effluent into rivers and ground water	Unknown	Discharge water/facilities, rain water /Smoky Mountain
20	Soil Contamination	Contamination of soil by dust and chemicals	Unknown	Soil included heavy metals in vicinity of Smoky Mountain
21	Noise and Vibration	Noise and vibration generated by vehicles	Yes	During construction and operation
22	Land Subsidence	Land subsidence due to the lowering of ground water	No	Sensitive lands do not exist in the subject area
Overall evaluation		Environmental Impact Assessment (EIA) is required or not	From the results of the evaluation, EIA is required.	

Social Environment

Resettlement. The landside of R10 is occupied up to the road's edge by a lot of informal dwellers. Moreover, the 5th Avenue part of C3 has narrowed. When this project is executed, these residents should be removed. Therefore, measures for the conversion of rights of residences and land ownership will be needed. So this item requires a detailed EIA.

Economic Activities. There are various economic activities along the Case Study Expressway. Traffic flow, distribution of cargos and the overall economic activities in this area will improve with the implementation of this project.

Traffic and Public Facilities. With the implementation of this project, the traffic flow along the Case Study Expressway and the traffic jams on 5th Avenue section of C3 will improve.

Split of Communities. There is no big split of communities along the Case Study Expressway. However, the union of scavengers near Smoky Mountain might break up or be divided upon resettlement of squatters.

Cultural Property. There are no cultural properties along the Case Study Expressway.

Water Rights and Rights of Common. There are no water rights and rights of common except the right of the scavengers' union on R10.

Public Health. This project will not produce a large amount of refuse to affect public health.

Wastes. Since road construction will surely generate wastes, measures will have to be taken such as plans for the collection of used construction materials and dumped soil.

Hazards. With the construction of an elevated road in this project, the new road will not be flooded during heavy rains. But the existing roads, such as the one from C2 to Estero de Vitas bridge of R10 and the C3 and PNR crossing will remain flooded during heavy rains.

Natural Environment

Topography and Geology. There is no distribution of geographical and geological features that are important along the Case Study Expresway. And there will be no change in topography and geology through excavation or filing works because there will be no large-scale structures or earthwork.

Soil Erosion. There will be no surface soil erosion by rainwater because there will be no changes in geographical features. But there is already soil erosion from the Smoky Mountain to R10.

Ground Water. There will be no earthwork with large-scale excavation to affect ground water.

Hydrological Situation. There will be no earthwork to affect hydrological situations such as flow of exhaust water during construction work into marshes or rivers in the vicinity of the construction site.

Coastal Zone. There will be no coastal erosion and sedimentation due to landfill or effects in marine conditions because the project area will be on land.

Flora and Fauna. The street trees along C3/R9 are not vital flora. It will be unavoidable that a part will be cut or replanted when the project proceeds.

Meteorology. There will be no large-scale development that will affect temperature, precipitation and wind.

Landscape. The existing urban landscape might be affected with the construction of this project.

Pollution

Air Pollution. There will be increased exhaust gas from increased number of vehicles when the project starts operation.

Water Pollution. There will be water discharge from road facilities, and the effluents flowing into rivers will not contaminate. But during heavy rains rainwater and heavy metal effuses from the Smoky Mountain will flow into onto R10.

Soil Contamination. No soil contamination will result from the construction of this project. However, there is a possibility of pollution from heavy metals in the vicinity of the Smoky Mountain due to the unprocessing of the open dump.

Noise and Vibration. From the result of a noise survey done 3 m beyond the road edge, it was found out that noise levels were lower than standard. However, the effects have been considered from the noise of construction machines during construction and the noise from vehicles with the increased traffic volume during operation stage.

Land Subsidence. As susceptible lands do not exist in the project area, there will be no land subsidence due to the lowering of ground water level.

Overall Evaluation. From the mentioned screening of environmental items, an EIA will be required.

(2) Environmental Scoping

Scoping involves the following: "among the predictable environmental impacts arising from a development project, select those regarded as significant, and based on these selections, clarify key fields and components of environmental impact assessment". Scoping is practiced based on the comprehensive judgements made during the screening stage. The results of scoping are shown in Table 4.31, and the category for evaluation is divided into four classes (A-D) as described in Note 1, which determines the key fields in the EIA.

In cases where at least one environmental item is graded A, B or C, it is vital to conduct an enviromental study on that particular item.

Social Environment

Resettlement. Squatter houses along R10 and private houses along 5th Avenue on C3 will have to be moved. Therefore, it is necessary to confer with target residents on loss of residence, split of community (barangay), friction among inhabitants after resettlement, and worsening of living standards and to execute measures on these problems. Since serious impact is predicted, evaluation category is A.

Economic Activities. Economic activities will be heightend, especially the movement of cargos to/from the Manila North Port. Although some residents in the squatter area are working at the Manila North Port, the creation of more job opportunities for more residents is expected as economic activities at the Manila North Port become more active. Since a plus impact is predicted, evaluation category is B.

Traffic and Public Facilities. Traffic flow will become good, especially on 5th Avenue on C3. Traffic accidents will decrease because the project road is only for vehicles. Since a plus impact is predicted, evaluation category is B.

Table 4.31 Results of Environmental Scoping by JICA Guidelines

Scoping (JICA-IEE)

No	Environmental Item	Evaluation	Remarks/Reason
Social Environment			
1	Resettlement	A	Informal houses along R10 and private houses along 5th Avenue section of C3 have no option but to resettle.
2	Economic Activities	B (Plus)	Economic activities will become more active, especially the movements of cargoes from/to Manila North Port
3	Traffic and Public Facilities	B (Plus)	Traffic flow will become good, especially on 5th Avenue section of C3
4	Split of Communities	C	In most places, a split of community will not be generated, but split of scavenger union along R10 will be expected
5	Cultural Property	D	No cultural heritage is identified in the Case Study Expressway
6	Water Rights and Rights of Common	C	In most places, there are no issues of water rights and rights of common, but rights of scavenger along R10 will be lost
7	Public Health Condition	D	Large refuse amount will not be produced
8	Waste	B	Some construction waste dumps will be produced
9	Hazards (Risk)	C	The flooded areas along R-10/C-3 will disappear by executing this project
Natural Environment			
10	Topography and Geology	D	No large-scale structure or earthwork
11	Soil Erosion	C	Subject areas are already urbanized, but the soil erosion from Smoky Mountain into R10 is expected.
12	Ground Water	D	There is no earthwork with large-scale excavation
13	Hydrological Situation	D	There is no earthwork that will affect hydrological situation
14	Coastal Zone	D	Project area is on land
15	Flora and Fauna	C	Project sites are urbanized and developed area, so there is no flora and fauna affected by project except street trees.
16	Meteorology	D	No large-scale development affecting meteorology.
17	Landscape	B	Existing urban landscape will be affected by project
Pollution			
18	Air Pollution	B	The exhaust gas from increasing traffic will cause the deterioration of air quality
19	Water Pollution	C	There is discharge of residual water from transport facilities, but this will not affect water quality. Rainwater from the Smoky Mountain will flow into R10.
20	Soil Contamination	C	No activities requiring chemicals, but the soil in the vicinity of the Smoky Mountain will include heavy metals.
21	Noise and Vibration	B	During construction and operation, noise and vibration from construction equipment and increased traffic will cause noise and vibration.
22	Land Subsidence	D	Sensitive lands do not exist in the subject area

Notes 1) Evaluation categories:
- A: Serious impact is predicted.
- B: Some impact is predicted.
- C: Extent of impact is unknown (Examination is needed. Impact may become clear as study proceeds).
- D: No impact is predicted. EIA is not necessary.

2) The evaluation should be made with reference to the explanation of each item.

Split of Communities. In most places, a split in the community will not happen, but a split of the barangay of squatter residents along R10 and the scavengers' union in the vicinity of Since Smoky Mountain will occur although it is unclear yet. Since the extent of impact is unknown (examination is needed to make impact clear), evaluation category is C.

Cultural Property. There are no cultural properties identified on the Case study Expressway. Since no impact is predicted and an EIA is not necessary, evaluation category is D.

Water Rights and Rights of Common. In most places, there are no issues on water rights and rights of common, but the rights of scavengers' union in the vicinity of the Smoky Mountain along R10 will be lost, although yet unclear. Since the extent of impact is unknown (examination is needed to make impact clear), evaluation category is C.

Public Health. The project will not generate a large amount of refuse and it is likely that it will not cause the deterioration of the environment. Since no adverse impact is predicted and an EIA is not necessary, evaluation category is D.

Wastes. Some construction waste dumps will be produced, so the plan and implementation of a treatment plant for construction wastes might be necessary according to law. Since some impact is predicted, evaluation category is B.

Hazards. The flooded areas along R10/C3 are expected to disappear with the execution of this project. But as flood-prone parts will not be directly improved on account of the construction of a viaduct, the impact is unclear. Since the extent of impact is yet unknown (examination is needed to make impact clear), evaluation category is C.

<u>Natural Environment</u>

Topography and Geology. As this project has no large-scale structures or earthwork, there is no impact on topography and geology. Since no impact is predicted and an EIA is not necessary, evaluation category is D.

Soil Erosion. Subject areas are already urbanized, so soil erosion will not occur. But soil erosion from the Smoky Mountain to R10 is beginning to be generated and its impact on R10 is unclear. Since the extent of impact is unknown (examination is needed to make impact clear), evaluation category is C.

Ground Water. There will be no earthwork with large-scale excavation and no impact on ground water. Since no impact is predicted and an EIA is not necessary, evaluation category is D.

Hydrological Situation. There will be no earthwork that will affect hydrological situation such as changes in the flow volume and river beds. Since no impact is predicted and an EIA is not necessary, evaluation category is D.

Coastal Zone. As the project area will be on land, there will be no impact on coastal zones. Since no impact is predicted and an EIA is not necessary, evaluation category is D.

Flora and Fauna. The project area is almost urbanized and developed, so there will be no flora and fauna to be affected. However, cutting or replanting of trees along C3/R9 will be unavoidable. Since the extent and size of impact on street trees are unclear at present (examination is needed to make impact clear), evaluation category is C.

Meteorology. This project is not large scale to affect meteorology. As no impact is predicted and an EIA is not necessary, the evaluation category is D.

Landscape. The existing urban landscape will be affected because of the construction of a viaduct. As some impact is predicted, the evaluation category is B.

<u>**Pollution**</u>

Air Pollution. There will be increased emission of exhaust gas from increased number of vehicles when the project starts operation. As some impact is predicted, a monitoring plan is needed after the inauguration of service. The evaluation category is B.

Water Pollution. There will be discharge of residual water from transport facilities, but this will not affect water quality. Rainwater including heavy metal discharge from the Smoky Mountain will affect sewage water. As the extent and size of impact on sewerage water from Smoky Mountain are yet unknown (examination is needed to make impact clear), evaluation category is C.

Soil Contamination. There are no chemical activities in the project, but the soil in the vicinity of the Smoky Mountain will possibly be contaminated with heavy metal discharge. Since the extent of soil contamination in the vicinity of the Smoky Mountain is unknown at present (examination is needed to make impact clear), evaluation category is C.

Noise and Vibration. During construction and operation, noise and vibration from construction equipment and increased traffic will cause noise and vibration. Since some impact is predicted, a monitoring plan is needed after the inauguration of service. Evaluation category is B.

Land Subsidence. Lands susceptible to subsidence do not exist in the project area. Since no impact is predicted and an EIA is not necessary, evaluation category is D.

4.5.7 Results of Air and Noise Pollution Simulation Models

Republic Act 8749 of 1998 established the Philippine standards for ambient air concentrations as listed in Table 4.32.

Table 4.32 National Ambient Air Quality Guideline for Criteria Pollutants

Pollutants	Short Term[a]			Long Term[b]		
	$\mu g/m^3$	ppm	Averaging Time	$\mu g/m^3$	ppm	Averaging Time
Suspended Particulate Matter [c]						
TSSP	230 d		24 hours	90		1 year e
PM-10	150 f		24 hours	60		1 year e
Sulfur Dioxide [c]	180	0.07	24 hours	80	0.03	1 year
Nitrogen Dioxide	150	0.08	24 hours			
Photochemical Oxidants as Ozone	140 60	0.07 0.03	1 hour 8 months			
Carbon Monoxide	35 mg/Ncm 10 mg/Ncm	30 9	1 hour 8 hours			
Lead [g]	1.5		3 months [g]	1.0		1 year

[a] Maximum limits represented by ninety-eight percentile (98%) values not to exceed more than once a year.
[b] Arithmetic mean
[c] SO_2 and suspended particulate matter are samples once every six days when using the manual methods. A minimum of 12 sampling days each quarter or 48 sampling days each year is required for these methods. Daily sampling may be done in the future once continuous analyzers are procured and become available.
[d] Limits for total suspended particulate matter with a mass median diameter of less than 25-50 µm.
[e] Annual Geometric Mean.
[f] Provisional limits for suspended particulate matter with mass median diameter less than 10 microns and below until sufficient monitoring data are gathered to base a proper guideline.
[g] Evaluation of this guideline is carried out for 24-hour averaging time and averaged over three moving calendar months. The monitored average value for any three months shall not exceed the guideline value.

This section illustrates the results of simulation analysis against Philippine standards of future concentrations of NO_x and SPM (identified critical pollutants for the Case Study Expressway. Noise levels also identified as critical for the Case Study is also analyzed.

DPWH-EIAPO Air and Noise Pollution Simulation Models

(1) Background

The DPWH-EIAPO model for emission of various pollutants was developed by Carlbro International in March 1998. The model was developed for the DPWH-EIAPO in relation to a study on the cause and effect of traffic, noise and air pollution and on mitigation of traffic-caused pollution.

(2) Air Pollution Model Description

The DPWH-EIAPO Air Pollution Model is MapInfo™-based. Inputs in the model are:

1) Age of vehicles at each link
2) Traffic volume at each link
3) Traffic speed at each link
4) Emission factors
5) Network configuration

The output of the model is a pollution concentration at any point in the network. Using Vertical Mapper™, the model output is presented as isometric lines showing points in the network with equal pollution concentration.

The Model can simulate the following pollutants:

1) CO (carbon monoxide)
2) CO_2 (carbon dioxide)
3) NO_x (nitrogen oxides, mainly NO and NO_2)
4) HC (hydrocarbons)
5) PM (particulate matter)

The following is the functional model used in the simulation system:

$$C_i = Co_i + K_i \left[\sum_j Q_j e_{i,j} \right] \frac{v_s}{v} \exp\left(-\alpha x + \beta_i - \gamma_i t\right)$$

where Ci	concentration of pollutant *i* at the distance *x* from road center [mg/m^3] x meters
t	average vintage of vehicles as years since 1980
$C_{0,i}$	background concentration of pollutant *i* [mg/m3]
K_i	conversion factor between emission and omission [h/m2]
Q_j	traffic flow as peak hour average for vehicle category *j* [vehicles/h]
e_{ij}	emission per vehicle per unit distance driven [mg/m/vehicle]
V	average velocity of vehicles at peak hour [km/h]
V_s	standard velocity at which e_{ij} and β_i has been estimated [km/h]
α,β,γ	coefficients

(3) Noise Pollution Model Description

The DPWH-EIAPO Noise Pollution Model is MapInfo™-based. Inputs in the model are:

1) Traffic volume at each link
2) Traffic speed at each link

The outputs of the model are the noise level at any point in the network. Using the Vertical Mapper™, the model output is presented as isometric lines showing points in the network with equal noise levels.

The following is the functional model used in the simulation system:

$$L_j(x) = L_{0,j} + 10\log_{10}\frac{Q_j}{1000vx} + 0.2v \quad (10m < x < 200m; v > 10kph)$$

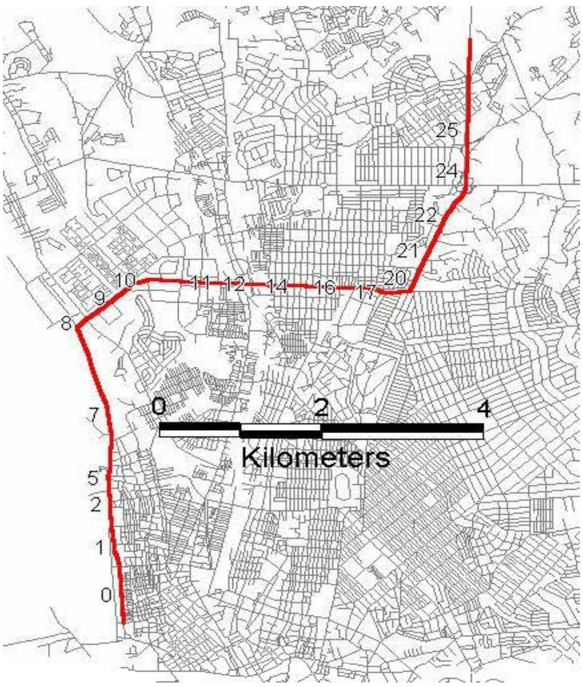
The overall road segment noise, *L*, can be estimated from individual vehicle types by aggregating, as follows:

where $L_j(x)$	is the noise level at a distance *x* [m] from road center originating from vehicle type *j* [dB(A)$_{eq}$]
L_{0j}	noise level from one vehicle type *j* extrapolated to $x = 0$ (specific emission) [dB(A)$_{eq}$]
Q_j	traffic flow as hourly average for vehicle category *j* [vehicle/h] v average velocity of vehicles [km/h]

Results of Simulation Using DPWH Model

The object of examination of air pollution and noise is R10/C3/R9 as shown below.

Figure 4.44 R10/C3/R9 Route and Sections Examined by the DPWH Model



(1) Air Pollution

Air pollution and noise are observed at the Makro Store in the vicinity of Smoky Mountain along R10 and at La Loma Cemetery along C3. The observation items of air pollution are NO_2 and SPM (suspended particle matter).

The results of calculations using the DPWH model (which used current traffic data of current state) and through observation were compared to verify the accuracy of the DPWH model and the parameter corrections. The parameters of speed correction factors, emission factors (based on the report from UP-NCTS), background concentration, conversion factors, and distance parameters were corrected. As a result, the calculated values became almost equal to the NO_x and SPM concentrations observed in actual situations. The unit of concentration is 1hour/24hour (average value for one hour per day). NO_x and SPM simulation results are shown in Figures 4.45 and 4.46, respectively.

Figure 4.45 Result of Modification on NO_X

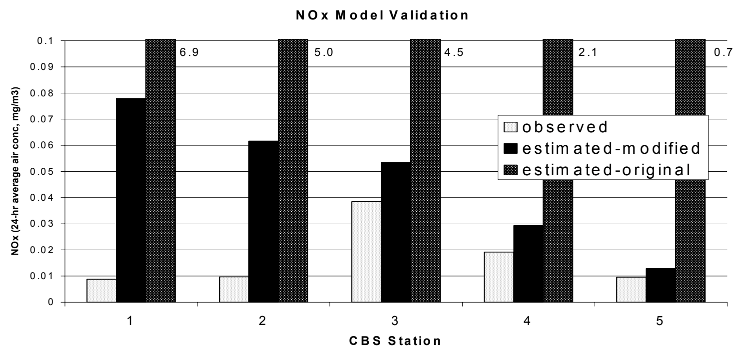
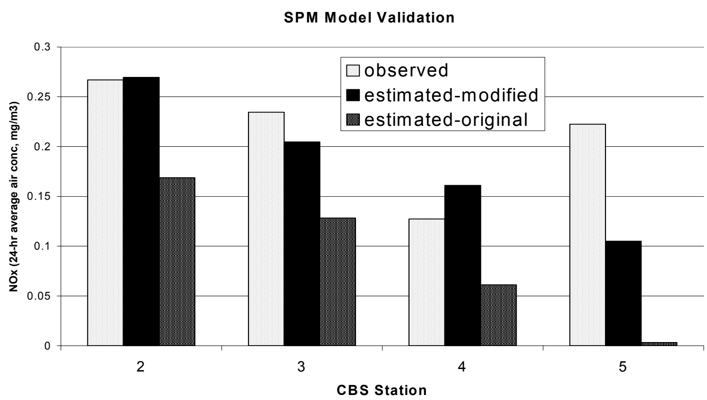


Figure 4.46 Result of Modification on SPM



Note: To validate the data, field measurement from the Cavite Busway System Study (2002) is used.

The modified DPWH model was then used to simulate NO_x and SPM concentration (see Figure 4.47 to 4.50) using forecasted traffic volumes.

NO_X (Figures 4.47 and 4.49)

R10. In 2002, the pollution concentration on all routes was less than 0.06 mg/m^3. In 2015, pollution concentration at the road edge will reach around 0.1 mg/m^3, deteriorating a little but still meeting the environmental standard.

C3. In 2002, pollution concentration on all routes was less than 0.06 mg/m^3. As traffic volume was less than in other sections, the pollution concentration on Section 14 of 5th Avenue was 0.04 mg/m^3. In 2015, the pollution concentration at the road's edge will become more than 0.1 mg/m^3. Especially, on 5th Avenue pollution will worsen because traffic volume will greatly increase; however it will still be within standards.

R9. In 2002, pollution on the routes between Section 24 and the toll gate as well as from the road edge to about 40 m exceeded the environmental standard. In 2015, all segments will exceed the environmental standard. Between Section 24 and the toll gate environmental pollution will further deteriorate. In the vicinity of Section 24, pollution concentration from the road's edge to about 60 m will exceed the environmental standard.

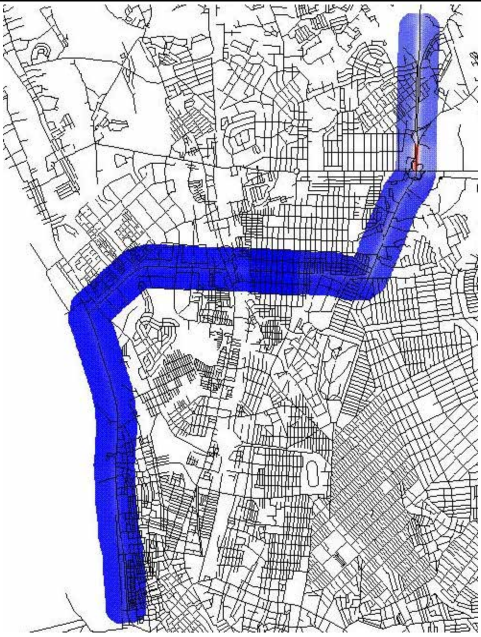
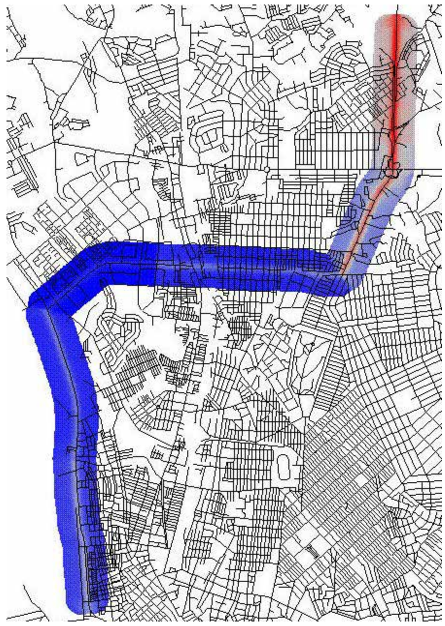
SPM (Figures 4.48 and 4.50)

R10. In 2002, 24-hour average SPM concentration exceeded standards at its southernmost segment but extends only within a short distance from the road's edge. The rest of the segments of R10 slightly exceeded standard for SPM. In 2015, increased traffic will exacerbate the situation to the point that the entire R10 section will fail the standards and the SPM concentration will exceed standards up to around to 10meters from the road's edge.

C3. In 2002, the 24-hour average SPM concentration slightly exceeded the standard. Due to lower traffic along 5th Avenue, SPM concentrations were below critical levels. In 2015, SPM levels will increase and exceed standards. In particular, the eastern segments of C3 will have SPM concentrations exceeding standards up to 10meters from the road's edge. The 5th Avenue segment will likewise experience a drastic increase in SPM levels.

R9. In 2002, SPM concentration along R9 is already exceeded the standard. SPM levels will increase sharply in 2015, far exceeding the SPM standards.

Figure 4.47 Result of Simulation for NO_X

2002	2015
	
■ Fail standards (high = 0.18 mg/m3)	■ Fail standards (high = 0.21 mg/m3)
■ Borderline (std = 0.15mg/m3)	■ Borderline (std = 0.15mg/m3)
■ Pass standards (low = 0.02 mg/m3)	■ Pass standards (low = 0.03 mg/m3)

/1 Outer limits are 300 m from the center line

Figure 4.48 Result of Simulation for SPM

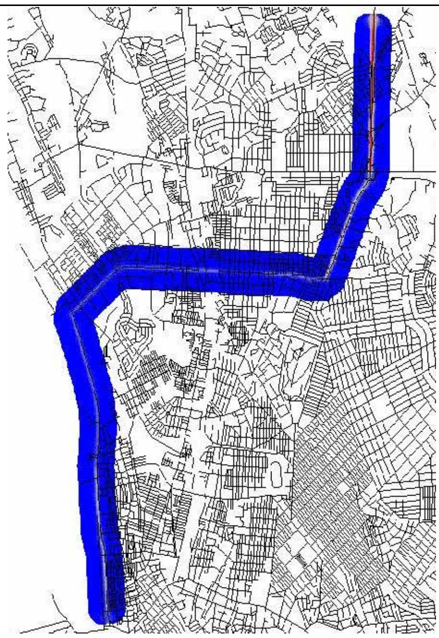
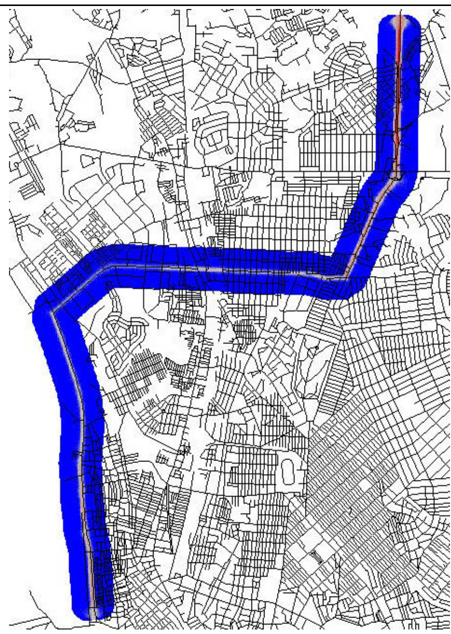
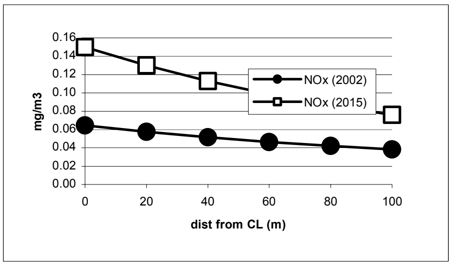
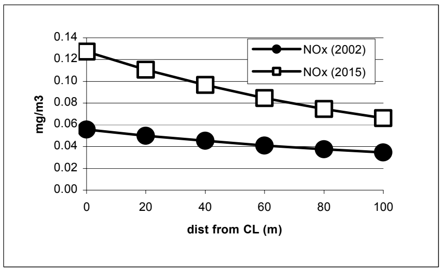
2002	2015
	
■ Fail standards (high = 0.67 mg/m3)	■ Fail standards (high = 0.61 mg/m3)
■ Borderline (std = 0.23mg/m3)	■ Borderline (std = 0.23 mg/m3)
■ Pass standards (low = 0.1 mg/m3)	■ Pass standards (low = 0.1 mg/m3)

Figure 4.49 Comparison between Roadside Air Pollution in 2002 and 2015 (NO_X)

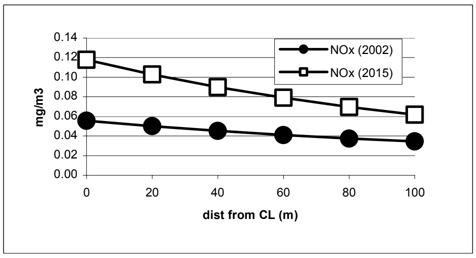
R10 (0)



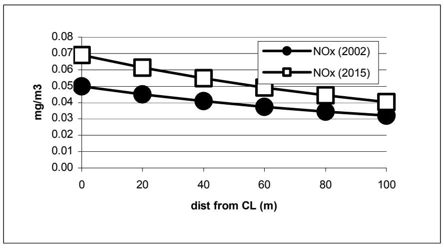
R10 (6)



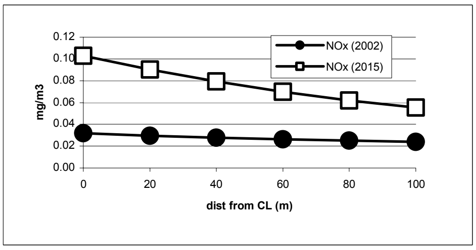
R10 (7)



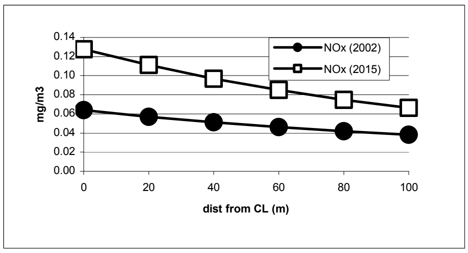
C3 (8)



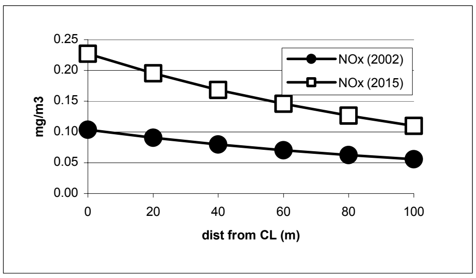
C3 (14)



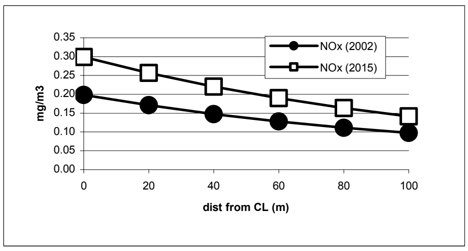
C3 (18)



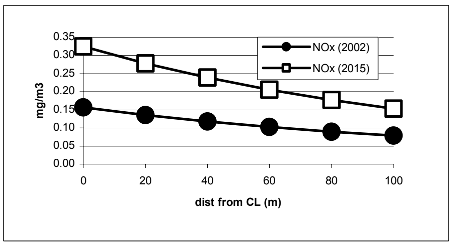
R9 (21)



R9 (24)

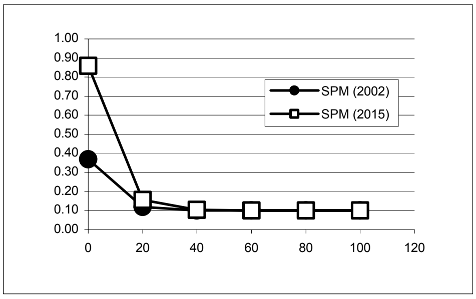
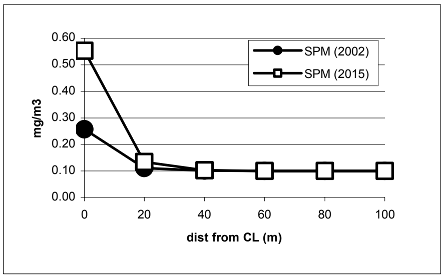
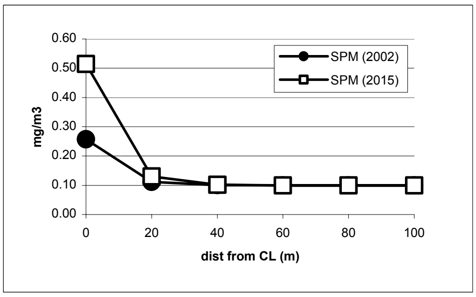
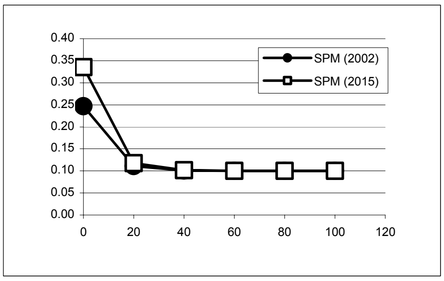
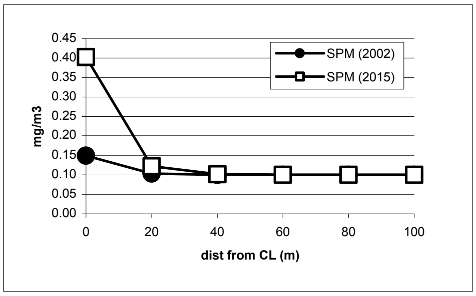
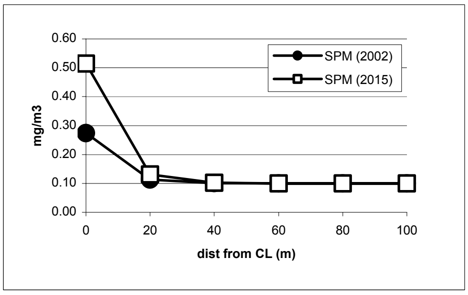
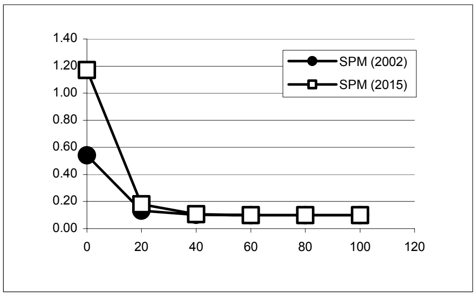
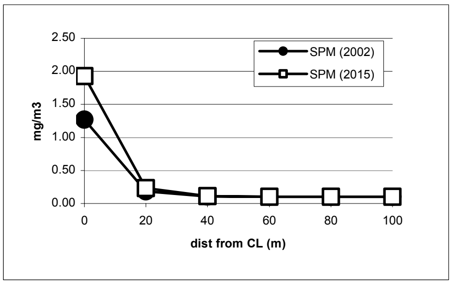
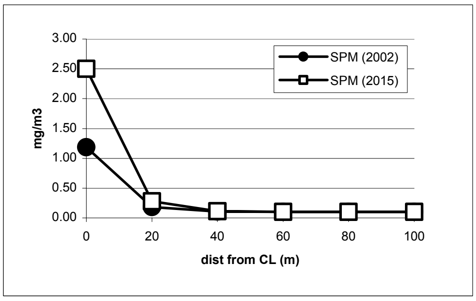


R9 (25)



Note: Figures in ( ) indicate road sections identified in Figure 4.43.

Figure 4.50 Comparison Between Roadside Air Pollution in 2002 and 2015 (SPM)

R10 (0)	R10 (6)
	
R10 (7)	**C3 (8)**
	
C3 (14)	**C3 (18)**
	
R9 (21)	**R9 (24)**
	
R9 (25)	
	

Note: Figures in ( ) indicate road sections identified in Figure 4.43.

(2) Noise

Noise levels were calculated using the DPWH Model. Figure 4.51 compares observed noise and the calculated noise. Overall, the Noise Model was able to reasonably estimate actual noise levels at each station. The model, however, tends to overestimate, but the difference of around 10% is considered small to merit recalibration.

The traffic volume used to calculate was the average traffic volume per hour of the day. The results were pitted against Philippine standards for traffic noise stipulated in Table 4.33. The area along Case Study Expressway is considered to be primarily residential.

Figure 4.51 Comparison Between Observation and Calculation Values

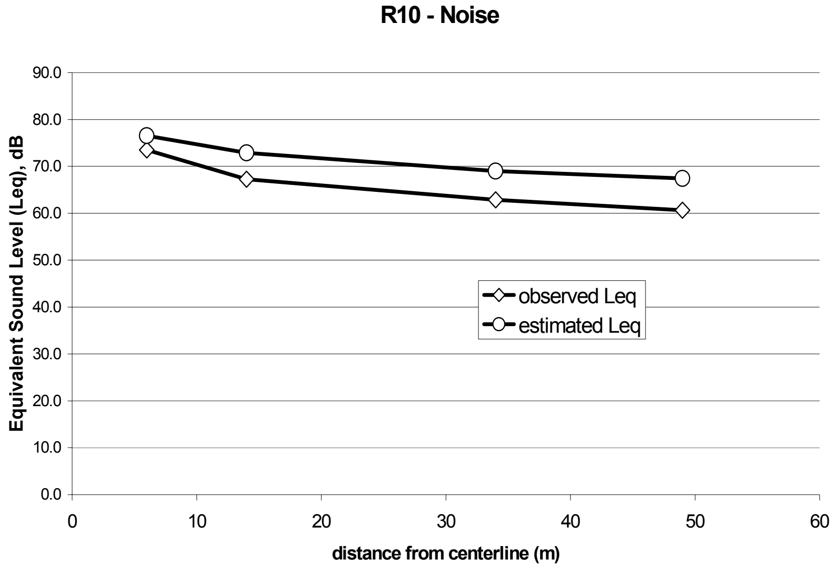


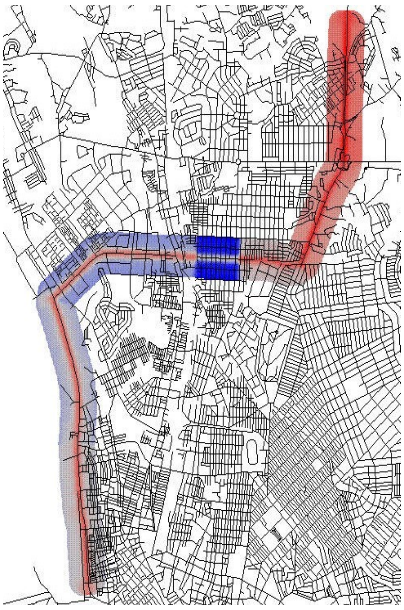
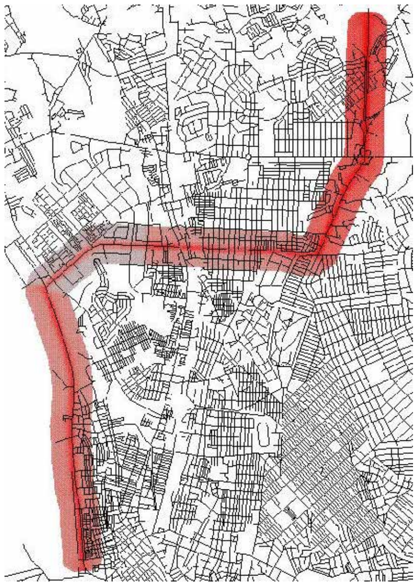
Table 4.33 Standard Value of Noise

Category of Area	Daytime	Morning and Evening	Nighttime
Area that requires quietness	50 dB	45 dB	40 dB
Primarily residential	55 dB	50 dB	45 dB
Primarily commercial	65 dB	60 dB	55 dB
Primarily light industrial	70 dB	65 dB	60 dB
Primarily heavy residential	75 dB	70 dB	65 dB

Note: Daytime (9am-6pm); Morning and Evening (5am-9am and 6pm-10pm); Nighttime (10pm-5am).

The result of noise level simulation along R10/C3/R9 at present (2002) and in the future (2015) is shown in Figure 4.52.

Figure 4.52 Result of Simulation for Noise

2002	2015
	
■ High Laeq = 76.5 dB) ■ Laeq = 65 dB ■ Low Laeq = 59.7 dB)	■ High Laeq = 76.4 dB) ■ Laeq = 65 dB ■ Low Laeq = 62.2 dB)

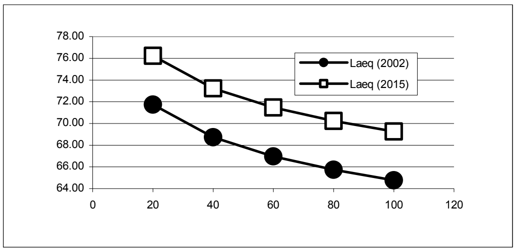
To examine in detail the influence of noisepollution, the cross-sectional figures of noise in the main section are shown in Figure 4.53.

1) In 2002, traffic noise exceeded the standard value (65dB) along all roads except 5th Avenue (Section 14) on C3 where traffic noise was lesser than 65 dB. Traffic noise on Sections 24 and 25 of R9 is more than 65 dB from the road's edge up to 100 m. Traffic noise along the road edge of Sections 24 and 25 was over the standard for a primarily heavy residential area (75 dB).

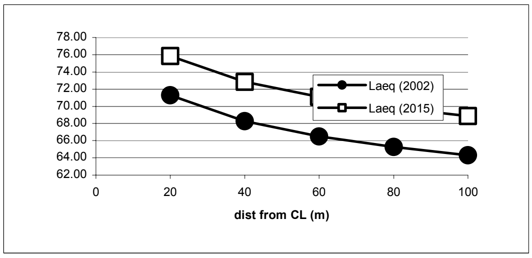
2) In the future, traffic noise on the road edge will be 75 dB or more along all road segments (2015). Sections 24 and 25 of R9 will have more than 75 dB from the road's edge up to 40 m and 70 dB from the road's edge up to 100 m.

Figure 4.53 Comparison Between 2002 and 2015 Roadside Noise

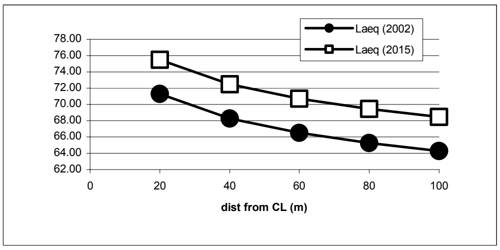
R10 (0)



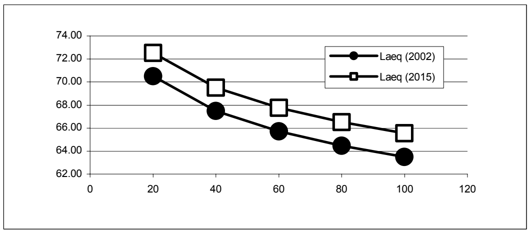
R10 (6)



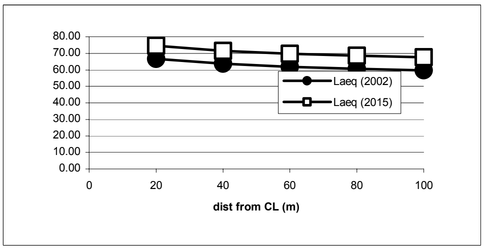
R10 (7)



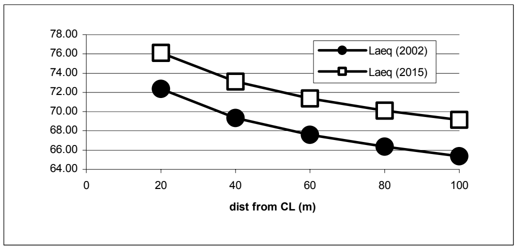
C3 (8)



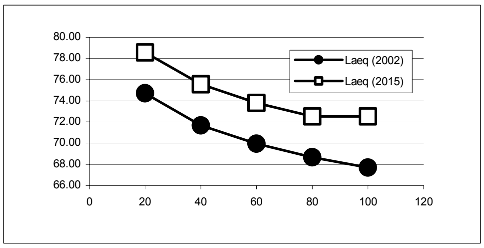
C3 (14)



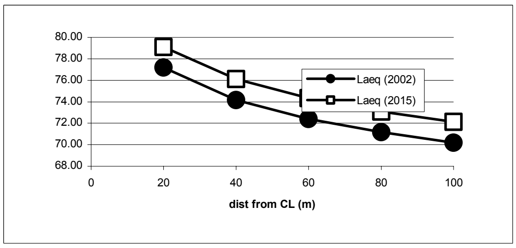
C3 (18)



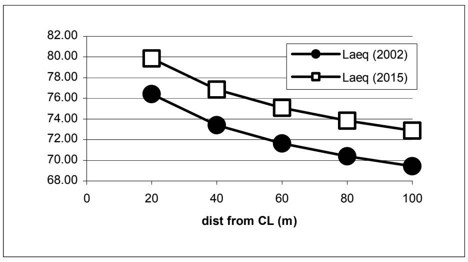
R9 (21)



R9 (24)



R9 (25)



Note: Figures in ( ) indicate road sections identified in Figure 4.43.

4.5.8 Environmental Measures and Monitoring

In making the EIS report, it is necessary to include environmental improvement measures and environmental monitoring methods in executing the project and at the detailed design stage. Because this is the pre-design stage, notes on environmental measures and monitoring are described. Table 4.34 lists the environmental monitoring methods and Table 4.35 lists the environmental improvement measures.

Table 4.34 Environmental Monitoring Methods

Social Environment

Item	Environmental Monitoring Method
1. Resettlement of Inhabitants	Hold regular hearings with the administrative body in charge of public welfare for collecting data on the effect of resettlement on residents.
2. Economic Activities	Hold regular hearings with organizations related to economic, labor and welfare conditions of the local society, and monitor economic indices, industrial trends, unemployment rates,etc. of the region.
3. Traffic/Public Facilities	Hold regular hearings with the administrative body in charge of public welfare to collect data on changes in the access of local residents to public facilities and on conditions such as accidents.
4. Split of Community	Hold regular hearings with the administrative body in charge of public welfare to collect data for determining the inconveniences in the everyday life of the barangay.
7. Wastes	Conduct regular site inspections to determine whether or not waste treatment is being implemented according to schedule.
8. Disasters (Flooding)	Conduct regular inspections to prevent flooding during heavy rains.

Natural Environment

Item	Environmental Monitoring Method
2. Soil Erosion	Conduct regular inspections in the vicinity of Smoky Mountain.
4. Flora and Fauna	If street trees are replanted, conduct punctual tracking surveys.
5. Landscape	After completion of artificial structures, conduct site inspections at observation points to determine whether or not the landscape is hindered by the shape, position and color of the structures.

Table 4.35 Environmental Improvement Measures

Social Environment

Item	Environmental Improvement Measure
Resettlement of Inhabitants	(1) Discuss with residents, inform the public (2) Develop human and economic environment of the resettlement site (3) Provide resettlement compensation (4) Provide guidance on job changes
Economic Activities	(1) Secure alternative means of crossing
Traffic/Public Facilities	(1) Develop transport systems (bus, etc.) (2) Establish traffic safety facilities (pavement, etc.)
Community Division	(1) Provide sufficient compensation (2) Secure alternative means
Wastes	(1) Secure disposal stations with ample capacity (2) Provide adequate waste disposal schemes (3) Plan and manage construction carefully
Disasters (Flood)	(1) Improve drainage system of rainwater (2) Provide legal protection

Natural Environment

Item	Environmental Improvement Measure
Soil erosion	(1) Improve drainage (2) Implement forestation works (3) Provide legal protection
Flora and fauna	(1) Protect existing trees (2) Transfer plants
Landscape	(1) Consider arrangements, scale, formation, material quality, color, etc. in the planning stage

Pollution

Item	Environmental Improvement Measure
Air Pollution	(1) Plan and manage construction carefully (2) Implement measures to prevent coarse particulates, e.g. water sprinkling (3) Monitor air pollution
Water Pollution	(1) Establish drainage treatment facilities (especially for water containing oil) (2) Implement measures to prevent coarse particulates and to suppress the outflow of earth and sand (3) Manage and store harmful substances adequately
Noise and Vibration	(1) Implement land-use projects (i.e. establishment of green buffer zones etc.) and enforce land-use regulations in the vicinity (2) Use low-noise, low-vibration construction machinery (3) Plan and manage construction carefully, e.g. investigation of construction period and construction hours (4) Sound-proof facilities
Obstruction of Sunlight	(1) Provide changes in planned routes, etc. (2) Compensate for the cutdown

4.6 Application of the PPP Technique to the Case Study Expressway

4.6.1 Financial and Economic Evaluation

(1) Financial Evaluation

By comparing costs and revenues, a preliminary financial evaluation was made for the Case Study Expressway. The financial internal rate of return (FIRR) of the Case Study Project was estimated under various conditions to determine which case(s) can bring an FIRR of over 15% (not in nominal terms but in real terms) because it is the lowest rate for attracting private capital to an infrastructure project implemented under a PPP scheme.

Main assumptions and points on methodology are as follows:

1) Construction period is four years from 2006 to 2009: In 2006, land is acquired and detail design is conducted. (Detail design cost is 5% of the project cost).
2) To years 2007, 2008 and 2009, 15%, 40% and 40% of the project cost are allotted, respectively.
3) Operation and maintenance cost is 15% of annual toll revenue. (In case of the Tokyo Metropolitan Expressway, O&M cost is about 18% of toll revenue.).
4) Evaluation period is 30 years from 2010 to 2040, which may correspond to the concession period.
5) Residual value after 30 years is not taken into account.
6) No tax exemption is considered in this analysis.

Results of financial analysis are summarized in Table 4.366, where the FIRR is calculated for three cases: (1) project cost is fully accounted; (2) ROW cost is excluded because the Government is responsible for land acquisition, and (3) a half of project cost is accounted because government subsidy cannot exceed 50% of project cost. In addition, cost reduction necessary for a 15% FIRR is estimated to determine the minimum contribution by the public sector to implement the project by a PPP scheme. The analysis was made for 12 cases. In the following analysis, Group A includes MCTE extension, MNT rehabilitation/widening, NAIA Expressway Skyway Stages 2 and 3 and Case Study Expressway:

Table 4.36 Results of Financial Evaluation

Case		Cost (Million Pesos)		Project FIRR(%)			Cost Reduction necessary for 15% of IRR
		Const. Cost	ROW Cost	All Cost into account	w/o ROW Cost	Cost Reduction by 50%	
1	R10/C3/R9/R10 ext.	13,747.3	350.0	10.4%	10.7%	16.8%	40.5%
2	R10/C3/R9 only	7,836.8	0.0	13.5%	13.5%	22.4%	13.0%
3	R10/R10+R10/C5 Link	6,631.6	350.0	9.8%	10.3%	16.3%	43.0%
4	R10/C3/R9/R10 ext. in Group A	13,747.3	350.0	8.1%	8.3%	13.7%	56.5%
5	Skyway 3 only	25,800.6	1,270.8	8.6%	9.1%	15.9%	46.2%
6	Skyway 3 in Group A	25,800.6	1,270.8	8.2%	8.6%	14.7%	51.5%
7	R10/C3/R9+Skyway 3 in Group A	39,197.9	1,620.8	8.3%	8.6%	14.4%	52.5%
8	R10/C3/R9 with Rev. of Skyway 3	13,747.3	350.0	19.1%	19.5%	-	-
9	Skyway 3 with Rev. of R10/C3/R9	25,800.6	1,270.8	11.7%	12.2%	-	-
10	C3/R9 with Rev. of R10/R10ext	6,871.3	0.0	17.0%	17.0%	-	-
11	R10/R10ext with Rev. of C3/R9	6,876.0	350.0	16.5%	17.3%	-	-
12	Skyway 3A with Rev. of R10/C3/R9/R10ext.	11,630.1	572.8	11.0%	11.3%	-	-

(Note) In Case 10 1nd 11, the cost of Junction R10/C3 is included in C3/R10. Both cases do not assume the Group A Projects.

Case 1: Entire Case Study Expressway (R10/C3/R9+R10/C5 Link)

Project FIRR of the entire Case Study Expressway is 10.4%, not high enough to invite private capital. As the ROW cost is minimal compared to the total project cost, the FIRR slightly improves by 0.3 percentage points. If 50% of the project cost is shouldered by the public sector, the FIRR will be 16.8%, in which case the private sector may have an interest. To secure 15% FIRR or better, the public sector has to contribute at least 40.5% of the project cost.

Group A includes MCTE extension, MNT rehabilitation/widening, NAIA Expressway, Skyway Stages 2 and 3, and Case Study Expressway.:

Case 2: R-10/C-3/R-9 excluding (excluding the R-10/C-5 Link)

If cost of the R-10 extension and the R-10/C-3 junction is excluded from the project, about 40% of cost is reduced and the FIRR greatly improves. If the Government shares 50% of cost, the FIRR becomes 22.4% and if 13% of cost is subsidized, the FIRR becomes 15%.

Case 3: R-10+/R10 Extension OnlyR-10/C-5 Link

As the cost of the R10 extension and the R-10/C-3 junction is comparatively high, the FIRR becomes lower than that of the entire Case Study Expressway.

Case 4: Entire Case Study Expressway + Group A Projects

As seen in Chapter 4.2, the Case Study Expressway will significantly lose its demand if the Skyway 3 is built. In such a case, the FIRR will fall to 8.1%. Even with a 50% subsidy, the FIRR will only become 13.7%. To make the FIRR 15%, 56.5% of the project cost has to be shouldered by the Government.

Case 5: Skyway Stage 3

The Skyway Stage 3 has more potential demand than the Case Study Expressway but its project cost is also high. The FIRR is estimated at 8.6%. If the Government shares 50% of its cost, it will improve to 15.9%.

Case 6: Skyway Stage 3 + Group A Projects

The Skyway Stage 3 is not greatly affected by the Group A projects. The FIRR of the project in this case will slightly be lower than that of Case 5. To make the FIRR over 15%, more than 50% of subsidy will be needed.

Case 7: Entire Case Study Expressway and Skyway Stage 3 with Group A Projects

The Case Study Expressway and the Skyway Stage 3 are packaged into one and evaluated together. The FIRR is 8.3%, which corresponds to the weighted average of Cases 4 and 6. The necessary subsidy is 52.5%, which may be lowered below 50% by tax exemptions or other subsidiary measures.

Case 8: Entire Case Study Expressway with Revenue of Skyway Stage 3

If the private sector implements the entire Case Study Expressway with its own fund and the public sector implements the Skyway Stage 3 with public investment and both expressways are operated for 30 years by the private sector for investment recovery, the FIRR for the investors will be 19.1%. However, the project cost of the Skyway Stage 3 is higher than that of the Case Study Expressway. Then, the subsidy ratio will far exceed 50%.

Case 9 Skyway Stage 3 with Revenue of Entire Case Study Expressway

Contrary to Case 8, if the private sector implements the Skyway Stage 3 and the public sector implements the Case Study Expressway, the FIRR for the private sector will only be 11.7%.

Case 10: C3/R9 with Revenue of R10+R10/C5 Link extension

Here the Case Study Expressway is divided into two groups: C3/R9 and R10+/R10/C5 Link. The former is implemented by the private sector and the latter by the public sector. By including the R10/C3 junction and the C3/R9/Skyway junction in C3/R9, the costs of the two groups become almost similar. In this case, the FIRR for the private sector will be 17.0%, which seems appropriate for a PPP scheme.

Case 11: R-10+/R-10 extension/C-5 Link with Revenue of C-3/R-9

If the private sector undertakes the R10+/R10/C5 Link and the public sector implements C3/RT9, the FIRR for the private sector will be 16.5%, which is slightly lower than in Case 10.

Case 12: Skyway Stage 3A with Revenue of Entire Case Study Expressway

To lessen the burden on the private sector in Case 9, the Skyway Stage 3 is divided into two sections: the Skyway Stage 1 – Aurora Avenue (Stage 3A) and the Aurora Avenue – C3/R9 intersection (Stage 3B). In this case, the private sector constructs only Stage 3A and operates this section together with the entire Case Study Expressway for 30 years. The Skyway Stage 3B is assumed to remain undeveloped. Although initial costs are decreased to less than half, the demand/revenue also decreases and the FIRR does not improved.

Among the cases analyzed above, Cases 10 and 11 are suitable for a PPP scheme because their FIRRs are in the feasible range and government participation does not exceed 50% of the total cost. Comparing these two cases, the R10+/R10/C5 Link requires relocation of a lot of informal dwellers on the ROW, while C3/R9 requires widening of a 600-meter section along C3. The former will need more time and effort from the Government. Case 10 appears to be a more appropriate scenario wherein the Government's capacity to acquire the ROW will be more pronounced. However, it is foreseen that ODA lenders – which will source the government component – will be reluctant to finance the R10+/R10/C5 Link Section because in the event that the private component (C3/R9) does not materialize, the project will grossly lose functionality especially if the MNT-C5 is not built due to a lack of connectivity to the NLE. Therefore, Case 11 is recommended and will the basis of further study.

(2) Economic Analysis

Investment Schedule and Economic Cost

The Case Study Expressway is scheduled to open in 2011. To attain this, construction work has to commence at the latest in the middle of 2007. Thus, ROW acquisition and detailed design work should be completed by 2006. Taking these into consideration, its investment schedule was assumed as shown in Table 4.37.

To convert costs estimated at market prices, the standard conversion factor (SCF) was used, which was assumed at 83%, the same value as used in the MMUTIS. Total economic cost is ₱11,470 million pesos at 2002 price. Through the project life of 30 years (2010-2040), maintenance cost was assumed annually at 15% of toll revenue of the year. No residual values were assumed in 2040.

Table 4.37 Economic Cost and Investment Schedule

Unit; million Pesos at 2002 Price

	Cost Item	2006	2007	2008	2009	Total
Annual Investment Proportion (%)	ROW Acquisition Cost	30	70	0	0	100
	Project Cost excl. ROW Cost	6	20	50	30	100
Financial Cost	ROW Acquisition Cost	1810.20	4223.80	0.00	0.00	6034.00
	Project Cost excl. ROW Cost	262.76	875.88	2189.70	1313.82	4379.39
	Total	**2072.96**	**5099.68**	**2189.70**	**1313.82**	**10413.39**
Economic Cost	ROW Acquisition Cost	1502.47	3505.75	0.00	0.00	5008.22
	Project Cost excl. ROW Cost	218.09	726.98	1817.45	1090.47	3634.90
	Total	**1720.56**	**4232.73**	**1817.45**	**1090.47**	**8643.12**

<u>Economic Benefit</u>

The most direct transportation cost is the vehicle operating cost (VOC) and the travel time cost (TTC). Here, economic benefits generated by an expressway project are defined as VOC and TTC savings attributable to the project. The benefit was estimated through a "with project" and "without project" comparisons of traffic assignment on the network.

The unit VOC and TTC used in the MMUTIS updated using overall inflation rates during 1997-–2001as shown in Table 4.38 and 4.39, respectively. The public mode comprises buses and jeepneys, and the private mode includes cars, taxis and trucks. The unit costs shown in the tables are weighted averages of them. The unit VOC is expressed as function of travel speed, which is different from those in inter-city road planning.

Table 4.38 Unit VOC by Public and Private Modes as of 2002

Velocity	Public Mode		Private Mode	
(km/hour)	Peso/1000km	Peso/hour	Peso/1000km	Peso/hour
10	6127.6	58.8	4160.9	34.6
20	5720.1	69.6	3855.1	39.5
30	5446.4	74.2	3626.8	39.4
40	5302.9	76.1	3473.5	37.9
50	5397.5	77.1	3420.3	36.1
60	5609.0	77.6	3434.5	34.3
70	5990.7	78.3	3536.1	32.7
80	6655.6	79.6	3741.7	31.3
90	7794.9	82.2	4096.2	30.2

Table 4.39 Unit TTC by Public and Private Modes

Unit: ₱/hr/veh

Mode	1997*	1997	2005	2010	2015
Public Mode	432.3	631.1	858.4	948.3	1047.7
Private Mode	60.4	88.2	120.0	132.5	146.4

Note: * 1997 price (Others are at 2002 price)

By applying the above unit costs to the assigned traffic volumes on each link and summing the VOC and the TTC, aggregate transportation cost was estimated as shown in Table 4.40. The economic benefit was the difference of the aggregate costs between "without project" and "with project" cases. In the case of the entire Case Study Expressway, the benefit is expected to amount to ₱4,251 million (as annual total) in 2010 and ₱5,650 million pesos in 2020.

In 2010, about 80% of economic benefits will accrue from mitigating the congestion of private modes and 20% from public modes. The benefit to the public mode will decrease to 12% in 2015 and 11% in 2020 due to worsening traffic conditions on the ordinary road network.

The economic benefit of the Case Study Expressway will grow at 3.2% per annum during 2010-2015 and 2.5% during 2015-2020. This declining tend is also due to the overall worsening congestion.

Dividing the project into the two sections of the C-3/R-9 and the R-10+/R-10/C-5 Link, the economic benefit was estimated for each section because the division will be applied later on in designing a PPP scheme. The sum of the benefits from both sections corresponds to about 87-88% of the benefit by the entire project, due to the network effect.

Table 4.40 Aggregate VOC and TTC and Economic Benefit

(Million Pesos)

Year	Case	Cost Item	Entire Case Study Expressway			C3 and R9			R10 and R10/C5 Link		
			Public Mode	Private Mode	Total	Public Mode	Private Mode	Total	Public Mode	Private Mode	Total
2010	Without Case	VOC	33473.0	54787.7	88260.7	33473.0	54787.7	88260.7	33473.0	54787.7	88260.7
		TTC	106229.9	39819.8	146049.7	106229.9	39819.8	146049.7	106229.9	39819.8	146049.7
		Total	139702.8	94607.5	234310.4	139702.8	94607.5	234310.4	139702.8	94607.5	234310.4
	With Case	VOC	33023.6	54031.4	87055.0	33128.6	54423.4	87552.0	33148.6	54471.4	87620.0
		TTC	105772.4	37232.0	143004.3	105956.4	39059.1	145015.4	106138.4	38575.3	144713.6
		Total	138796.0	91263.3	230059.3	139085.0	93482.4	232567.4	139287.0	93046.6	232333.6
	Benefit	VOC	449.3	756.3	1205.6	344.3	364.3	708.6	324.3	316.3	640.6
		TTC	457.5	2587.9	3045.4	273.5	760.8	1034.3	91.5	1244.6	1336.1
		Total	906.8	3344.2	4251.0	617.8	1125.1	1742.9	415.8	1560.9	1976.7
2015	Without Case	VOC	33180.3	77738.3	110918.6	33180.3	77738.3	110918.6	33180.3	77738.3	110918.6
		TTC	110513.2	62749.7	173262.9	110513.2	62749.7	173262.9	110513.2	62749.7	173262.9
		Total	143693.5	140488.1	284181.6	143693.5	140488.1	284181.6	143693.5	140488.1	284181.6
	With Case	VOC	33072.1	76023.1	109095.2	33072.1	77142.3	110214.4	33163.1	77251.2	110414.3
		TTC	110021.2	60088.2	170109.4	110201.6	61725.0	171926.6	110277.6	61175.3	171452.9
		Total	143093.3	136111.3	279204.5	143273.7	138867.3	282141.0	143440.7	138426.5	281867.2
	Benefit	VOC	108.2	1715.2	1823.5	108.2	596.0	704.2	17.2	487.1	504.3
		TTC	492.0	2661.6	3153.6	311.5	1024.8	1336.3	235.5	1574.5	1810.0
		Total	600.2	4376.8	4977.0	419.8	1620.8	2040.5	252.8	2061.5	2314.3
2020	Without Case	VOC	41872.6	109082.4	150955.0	41872.6	109082.4	150955.0	41872.6	109082.4	150955.0
		TTC	150935.5	94973.9	245909.4	150935.5	94973.9	245909.4	150935.5	94973.9	245909.4
		Total	192808.1	204056.3	396864.4	192808.1	204056.3	396864.4	192808.1	204056.3	396864.4
	With Case	VOC	41532.8	107573.4	149106.2	41532.8	108421.4	149954.2	41574.3	108321.7	149896.0
		TTC	150632.8	91475.5	242108.3	150932.8	93661.0	244593.7	150881.6	93459.6	244341.2
		Total	192165.6	199048.9	391214.5	192465.6	202082.4	394547.9	192455.9	201781.2	394237.2
	Benefit	VOC	339.8	1509.0	1848.8	339.8	661.0	1000.8	298.3	760.7	1059.1
		TTC	302.7	3498.3	3801.0	2.7	1312.9	1315.6	53.8	1514.3	1568.2
		Total	642.5	5007.3	5649.9	342.5	1973.9	2316.4	352.2	2275.1	2627.2

Results of Economic Evaluation

Table 4.41 shows the economic cash flow over the project period for calculating economic internal rates of return (EIRRs). The entire Case Study Expressway was envisioned to imply a high EIRR of 27.5%. According to the NEDA criteria, the threshold value to judge a project as economically feasible in the Philippines is 15%. This, then, confirms that the project is highly economically feasible. The two components of the project also show a high return of 24-25%, meaning, each one can be implemented independently from an economic point of view.

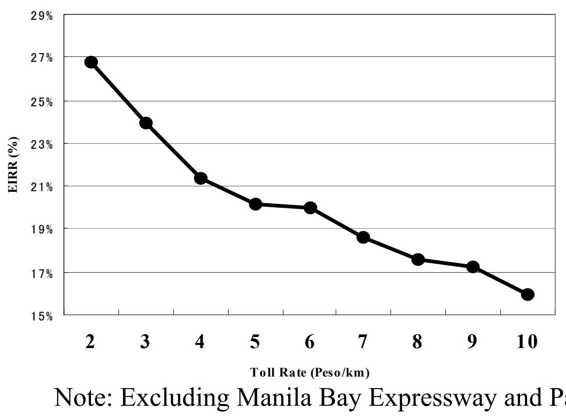
As the toll rate rises, the EIRR as well as the demand will lesser. Figure 4.54 shows the EIRRs of MMUEN projects excluding two unsolicited projects under various toll rates. The figure suggests that if the toll rate is raised higher than ₱10/km, MMUEN projects may become unfeasible as a whole.

Table 4.41 Economic Cash Flow and EIRR

Year	Entire Case Study				C3 and R9				R10 and R10 Extension			
	Cost	O&M	Benefit	Net Flow	Cost	O&M	Benefit	Net Flow	Cost	O&M	Benefit	Net Flow
2006	906			-906	281			-281	625			-625
2007	1,668			-1,668	842			-842	826			-826
2008	4,448			-4,448	2,246			-2,246	2,202			-2,202
2009	4,448			-4,448	2,246			-2,246	2,202			-2,202
2010		638	4,251	3,613		261	1,743	1,481		297	1,977	1,680
2011		658	4,387	3,729		270	1,799	1,529		306	2,040	1,734
2012		679	4,528	3,849		278	1,856	1,578		316	2,105	1,790
2013		701	4,673	3,972		287	1,916	1,628		326	2,173	1,847
2014		723	4,823	4,099		297	1,977	1,681		336	2,242	1,906
2015		747	4,977	4,230		306	2,041	1,734		347	2,314	1,967
2016		766	5,105	4,339		314	2,093	1,779		356	2,374	2,018
2017		785	5,236	4,451		322	2,147	1,825		365	2,435	2,070
2018		806	5,370	4,565		330	2,202	1,872		375	2,497	2,123
2019		826	5,508	4,682		339	2,258	1,920		384	2,561	2,177
2020		847	5,650	4,802		347	2,316	1,969		394	2,627	2,233
2021		871	5,809	4,938		357	2,382	2,025		405	2,701	2,296
2022		896	5,973	5,077		367	2,449	2,082		417	2,778	2,361
2023		921	6,142	5,221		378	2,518	2,140		428	2,856	2,428
2024		947	6,315	5,368		388	2,589	2,201		440	2,937	2,496
2025		974	6,493	5,519		399	2,662	2,263		453	3,019	2,567
2026		1,002	6,677	5,675		411	2,737	2,327		466	3,105	2,639
2027		1,030	6,865	5,835		422	2,815	2,392		479	3,192	2,713
2028		1,059	7,059	6,000		434	2,894	2,460		492	3,282	2,790
2029		1,089	7,258	6,169		446	2,976	2,529		506	3,375	2,869
2030		1,119	7,463	6,343		459	3,060	2,601		521	3,470	2,950
2031		1,151	7,674	6,523		472	3,146	2,674		535	3,568	3,033
2032		1,184	7,890	6,707		485	3,235	2,750		550	3,669	3,119
2033		1,217	8,113	6,896		499	3,326	2,827		566	3,772	3,207
2034		1,251	8,342	7,090		513	3,420	2,907		582	3,879	3,297
2035		1,287	8,577	7,291		527	3,517	2,989		598	3,988	3,390
2036		1,323	8,819	7,496		542	3,616	3,074		615	4,101	3,486
2037		1,360	9,068	7,708		558	3,718	3,160		633	4,217	3,584
2038		1,399	9,324	7,925		573	3,823	3,249		650	4,336	3,685
2039		1,438	9,587	8,149		590	3,931	3,341		669	4,458	3,789
2040		1,479	9,858	8,379		606	4,042	3,435		688	4,584	3,896
Total	11,470	31,172	207,815	165,173	5,615	12,781	85,204	66,808	5,854	14,495	96,634	76,284

Entire Case Study			C3 and R9			R10 and R10 Extension		
EIRR	(%)	27.5%	EIRR	(%)	24.4%	EIRR	(%)	25.4%
NPV	(Mil. Peso)	11979.8	NPV	(Mil. Peso)	4170.61	NPV	(Mil. Peso)	5069.15
B/C	–	2.21	B/C	–	1.87	B/C	–	1.99

Figure 4.54 Economic Benefit and EIRR of MMUEN Projects



(Million pesos/Year)

Toll Rate (P/km)	Year			EIRR
	2010	2015	2020	
2	40,216	70,719	100,340	26.7%
3	30,045	59,751	87,187	24.0%
4	23,937	50,206	71,621	21.3%
5	20,638	45,324	66,083	20.2%
6	16,688	38,551	65,116	19.9%
7	13,180	34,924	58,379	18.6%
8	10,646	29,859	51,640	17.6%
9	8,380	23,787	46,176	17.3%
10	6,128	20,794	39,734	15.9%

Note: Excluding Manila Bay Expressway and Pasex

4.6.2 Financing Options

(1) Conventional Methods of Implementation

The proposed R10/C3/R9 Expressway can be implemented in the conventional manner as a purely government infrastructure. In such a case, the entire project cost (construction and land cost) of ₱13,747 million would have to be accommodated in the capital budget of the DPWH and compete with other important road projects for the limited resources of the national treasury. Invariably, the DPWH may tap ODA financing – up to 85% of cost, excluding ROW, or approximately ₱11.4 billion. The foreign loan would then end up as a public liability.

There are several weaknesses to this method of implementation: (a) it will not expand available resources for road development since no private funds get harnessed; (b) it will increase total public debts; (c) payment would be charged to all taxpayers, even those who will not use the road; and (d) as a government facility, there is less pressure to charge proper toll fees.

Alternatively, the expressway can be privatized after completion. This is similar to what happened to the NLE and the SLE in the 1970s. Private sector efficiency in operations and maintenance can be captured, aside from potential recovery of investments. This option is recommended as a fall-back plan, in case of failure in securing private sector participation.

(2) PPP Structure

The preferred method of implementing the project is through PPP. Because of the marginal FIRR (10.7% excluding ROW, and 10.4% if ROW cost is included), the project is unlikely to get serious bids. If an investor comes in, the required toll fees would be too high as to be beyond the calculated affordable or reasonable value.

Government support up to 50% of project cost is permissible under the IRR of the BOT Law, provided the project goes through a competitive tender. If only 50% of the cost is shouldered by a private concessionaire, the FIRR shoots up to about 16.5%, a level that could already attract serious bidders. The 'two-in-one' scheme entails the following division of the expressway into two subprojects:

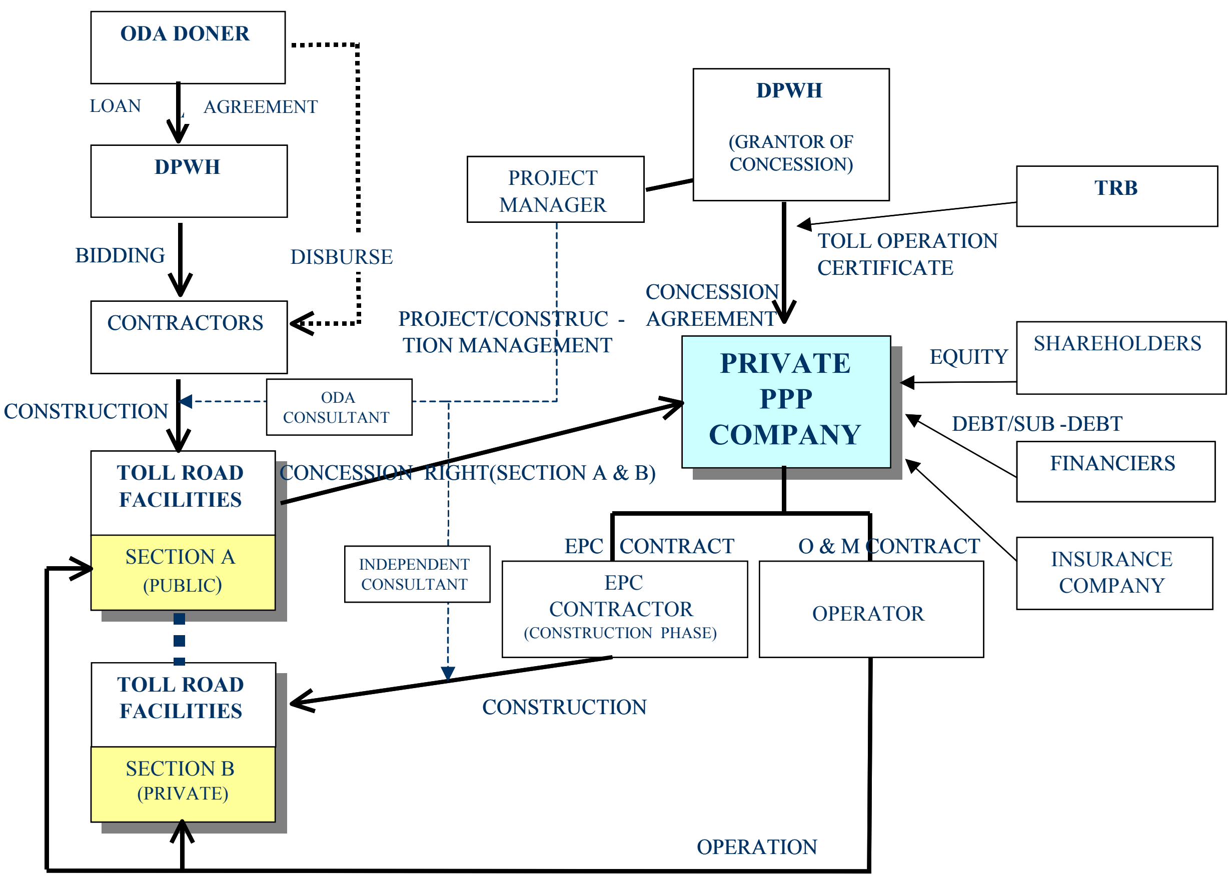
Subproject	Project Cost (mil. ₱)	Fund Source
C3/R9 (Government)	1,328	Ordinary budget
	5,543	ODA sources
	6,871	Sub Total
R10/+ R10/C5 Link (Private Funding)	1,719	Equity
	2,063	Domestic debt
	3,094	Foreign loan
	6,876	Sub Total

This project structure implies that only half of the project cost would be incorporated in the DPWH capital budget, and ₱5,543 million (down by 51% from ₱11.4 billion in the case of the conventional method) would be borrowed from ODA sources.

Usually, in BOT projects, the proponent or concessionaire sets up a project company that is responsible for fund raising and disbursing. A single organization is accountable for the success of the project. It is not tenable, however, to follow this mechanism and channel government support into the project company. ODA rules forbid disbursement of funds to private entities not otherwise are not direct contractor, unless the loan is designed for on-lending. Otherwise, the ODA will be vulnerable to risks of private loan defaults to which it is not a party. Hence, the need to split the expressway into two separate, but integral, sections.

By itself, the C3/R9 section would not be financially viable with an FIRR at 13.5%. Nor is the R10+R10/C5 section bankable with an FIRR at 9.8%. However, by ceding the revenue potentials of the former to the latter, the calculated return of 16.5% will becomes attractive to private investors. Figure 4.55 illustrates the proposed project structure.

Figure 4.55 PPP Project Structure for Case Study



(3) Addressing the Downside of Splitting

There are several risks involved in splitting the project, viz: the various elements may not be fully integrated, schedule coordination becomes more difficult, workmanships might be dissimilar, and blame-tossing for damages or delays.

It is envisioned that there will be only one feasibility study for the two subprojects of the Case Study Expressway, the cost of which will be for the government account. The detailed engineering, which serves as the basis for bidding out the construction, and the concession would likely be split. With as much basic design information prepared *a priori* by the Government, the risks attendant to splitting the projects into two can be minimized, if not obviated.

During implementation, an Independent Engineer (IE) (ODA Consultant in Figure 4.55) – usually required by an ODA agency – will be present to monitor the execution of the project. The IE for the private section (Independent Consultant in Figure 4.55) will be also present to do the same. One section will be built by a private contractor chosen and paid for by the Government. The other will be built by a contractor chosen and paid for by the concessionaire. The IEs will focus on quality assurance and compliance with design specifications, and can be separate from the Construction Project Manager. Its report will be available to the Government as well as the private concessionaire, thus ensuring transparency and mutual satisfaction on the works performed. One project manager attached to the DPWH will coordinate the activities of the IEs and manage the whole construction of the Case study Expressway.

If delineation of responsibilities overlaps in terms of locations, or causes one to wait for the other's completion, the potential for blaming the other party increases tremendously. This can be minimized by physically separating work obligations. It would be counterproductive, for example if one party handles all foundation works and the other, the overlay. Then, it would be difficult to pinpoint blame for subsequent pavement failure.

4.6.3 Proposed Features of the Concession

(1) Risk Allocation

Because the basic project design has been prepared by the Government, the preparatory cost of the private concessionaire should be reduced. The latter, however, should retain the right to review the studies and take exception where it sees fit to minimize its own risk once the toll road becomes operational.

The recommended contractual structure is BTO, not unlike those of the existing expressway concessions. Title to the Government-funded section would remain with the Government. Title for the private-funded section would be transferred to the Government upon completion of construction and issuance of the corresponding Toll Operating Certificate (by the TRB). In exchange for the transfer of ownership, the concessionaire would be granted the right to collect tolls for the two sections of the R10/C3/R9 Expressway.

Completion risk for the C3/R9 section would be assumed by the Government; the private concessionaire shall be liable for completing the R10/R10/C5 section. The question arises: what happens if one section gets delayed?

The following mechanism should be built in to mitigate delays:
a) Head start of construction for the public section
b) Liquidated damage system for the construction of both sections
c) A completion bonus for an early completion achieved by the concessionaire as an additional cash flow generated before the original start of the concession.

A delay should permit the concessionaire to extend his concession period if the fault is on the Government side. Conversely, if the fault is on the private side, the concession clock can commence immediately. In other words, the concession period shall be reckoned from the date of completion of the government-funded section.

Regarding traffic risk, the BTO structure implies that the private concessionaire will assume the market risk. Notwithstanding the preparation of the feasibility study and demand forecast by the Government, the Government should not guarantee the traffic volumes. The concessionaire is free to review and validate the demand forecast and shall make his bid on the basis of such information. For the competing route risk, the Government should prepare the forecast which will incorporate the effects of such competition.

Financial closure is an inherent risk that is solely on the shoulders of the winning bidder. The bid document should allow a period of 12 months to secure firm project financing. Failure should penalize the bidder with loss of concession, as well as forfeiture of the bid bond or performance bond. Thereafter, the Government should be free to award the concession to the second best bidder, or to conduct another bidding.

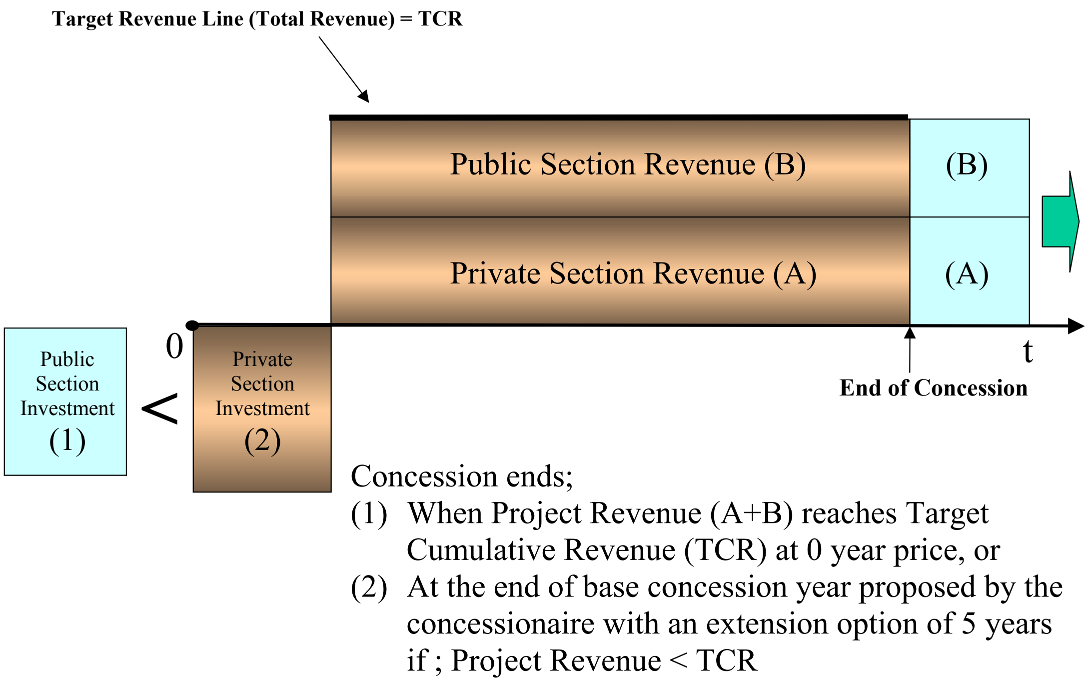
(2) Endogenous Concession Period

As a partial relief to the absence of traffic guarantees, it is suggested that a flexible concession period be adopted. There will be a base concession period proposed by the concessionaire, which can be shortened or lengthened until a target cumulative revenue, **TCR,** expressed at the contract year price, is reached. Figure 4.56 shows the basic mechanism of the Endogenous Concession. With an endogenous concession period, the concession will end when the actual cumulative revenue expressed at the contract year price reaches the **TCR.** The concessionaire will be allowed a five year extension of the base concession period if it fails to reach the **TCR** by the end of base concession period in order to further recoup its investment. After the concession is terminated the Government is allowed to take over the expressway (and recoup its share of investments) sooner in the event that traffic exceeds expectations.

The following are the merits of introducing the Endogenous Concession System;

a) Command on toll level, thus minimum difference for the benefit of toll road users
b) Command on profitability level for the fairness among the projects
c) Firm recoupment of investment for promoting private participation
d) Recoupment of investment by the Government/ Fund generation for cross-subsidy

Figure 4.56 Endogenous Concession



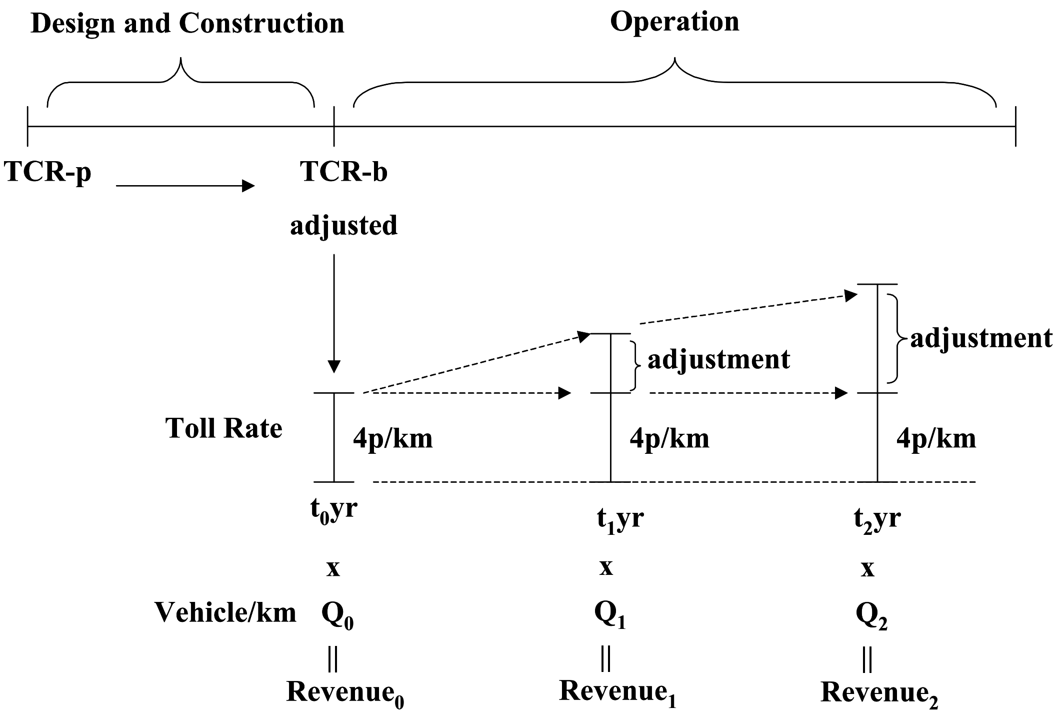
(3) Toll Rate

The initial toll fee, $\mathbf{F_i}$, shall be set as one of the parameters of the bidding process. The indicative rate for the project is ₱ 4/km/PCU. The actual value or base rate, $\mathbf{F_b}$, when the toll road commences operation may differ from this indicative rate, $\mathbf{F_i}$. The manner in which the base rate shall be calculated should be specified in the Concession Agreement.

The base rate should equal the indicative rate (i.e. $\mathbf{F}_i = \mathbf{F}_b$) only if there were no material changes in project costs from the time the bid was conducted to the time the construction was completed. Adjustments would have to be made by the TRB during its review of out turn cost, prior to the issuance of a Toll Operating Certificate, and also taking into account the comparative toll rates in other road concessions. The adjustment should be reflected in the target cumulative revenue as well as in the approved base rate, as disaggregated into the three vehicle classes.

The target cumulative revenue, **TCR** which is expressed at the contract year price, shall be the bid price as adjusted upon project completion. But the bid price will be adjusted only by including price escalation during construction period and change orders initiated by the DPWH. In calculating the **TCR** of each year, actual revenue will be adjusted back to the contract year price excluding the nominal increase caused by the adjustment of inflation and of changes in foreign exchange rates. Past year's revenues shall be netted out of the computation based on actual conditions; therefore, the value of the **TCR** will decline as the termination date nears. The actual TCR will be calculated based on the statements and information submitted by the concessionaire and should be closely monitored by the TRB. Figure 4.57 illustrates the basic mechanism of calculating the **TCR**.

Figure 4.57 Calculation of TCR



There is, of course, a relationship between the **TCR** and the $\mathbf{F}_b$. The higher the $\mathbf{F}_b$, assuming traffic is constant, the faster the **TCR** would decline. Similar to the toll adjustment formula signed by the TRB in existing concession agreements, the $\mathbf{F}_b$, can be adjusted periodically every review date, say every three years, with provision for interim adjustments in between the review period. However, the approved $\mathbf{F}_b$ would serve as an upper toll rate ceiling.

(4) Closed System of Toll Collection

Collection of a fixed fee upon entry into the R10/C3/R9 Expressway may be simple, but this tends to be unfair for short-distance users. Multiple entry/exit points are envisioned for this project, aside from the desired seamless interfacing with the other expressways in the urban network. Accordingly, a closed system of toll collection is recommended.

However, the future toll will be composed of a fixed portion as an entrance fee and of the portion which is proportional to traveling distance to reflect increase of users' income level in real term.

Table 4.42 Increase in Toll Rates in Real Terms

	Class I Vehicle	Class II Vehicle	Class III Vehicle
TR_b	₱ 4.0/km	₱ 8.0/km	₱ 10.4/km
2015	₱ 10.0 + ₱ 4.0/km	₱ 20.0 + ₱ 8.0/km	₱ 26.0 + ₱ 10.4/km
2020	₱ 20.0 + ₱ 4.0/km	₱ 40.0 + ₱ 8.0/km	₱ 56.0 + ₱ 10.4/km

To minimize commuter inconvenience, the ticketing arrangement should be coordinated with the operator of the MNT and the operator of the Skyway, such that the overhead for collection is reduced to benefit all parties. The revenue-sharing arrangement (as well as cost-sharing for the ETC system) should be negotiated directly between the different concessionaires, or imposed by the TRB if no mutually acceptable settlement is reached ahead of commercial operation.

(5) Investment Incentives

Under the Investment Priorities Plan of the Board of Investments, BOT projects worth more than ₱ 1 billion are automatically entitled to incentives such as the following:

- Right to repatriate the entire proceeds of the liquidation of the investment in the currency in which the investment was originally made and at the exchange rate prevailing at the time of repatriation;
- Income tax holidays for six years from commercial operation;
- Tax and duty exemptions on imported capital equipment;
- Tax credits on domestic capital equipment; and,
- Exemptions from Contractor's Tax;

All the past four expressway projects secured the appropriate incentives.

(6) Liabilities for the Two Road Sections

A standard clause found in existing concession agreements is the continuing liability of the investor (or project company) for defects arising from design and construction of the toll road. Any damage, other than due to wear and tear or force majeure, is to be repaired at investors' expenses throughout the franchise period. Under the Civil Code of the Philippines, third party liability is limited to 15 years from completion of construction. There is no reason why this provision has to be modified nor waived in the case of the private section of the project.

It is understandable for the concessionaire to eschew a similar liability for the public section of the expressway that it did not build nor design. Therefore, a liability waiver for this road section should be granted.

A question would arise: which party should pay for repair of damages arising from hidden defects attributable to design and construction? For the private section, it is the Investor. For the public section, any expenses should be treated as an advance or additional investments of the project company entitled to future recovery. While it is reasonable to charge the corollary costs to the DPWH or the Government, it would be impractical to execute. Government budgets, inflexible as they are, usually do not carry an amount for contingent events. Even if such an amount has somehow been appropriated, it would take time to initiate repair works. Thus, it would be to the benefit of the toll operating company to initiate immediate repairs, so that traffic on the entire expressway is not impaired.

(7) Concession/Supervision Fee

The four expressway projects that were signed up in the last decade carried different provisions for annual supervision fees. The heaviest burden is found on the STAR project, which stipulated 2% of construction cost as payable to the Government. The applicable fee for the MNT was not as high, at 2% of the budgeted cost for repairs and maintenance. On the other hand, the MCTE and Skyway projects were virtually exempted.

It is only fair for a government agency to impose supervision fees to cover its administrative and regulatory expense attributable to the operations of the facility. The Study Team recommends the adoption of a rate equal to 2% of the annual budget for repairs and maintenance.

(8) Asset Ownership

Under a BTO contract, title and ownership of the expressway shall be transferred to the Government upon completion of construction. This provision should be made to apply for the private section of the project. There is no need to transfer ownership for the public section of the project, since the latter has been procured directly by the Government.

However, there are some project components that should preferably remain with the project company. Ownership for toll collection equipment and systems ought to be retained in the project company, since replacement or upgrading of technology may likely occur several times during the franchise period.

In consideration of the transfer of substantial project assets to the Government, the beneficial use (usufruct) of the project – both for the public section and the private section – shall be granted to the concessionaire over the franchise period. Naturally, under accounting rules, only the 'depletion or depreciation' charge for the private section would apply as it refers only to the asset that it built and transferred to the Government.

Who pays for property insurance for the transferred assets? Theoretically, it should be the owner. In the case of expressways, the concessionaire is usually required to secure the proper insurance cover and pay for the premiums, which shall be deemed as part of operating expenses to be recovered from toll fees.

4.6.4 Bidding and Implementation Issues

(1) Criterion for Choosing the Winning Bidder

It is easy enough to choose the winning bidder for the R10/R10/C5 segment – the lowest price among responsive bids. The design presupposes a bill of materials and a method of construction; hence price becomes the determining factor. Government rules on bidding are well established on this point.

The criterion for choosing the winning bidder (and automatically, the concessionaire and builder for the private section, i.e. the R10+ R10/C5) of the project is not as explicit. In the case of the STAR project, the basis was the lowest toll fee to be imposed. For the case study, the Study Team recommends the lowest revenue target (**TCR**) that will trigger end of concession period. This revenue target would provide capital recovery for the design and building of the private section and the toll equipment and facilities for both public and private sections of the Case Study Expressway, inclusive of returns on equity and interest charges anchored on a base toll fee of ₽ 4/km/PCU. The **TCR** will be calculated at the contract year price.

Had there been no splitting of expressway segments, the desirable criterion would be the bid requiring the least amount of government support not exceeding 50%.

(2) Project/Construction Management

The two sets of lenders, i.e. ODA and private, would insist on having an accountable and credible project management that satisfies their respective concerns. This would invariably lead to two sets of project managers (the ODA consultant and the Independent Consultant if he functions as a project manager) during the construction period – one for the public section (who is answerable to the Government and to the ODA) and another for the private section (who is answerable to the concessionaire and its stakeholders).

To obviate problems that may arise during this phase of the project, the DPWH should procure or act as a project manager to integrate the construction of the both sections, and should set up coordination mechanism and information-sharing arrangement between the two groups.

(3) ROW Acquisition

A narrow section of C3 may entail some ROW–depending on final design–and this item has not been factored into the project cost estimate.

Nevertheless, asking the winning bidder to advance the funds for ROW should be avoided, as it transfers the ROW risk from the public to the private sector. The standard practice in BOT projects is for the Government to shoulder the ROW obligation, as it is the party better equipped to do assume this task because of its power of eminent domain.

To achieve this, the DPWH should include the funding for the ROW (estimated at ₱350 million) in its capital budget program as soon as possible. In addition, some amount must be budgeted for relocation of squatters along R10. Considering the annual budgetary cycle, and the need for NEDA and Congressional approvals, the earliest that these funds could be made available would be 2005. It should be noted that the loan agreement for the ODA portion may get deferred without assurance on the ROW aspects (and relocation of informal dwellers) of the project.

Neither should the concession for the private section (the R10+R10/C5 Extension section) of the project be tendered, without substantial progress being achieved on ROW.

(4) Timetable

Conceivably, one section can proceed ahead of the other. However, this should be avoided. The object is to synchronize the start dates of both sections to get simultaneous completion. The key is to bid out the construction of the Government-funded segment at the same time as the bidding for the concession of the private-funded segment. This implies that the former would have a head start, since ODA funding has already been secured by the time the construction bid will be called. On the other hand, financial closure for the latter can only proceed after the signing of the concession agreement (which results from a tender). This should, together with the notice to proceed for the construction of the public section, provide enough comfort to lenders of the concessionaire, that the combined sections would be completed according to their expectations..

Another factor favoring the simultaneous conduct of the two bids is the competitive climate that it engenders. Construction companies would bid for the Government-funded segment like the usual DPWH road projects. They are also free to join any private consortium to bid for the private-funded section. In all likelihood, there will be entities that would join the tender for only one segment, as there are entities that would bid for both sections. This would be healthy, as the Government could get better prices and terms in such a situation.

On the other hand, it may also be argued that the tendering for concession should be set ahead of the Government-funded section for the basic reason that the winning bidder should be given lead time to gain financial closure and perform its own Detailed Design works. Furthermore, the preparation of the bid documents for the BOT section would take a shorter time period because of it had already been done substantially. Notwithstanding the validity of these arguments, the preferred action is for the simultaneous bidding – since it would ease financial closure. To facilitate the engineering works of the winning bidder, as much data shall be made available – soil tests, site plans, geodetic surveys, and basic or preliminary designs. Besides, unlike in the public sector, the concessionaire can commence construction as partial designs become available, i.e. perform an iterative design-build manner.

Table 4.43 is an indicative timetable for implementing the Case Study Expressway project. It takes into account the long lead time involved in lining up ODA financing for the C3/R9 section.

Table 4.43 Implementation Schedule for the Case Study Expressway Project

	ACTIVITY	1	2	3	4	5	6	7	8	9	10
		2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
1	Project approval of Government										
	1.1 SAF (F/S and Basic Design review)										
	1.2 EIA clearance/Approval of NEDA										
2	Public Section										
	2.1 Request for ODA										
	2.2 Pledge										
	2.3 Loan Agreement										
	2.4 Selection of consultant										
	2.5 Preparation of BD & bid documents										
	Review of F/S and Basic Design										
	Detailed Engineering										
	Preparation of Bid Documents										
	Approval of DE and BD										
	2.6 Selection of Contractor										
	Pre Q										
	Bidding										
	Technical & Financial Evaluation										
	Negotiation & Contract Award, NTP										
	2.7 Construction										
3	Private Section										
	3.1 Preparation of Bid Docs (incl. Basic D.)										
	Review of F/S and BD										
	Preparation of BOT Bid documents										
	Approval of bid documents										
	3.2 Selection of concessionaire										
	Pre Q										
	Bidding										
	Evaluation & Approval										
	Negotiation & Signing of Conc.Agr										
	3.3 Detailed Design										
	3.4 Securing of Project Finance										
	3.5 Construction										
4	Operation										
	4.1 Grant of TOC by TRB & Set Base Toll Fee										
5	Right of Way										
	5.1 Secure appropriation										
	5.2 ROW acquisition/clearance										

4.6.5 Detailed Financial Analysis of the Case Study Expressway

Although a financial analysis of the Case Study Expressway was already shown at the beginning of this section, it was done in a simplified way only for estimation of the project profitability, without considering conditions of fund raising and tax payment. Here, financial analysis is made in more detail, based on the aforementioned PPP structure by estimating pro-forma financial statements.

(1) Conditions of Analysis

The following conditions were assumed for the detailed financial analysis. Toll revenue (7) is the estimate based on the demand forecast under the toll conditions of (6). Interest rate of a foreign loan will be lower than that of a domestic loan. With the condition (5), however, the difference will become less. Then, all the long-term loan is treated as domestic loan for simplification.

1) Two in one Project

C3/R9:	Public Section -----	6,871 Million Pesos
R10+R10/C5:	Private Section ---	6,876 Million Pesos

2) Own Capital Ratio 25 %

3) Interest rate

Deposit	5% p.a.
Long term loan	12% p.a. (10 years repayment with 3 years grace period)
Short term loan	10% p.a.

4) Inflation

Domestic:	8% p.a.
Foreign:	3% p.a.

5) Exchange rate Peso devaluates by 5% p.a

6) Toll Rate
4 Pesos/Km in 2010
10 + 4 Pesos/km in 2015
20 + 4 Pesos/km in 2020 and after

7) Toll Revenue
1,032 million pesos in 2012
1,767 million pesos in 2017
3,843 million pesos in 2030 and after

8) Financial Cost

Arrangement Fee (Up-front Fee)	1% of total loan amount
Commitment Fee	0.4% of un-disbursed loan amount
Management Fee	one million pesos p.a. during operation

9) Corporate income tax: 32% of net operating income

10) Value added tax is exempted

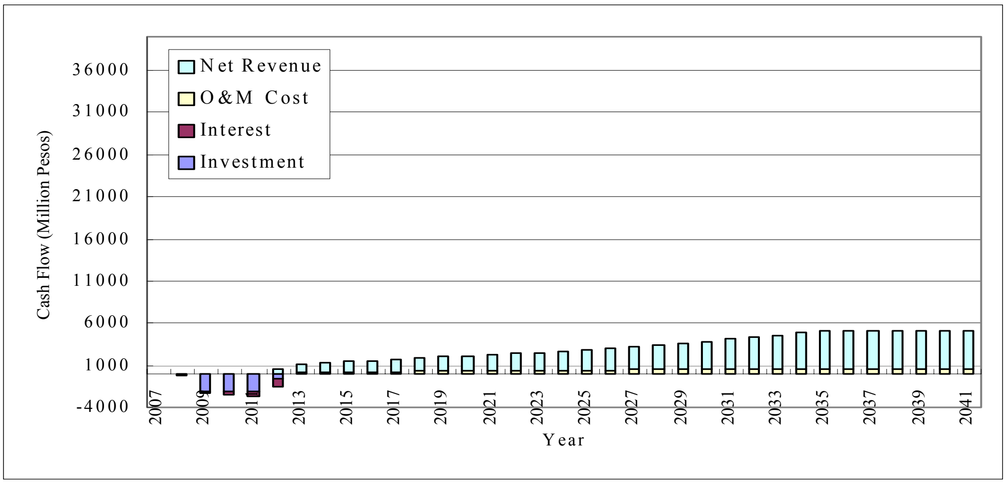
11) Depreciation of Concession: 30 years by straight line method

(2) Results

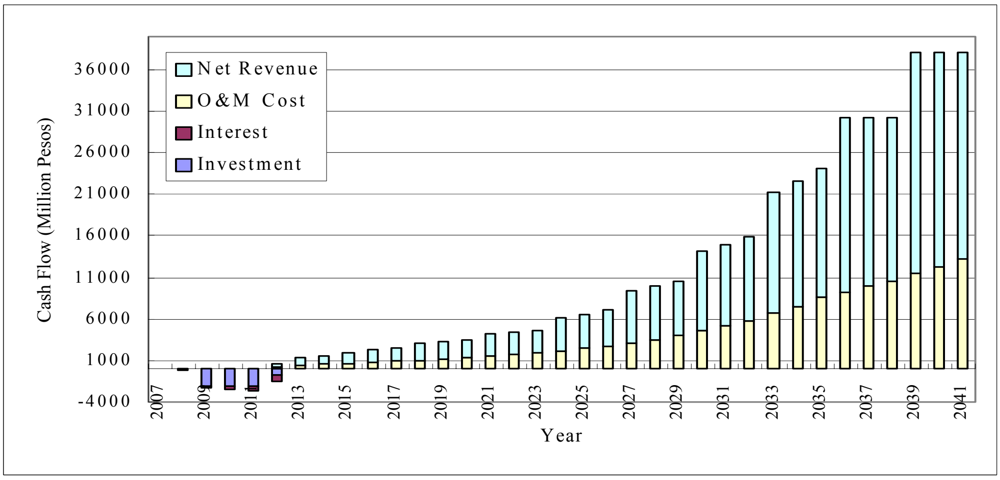
Figure 4.58 shows the cash flow of the Case Study Expressway, both in real and nominal terms. In 2036 annual revenue will reach a ceiling because traffic on the Case Study Expressway will reach capacity (80,000 pcu/day). In nominal terms, toll rate is adjusted in every three years according to the formula stated in the concession agreement, while O&M cost is inflated at the same rate as the CPI. As the toll adjustment rate is lower than the inflation rate during the foreign loan repayment period, O&M cost will increase at relatively higher rate than the gross revenue.

Figure 4.58 Cash Flow of Case Study Project

(1) Real-term Cash Flow



(2) Nominal-term Cash Flow with Toll Adjustment



In the real-term cash flow, cumulative gross revenue (aggregate net revenue and O&M cost) will reach ₱85,777 million in 30 years, 12.5 times of the initial project cost. Nominally, this rate will be 58.4 times.

Evaluation indices of FIRR and NPV are estimated as shown in Table 4.44. As long as the project cash flow is concerned, the project seems financially sound. However, return to equity holders is rather low at 13.0%. This is mainly because of corporate tax payment and partially of financial costs such as arrangement fee (Up-front Fee) and commitment fee. If the corporate tax is exempted throughout the concession period, the equity IRR in real term will be improved up to 15.5%. Therefore, some taxation measures will be needed to make this project more attractive to investors.

Table 4.45 shows the sensitivity of IRR to the change of revenue. By 10 % decrease of gross revenue, Project IRR lowers by 1.1 points and Equity IRR by 1.8 points. If the gross revenue decreases by 20%, Project IRR drops lower than 15% and Equity IRR lower than 10%. Thus, demand and revenue forecast is the key factor for the project viability.

Table 4.44 Evaluation Index of Project Cash Flow and Equity Cash Flow

	Evaluation Index	Project Cash Flow	Equity Cash Flow
Real-term	NPV (at 12% of DCR)	2,184 mil. Peso	177 mil. Peso
	FIRR (%)	16.6%	13.0%
	Cost Recovery (Years)	12	17
Nominal-term	FIRR (%)	20.7%	19.1%
	Cost Recovery (Years)	12	16

Table 4.45 Sensitivity of FIRR to Revenue Change (in real-term)

	Revenue Change (Times of Base Case Revenue)					
	BC x 1.1	Base Case	BC x 0.9	BC x 0.8	BC x 0.6	BC x 0.4
Project IRR (%)	17.6	16.6	15.5	14.4	11.9	8.8
Equity IRR(%)	14.8	13.0	11.2	9.3	5.0	-

Main indicators for annual evaluation are shown in Table 4.46. As a characteristic of urban transport facilities, demand and then revenue will increase gradually. As a result, raising funds is difficult in the initial stage after opening, especially during repayment period. Debt service coverage ratio is extremely low, lower than 1.0 in the first five years. This is why a longer repayment or balloon payment is needed for this kind of transportation project.

Fare box ratio is rather high, although it goes down gradually due to the gap between toll adjustment rate and inflation rate. Return on investment (ROI) and return on equity (ROE) are mostly in an acceptable range except the first four to five years.

Table 4.46 Annual Evaluation Indicators in Nominal Terms

Year	Debt Service Coverage Ratio	Fare Box Ratio	ROI	ROE
2012	29.0%	309.5%	1.4%	-29.6%
2013	59.2%	294.6%	6.9%	-8.4%
2014	64.5%	280.1%	7.8%	-3.9%
2015	89.1%	298.7%	11.1%	10.8%
2016	103.7%	298.7%	12.3%	18.5%
2017	122.5%	268.2%	13.5%	27.3%
2018	174.5%	288.0%	17.8%	49.1%
2019	204.4%	272.1%	18.4%	58.3%
2020	242.1%	256.8%	18.9%	68.2%
2021	4279.7%	277.6%	25.1%	99.5%
2022		261.4%	25.7%	75.2%
2023		245.9%	26.3%	79.8%
2024		291.2%	40.6%	121.7%
2025		273.4%	41.7%	129.4%
2026		256.5%	42.6%	136.8%
2027		302.9%	64.2%	200.5%
2028		283.8%	65.9%	212.5%
2029		265.6%	67.5%	224.4%
2030		313.0%	100.0%	321.0%
2031		292.5%	102.8%	339.8%
2032		273.3%	105.2%	358.4%
2033		321.4%	154.3%	504.7%
2034		299.9%	158.6%	534.0%
2035		279.7%	162.4%	562.8%
2036		328.4%	222.6%	746.3%
2037		306.0%	215.4%	752.4%
2038		285.0%	207.5%	757.2%
2039		334.2%	283.5%	989.9%
2040		311.0%	274.3%	999.2%
2041		289.4%	264.5%	1006.8%

Note: Fare box ratio: Toll revenue / O&M expense
ROI: Net Operating Income / Total Investment
ROE: Net Income after tax / Equity

4.6.6 Beyond the Case Study

(1) What Should be Done to Skyway 3?

There are cogent reasons why the Skyway 3, as currently structured, will fail to see the light of day. The calculated FIRR is 8.6%, a rate too low for commercial project financing. Its capital cost is also enormous at about ₱25.8 billion, as to exceed the financial capacity of the CMMTC which is already having difficulties raising funds for the Skyway 2. On top of this, the same proponent is behind the STAR project which has so far failed to reach financial closure. Government support cannot be extended to Skyway 3, as its proponents would like to happen, because the project is a product of a joint venture with the PNCC and did not undergo open competitive tender. The government, however, may be in estoppel to open a bidding for the project since the rights thereto had been ceded. A closer scrutiny of the Supplemental Toll Operation Agreement dated November 1995 reveals that Skyway 3 was not specifically demarcated for Citra. The claim of the PNCC, however, was explicitly recognized. To forestall any ambiguity that could undermine prospective bidding, the Study Team recommends that the DPWH, TRB, PNCC and Citra resolve the issue as soon as possible, with a view to clearing the way for the DPWH to bid out the concession for Skyway 3.

It should be noted that the cost estimate for public section included a short link section to NLT, which is originally a part of the Skyway 3.

(2) Inter-operability with NLT and Skyway 3

It is possible for the concessionaire of the Case Study Expressway to set up his own toll collection system, independent of and separate from that of the NLT and the Skyway. There would then be at least three operators in the expressway network. Without a proper system of inter-operability, a motorist traversing one into the other may: (a) stop several times at every toll gate/booth, thus losing valuable time; (b) have to use three incompatible tickets, and therefore pay several times; (c) suffer blockage due to an accident in the other. The remedial measures will be discussed in the subsequent section of this chapter.

4.7 Case Study on TIS, ETC and O&M

4.7.1 Case Study on TIS and ETC

In this section, the assumptions of scale and equipment grade of systems and cost estimate at Stages 1 and 2 are prepared.

The outline of the expressway network in both cases is as follows:

Table 4.47 Outline of Expressway Network at Each Stage

	Length (km)	No. of Interchange	Number of Ramps			No. of Junctions	No. of Lanes	Type of Structure
			On-ramp	Off-ramp	Total			
SLE	41.9	6	10	10	20	1	6	At-grade
MCTE	6.3	3	4	4	8	3	4	At-grade
Skyway 1	9.1	5	5	4	9	3	6	Elevated
R10/C3/R9	16.6	6	7	6	13	3	4	Elevated
Stage 1 Total	73.9	20	26	24	50	Net 5	-	-
Skyway 3	13.0	5	9	9	18	2	6	Elevated
Stage 2 Total	86.9	25	35	33	68	Net 6	-	-

(1) Assumptions

Systems for Existing Expressways

The completion time of Case Study Expressway and the Skyway 3 are expected to be in 2010 at the earliest. In this case study, it was assumed that the TIS and the ETC system, would be simultaneously introduced on existing sections, which are the SLE, the MCTE and the Skyway 1. Although, the SLE and the Skyway 1 already have an ETC system, it is expected that around 2010 This will be replaced with one similar to that to be used on the Case Study Expressay.

Number of O&M Station and Systems for the Station

At Stages 1 and 2, the expressway network consists of the sections belonging to Segments A and D (see Figure 3.15) of the assumed segmentations for operation and maintenance. Therefore, only two maintenance office systems should be set up.

Graphic Display Panel, Highway Radio System and Junction System

At these stages, it was assumed that there would be no alternative exit. Therefore, graphic display panels and highway radio systems for traffic information provision and junction systems for ETC would not necessary.

Outline of Systems

Tables 4.48 and 4.49 show the outline of systems at Stages 1 and 2.

Table 4.48 Outline of the TIS at Each Stage

Item			Principle	Subtotal	Total Per Stage
Common Device					
	Central Computer System			1	1
	Maintenance Office System			2	2
Field Equipment					
	For Existing Roads				
		Vehicle Detector	At every section between junctions, at every junction and at every ramp	13	
		CCTV Camera	At every junction and off-ramp	18	
		VMS on Main Line	Before every junction and off-ramp	18	
		VMS at Ramp	At every on-ramp	19	
		Graphic Display Panel	No graphic display panel at this stage	0	
		Emergency Telephone Booth	500 m apart	122	
		Highway Radio	No highway radio at this stage	0	
	For R10/C3/R9/R10/C5				Stage 1
		Vehicle Detector	At every section between junctions, at every junction and at every ramp	5	18
		CCTV Camera	At every junction and off-ramp	7	25
		VMS on Main Line	Before every junction and off-ramp	7	25
		VMS at Ramp	At every on-ramp	7	26
		Graphic Display Panel	No graphic display panel at this stage	0	0
		Emergency Telephone Booth	500 m apart	40	162
		Highway Radio	No highway radio system	0	0
	For Skyway 1				Stage 2
		Vehicle Detector	At every section between junctions, at every junction and at every ramp	3	21
		CCTV Camera	At every junction	9	34
		VMS on Main Line	Before every junction and off-ramp	9	34
		VMS at Ramp	At every on-ramp	9	35
		Graphic Display Panel	No graphic display panel at this stage	0	0
		Emergency Telephone Booth	500 m apart	24	186
		Highway Radio	No highway radio system at this stage	0	0

Table 4.49 Outline of the ETC at Each Stage

Item			Principle	Subtotal	Total Per Stage
Common Device					
	Center System			1	1
Entrance-Exit and Junction					
	For Existing Roads				
		Entrance System	At every on-ramp	19	
		Exit System	At every off-ramp	18	
		Junction System	No junction system at this stage	0	
	For R10/C3/R9/R10/C5				Stage 1
		Entrance System	At every on-ramp	7	26
		Exit System	At every off-ramp	6	24
		Junction System	No junction system at this stage	0	0
	For Skyway 3				Stage 2
		Entrance System	At every on-ramp	9	35
		Exit System	At every off-ramp	9	33
		Junction System	No junction system at this stage	0	0

(2) Cost Estimate

The costs of the above-mentioned systems are estimated in Table 4.50. These estimates are the same as the figures mentioned in Chapter 3.

Table 4.50 Cost Estimate for TIS and ETC System

Unit: mil. ₱

	Cost of ETC	Cost of TIS	Cost for Communication System and Cable	Total
Stage 1	1,138	1,376	774	3,287
Stage 2	1,610	1,782	1,047	4,438

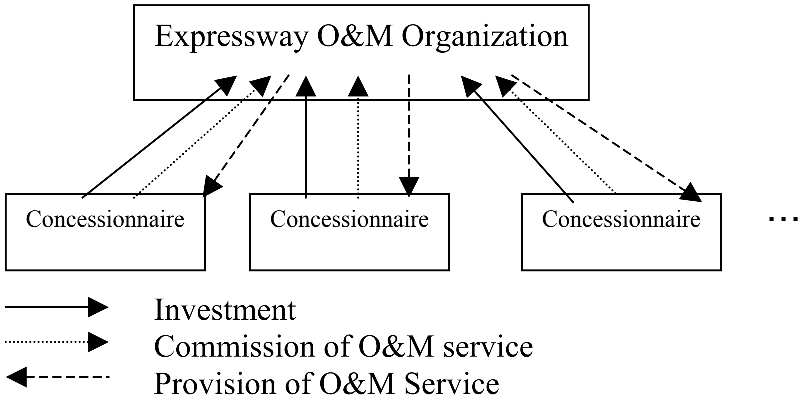
4.7.2 Operation and Maintenance

<u>**Organization for Operation and Maintenance**</u>

At Stages 1 and 2, the MMUEN is still divided in two parts, the northern part and the southern part. Despite this, it is recommended that an integrated operation and maintenance organization be established. The organizational framework is as shown in Figure 4.59, namely:

- Related concessionaires invest in establishing the organization.
- Related concessionaires commit O&M work to the organization.
- The organization provides O&M works to the concessionaires.

Figure 4.59 Framework of O&M Organization



The organizational structure and the roles of each division are mentioned in Chapter 3.

Cost Estimates for Operation

The annual costs of operation and maintenance of Case Study Expressway and the Skyway 3 were estimated using the following assumptions:

- Total length of expressway to be operated: 29.6 km
  - 4-lane section (Case Study Expressway) 16.6 km
  - 6-lane section (Skyway 3) 13.0 km
- Dimension of roadway: Four-lane (Case Study Expressway) and Six-lane(Skyway 3), two-way divided, with lighting
- Composition of roadway structure: elevated concrete-type viaduct
- Number of toll plazas: 11
- Daily traffic volumes handled at each toll plaza: 57,200
- Total length of entire expressway network: 303 km
- Total length covered by an Operation and Maintenance Station: 77 km

Cost of Routine Maintenance

Cleaning	1.45 (M₱/ km) x 29.6	= 42.9 M₱
Bridge Maintenance		
4-lane	1.96 (M₱/ km) x 16.6	= 32.5 M₱
6-lane	2.82 (M₱/ km) x 13.0	= 36.7 M₱
Lighting	1.18 (M₱/ km) x 29.6	= 34.9 M₱
Subtotal		147.0 M₱
Indirect cost (10%)		14.7 M₱
Total		**161.7** M₱

Shared Cost for the Operation and Maintenance Station

	Mil. ₱
12.152 (M₱/ km) x 29.6/77 =	**4.7**

Shared Cost for the Expressway Operation Station		
		Mil. ₱
5.892 M₱ x 29.6/303	=	**0.6**
Operating Cost of Toll Plazas		
Handled Daily Traffic, V		
(Thousand vehicles per day)		57.2
Total Number of Toll Attendants, N		
N= 0.81 V + 13		59.3
Toll Plaza Operating Cost		
583 + 194.7 N ('000 Peso)		12,129
11 Toll Plazas Total (Mil. ₱)		**133.4**
Subtotal		**300.4**
General Expenses		
159.6 x 0.25	=	**75.1**
Total (Mil. ₱)		**375.5**

It must be noted that these estimates are not inclusive of the cost of repair and rehabilitation of the expressway. If such periodic capital investment is considered to be a kind of annual cost, it will entail an additional annual average cost of ₱ 43.9 million, assuming it covers pavement overlay once every 12 years and is calculated as follows:

4-lane: 14.5 (Mil. Peso/km) x 16.6 (km)/12 (Years)= 20.1
6-lane: 22.0 (Mil. Peso/km) x 13.0 (km)/12 (Years)= 23.8
Total: 43.9 Million Peso per year.

5 PREPARATION OF MODEL BIDDING DOCUMENTS

5.1 Review of Existing Bidding Documents

In order to prepare the model bidding documents under a PPP scheme, the following four existing toll expressway projects already implemented in the Philippines were reviewed:

1) Southern Tagalog Arterial Road (STAR) Project
2) Manila- Cavite Toll Expressway (MCTE) Project
3) Manila North Tollway (MNT) Project
4) Metro Manila Skyway (MMS) Project, Phase 1

These four projects were analyzed and compared in detail in terms of project history, costs, concession terms, and other features as shown in Section 2.1.2, Review of Existing PPP Transport Projects.

However, among the four projects, it is only the STAR project where bidding for theselection of a concessionaire was carried out by the Government through the DPWH. The others were procured in an unsolicited mode on negotiation basis with the TRB and concessionaires. A review of existing expressway projects in the Philippines revealed that bidding documents were available only for the STAR project.

In preparing the model bidding documents, references were sought from PPP projects in other countries and from international funding agencies such as the United Kingdom and the United Nations Commission on International Trade Law (UNCITRAL). Some of the references are as follows:

1) Instructions and Guidelines to Tenderers and A13 Thames Gateway DBFO Contract, The Highways Agency
2) Second Stage Expressway Agreement between Expressway and Rapid Transit Authority of Thailand and Bangkok Expressway Company Limited
3) Model Concession Agreement, the Government of India
4) Legislative Guide on Privately Financed Infrastructure Projects, UNCITRAL

In reviewing these references for the bidding documents, the following points were the focus:

1) Appropriateness and applicability to the Philippines of the means and procedures of the bidding
2) Clearness of the scope of contract
3) Rights and obligations between contracting parties
4) Risk sharing among contracting parties
5) Contractual procedures in case unforeseen incidents occurred and provisions of force majeure

It should be noted that all private sector infrastructure or development projects shall be implemented in compliance with the Philippine BOT Law (RA No. 6957 "an Act Authorizing the Financing, Construction, Operation and Maintenance of Infrastructure Project by the Private Sector and for Other Purposes", as amended by RA No. 7718) and its Implementing Rules and Regulations. The Implementing Rules and Regulations include, among others, the criteria and guidelines for evaluation of bid proposals, list of financial incentives and arrangements that the Government may provide for the project in order to carry out the provisions of the Act in a most expeditious manner.

Therefore, the BOT Law and its IRR were analyzed in detail to secure the applicability of the model bidding documents for PPP projects in the Philippines.

5.2 Preparation of Model Bidding Documents

A model of the bidding documents was prepared covering the Case Study Expressway project. All the key elements found through PPP techniques in this Study were reflected in these model bidding documents.

The bidding documents which were prepared for the Case Study Expressway project consist of four components: Prequalification Documents, Bid Documents, Draft Toll Concession Agreement, and Bid Drawings. The latter two documents are parts of the Bid Documents.

In preparing the bidding documents, the following points were noted:

(1) Securing of transparency and fairness

It is very important to secure transparency and fairness to the public in the procurement process because the project is to be developed as a public utility. In light of this, the procedures for the public invitation, bidding and bid evaluation should be transparent and fair.

(2) Securing of competitive bidding

Securing competitive bidding in the procurement stage is one of the most important factors to implement the project at an appropriate price. To encourage prospective bidders to participate in the bidding, ambiguous and/ or unfair provisions of the contract must be eliminated.

(3) Clear contractual conditions

The rights and responsibilities of the contracting parties in each stage of design, construction and the succeeding operation and maintenance should be clearly stipulated in a toll concession agreement in order to avoid unnecessary disputes during project implementation.

(4) Appropriate risk sharing

BOT projects have inherent kinds of risks at each project stage. In order to reduce contractual disputes during project implementation and to avoid increases in project cost due to inappropriate risk allotments, it is essential to distribute risks fairly and appropriately to each of the contracting parties and stipulate consequences in case of defaults in the toll concession agreement.

The following are some of the risks that should be considered at each stage of project implementation:

1) In the design and construction stages:
    - Design risk (defects in study/design, design changes)
    - Right-of-way risk (land acquisition risks)
    - Completion risk
    - Cost overrun risk
    - Natural condition risk
    - Quality risk

2) In an operation and maintenance stage:
    - Demand risk
    - Toll rate risk (caused by disapproval of amending toll rate)
    - Operational cost overrun risk
    - Risks incurred from related facilities and/or their operation
    - Operation delay risk

3) In general:
    - Financial risk (price, interest rate, foreign exchange)
    - Economic risk (currency crisis, devaluation)
    - Force majeure risk
    - Legal/ institutional risk
    - Social/ environmental risks

4) Measures for risk management

Risks associated with projects are generally managed through the following four steps:

- Identification of risk
- Evaluation of consequences due to risk
- Minimization of risk
- Allotment of the remaining risk

It is crucial in BOT projects to evaluate in detail the risks associated with projects at the beginning of project implementation in accordance with the steps mentioned above and furthermore to prescribe procedures for amending contracts in case situations change.

(5) Appropriate dispute settlement

BOT projects involve many stakeholders. Therefore, an appropriate system for dispute settlements should be clearly mentioned in the concession agreement of the BOT project.

5.2.1 Prequalification Documents

Prospective bidders will be prequalified for the project in accordance with the methods and procedures specified in the Prequalification Documents. Only the applicants who pass the prequalification can participate in the succeeding bidding for the project.

The following is a composition of the prequalification documents set for the project:

Section 1: General Conditions
Section 2: Project Information
Section 3: Scope of Work
Section 4: General Information for Applicants
Section 5: Tentative Prequalification and Bidding Schedule
Section 6: Prequalification Procedures
Annexes

(1) Section 1: General Conditions

This section defines the terms used in the prequalification documents and summarizes project scope, prequalification evaluation criteria and indicative milestones for project implementation.

(2) Section 2: Project Information

This section provides information about the project to be bidded, which includes project description, toll road traffic forecast, construction cost estimates made by the Government, contractual framework, and public utility classification.

It should be noted that the project will be contracted out in a BTO scheme.

(3) Section 3: Scope of Work

The scope of work to be performed by the proponent is described in this section.

To assist the DPWH in assuring project quality, an Independent Consultant (IC) will play a role of an independent design checker and independent certification engineer during the design and construction stages of project implementation. The IC's scope of services includes checking of the detailed engineering design prepared by the proponent, periodic inspections of the construction, certification of claims, and certification of the operation and maintenance manual. The IC shall report directly to the DPWH.

It should be noted that the DPWH shall assume full responsibility for the acquisition of the ROW, and undertake an EIA to secure an ECC for the project.

(4) Section 4: General Information for Applicants

This section provides details on general information, such as who may participate, confidentiality of documents and information submitted by applicants, waiver of action, and withdrawal of applicant's members.

(5) Section 5: Tentative Prequalification and Bidding Schedule

This section provides a tentative prequalification and bidding schedule. The schedule starts from the Prequalification Conference to the issuance of a Notice to Proceed for construction in conformity with the IRR of the BOT Law.

(6) Section 6: Prequalification Procedures

This section describes prequalification procedures, which include the issuance of Prequalification Documents, submission of the Prequalification Documents, as well as requirements and evaluation criteria of the prequalification of applicants.

The prequalification of applicants will be carried out in two stages. Legal requirements such as ownership, financial undertakings, formality and completeness of Prequalification Documents submitted by applicants are evaluated in the first stage.

In the second stage, technical and financial capabilities of applicants are evaluated with a scoring system set against project experience, key personnel and subcontractors to be assigned, equipment and plants to be mobilized, and financial data of the applicants who passed the first stage evaluation.

To be qualified, applicants must gain more than 50% of the scores allocated to each of the evaluation items as well as at least 70 points in total.

(7) Annexes

The Prequalification Documents shall be prepared by the applicants in accordance with forms specified in Annex A: Confidential Prequalification Statement. The technical specifications, design and performance standards for the project is specified in Annex B. The structural features of the project are shown as Prequalification Drawings in Annex C.

The annexes mentioned above are those attached in the bidding documents.

5.2.2 Bid Documents

The proponent for the project will be selected through procedures specified in the Bid Documents. The Bid Documents consist of the following components:

1. Volume I:
   a. Part I — Instructions to Bidders
   b. Part II — Minimum Design and Performance Standards and Specifications
   c. Part III — Draft Toll Concession Agreement
2. Volume II: Bid Drawings
3. DPWH Standard Specifications for Public Works and Highways, 1988 Edition: Volume II- Highways, Bridges and Airports

Part I describes procedures for the bidding which include bidding conditions, required documents for bidding, procedures of bid openings, bid evaluation criteria, and a scoring system for the selection of a successful bidder. Part II includes the minimum requirements for design, construction, and operation and maintenance to be undertaken by the proponent. Part III is the Draft Toll Concession Agreement to be entered into between the Government (the Grantor) and the Proponent (the Grantee).

The following is a composition of Volume I: Parts I and II of the Bid Documents for the project:

(1) Section 1.0: General Conditions

This section defines the terms used in the bid documents and summarizes the project scope, bid evaluation criteria, indicative milestones for the project implementation, and the required bid and performance securities required to be submitted by bidders.

(2) Section 2.0: Project Information

This section is the same as that corresponding to the Prequalification Documents.

(3) Section 3.0: Scope of Work

This section is the same as that corresponding to the Prequalification Documents.

(4) Section 4.0: General Information for Bidders

This section specifies general information and requirements as well as procedures for the bidders to participate in the bidding.

Bid security must be submitted by each of the bidders for them to participate in the bidding. After awards, the winning bidder must post a performance security in the specified form to guarantee his faithful performance under the contract.

(5) Section 5.0: Submission and Opening of Bids

This section specifies the sealing and marking of the bid, conditions for submission, and procedures of opening of the bids.

The bidding will be carried out in a two-envelope system whereby the first envelope containing the technical proposal and the second envelope containing the financial proposal should be submitted simultaneously. The first envelopes are opened and evaluated first. Only the second envelope of bids that passed the first evaluation will be opened for financial evaluation.

(6) Section 6.0: Bid Proposal and Evaluation Criteria

This section describes the bid information required of bidders and the bid evaluation criteria and procedures for a selection of the proponent. The bid shall consist of the Technical Proposal (Envelope No.1) and the Financial Proposal (Envelope No.2).

The Technical Proposal shall contain the following documents:

1) Authority of the signing official
2) Bid security
3) Project marketability
4) Engineering design
5) Construction plan
6) Operational plan
7) Maintenance plan
8) Environmental management
9) Financial viability

The evaluation of bids shall be undertaken in two stages in accordance with the procedures described below:

The first stage evaluation will be carried out with the confirmation of completeness and adequacy of the bid proposal and the assessment of the technical, operational and maintenance, environmental, and financial viability of the proposal contained in the bidders' first envelopes in light of the prescribed evaluation criteria.

The proposal must outline the various elements comprising the project by narrative descriptions, drawings, diagrams, and schedules, and state the standards and specifications in compliance with which the toll road will be constructed.

Only bidders whose Technical Proposals are deemed satisfactory and complete by the PBAC will have their second envelopes (Envelope No. 2) opened for further evaluation. Bidders whose Technical Proposals are not deemed by the PBAC to be satisfactory and complete will have the envelope containing their Financial Proposals returned unopened together with the reasons for their disqualification.

The second stage evaluation will be carried out with the assessment and comparison of the financial proposals based on the cumulative revenue proposed at a price level of the bidding year and the length of the concession period proposed by the bidders. It should be noted that once bidders have passed the first stage evaluation, all complying bids are then considered to be on equal footing. Award, if any, will therefore be made to the lowest complying bidder whose bid is most advantageous to the Government.

The technical proposal will be evaluated under a scoring system whereby points are allocated to each of the items for evaluation. The bid to be qualified for the second stage evaluation shall gain more than 50% of the points allocated for each of the items for evaluation and at least 70 points in total.

(7) Section 7.0: Technical Specifications: Design and Construction

This section describes the technical specification and standards applied to the design and construction of the Case Study Expressway to be undertaken by the proponent. The construction work shall be executed under sound engineering practices in accordance with the technical specifications and final detailed engineering design approved by the DPWH.

The responsibility of both parties against variation orders to the design and/ or construction is stipulated herein. The requirement for handover of the works is also mentioned.

(8) Section 8.0: Operation and Maintenance Procedures

This section details the following:

1) Operation of toll facilities
2) Traffic management
3) Maintenance of toll road facilities

(9) Annex

The technical specifications, design and performance standards for the project is specified in Annex A. This annex is attached in the bidding documents.

(10) Bid Forms

The following four kinds of forms to be used for the bidding are to be used as bid forms:

1) Bid Form No.1 Bid Letter
2) Bid Form No.2 Statement of Bids
3) Bid Form No.3 Deviations/ Clarifications Sheets
4) Bid Form No.4 Cumulative Revenue and Concession Period

5.2.3 Draft Toll Concession Agreement

A Draft Toll Concession Agreement (TCA) composes a part of the bid documents. The Draft TCA should clearly define basic and legal relationships between parties concerned and their rights and responsibilities as well as procedures of settling matters.

The draft TCA consists of the following sections:

Section 1.0 Definitions and Interpretation
Section 2.0 Scope of the Project
Section 3.0 Grant of Privilege and Recital of Obligation
Section 4.0 Independent Consultant
Section 5.0 Design of the R10/C3/R9+R10C5 Link Expressway
Section 6.0 Construction of the R10/C3/R9+R10C5 Link Expressway
Section 7.0 Ownership of the Toll Road
Section 8.0 Operation and Maintenance
Section 9.0 Project Financing
Section 10.0 Toll Rate and Toll Collections
Section 11.0 Default and Termination
Section 12.0 Representations and Warranties
Section 13.0 Settlement of Disputes
Section 14.0 Force Majeure
Section 15.0 Miscellaneous Provisions
Annexes

The following are the main points that characterize the Draft TCA in a PPP scheme:

(1) Parties to be entered into the agreement

The Republic of the Philippines (the Grantor), acting by and through the DPWH and the concessionaire (the Grantee) are the only parties who enter into the agreement. On the other hand, the TRB is involved in the agreement as a governmental regulatory agency.

(2) Risk allocation

The Draft TCA was prepared in examining various risks from a standpoint of ensuring fairness for each party and based on a principle that risks should be allocated to the most efficient entity in managing and handling them on the basis of cause for its liability. Table 5.1 shows a risk allocation matrix for the Case Study Expressway.

Table 5.1 Risk Allocation Matrix for the Case Study Expressway

Type of Risk	Contractor	Grantee	Grantor	Insurance	Unallocated
Construction Phase					
1. Cost overruns/ delays due to:					
Design		OO			
Engineering	O	OO			
Construction	OO				
2. Change in legal requirement					
National			OO		
Local			OO		
3. Land acquisition			OO		
4. Natural disaster					
Insurable				OO	
Uninsurable			OO		
5. Industrial action					
Site-specific	OO				
General					OO
6. Environmental					
EIS breach			OO		
Known/caused by State			OO		
7. Traffic and activity relocation		O	O		
8. Insurance					
Workers compensation	OO				
Public liability		O		OO	
9. Force majeure		O	OO	O	
10. Confiscation – state			OO		
11. Approvals/licenses/ permits	O	O	O		
12. Variations					
By government			OO		
By contractor	OO				
13. Interest rate risk		OO			
14. Taxation		OO			
Operating Phase					
1. Revenue/Traffic demand		OO			
2. Operation		OO			
4. Defects liability		OO			
5. Natural disaster					
Insurable				OO	
Uninsurable			OO		
6. Industrial action					
Site-specific		OO			
General					OO
7. Environmental					
EIS breach		OO			
Known/caused by State			OO		
8. Traffic and activity relocation		OO			
9. Insurance					
Workers' compensation		OO			
Public liability		OO			
10. Force majeure		O	OO	O	
11. Confiscation – state			OO		
12. Approvals/licenses/permits		OO	O		
13. Restrictions on toll			OO		
14. Interest rate risk		OO			
15. Taxation		OO			

Legend: O: minor/joint responsibility OO: major responsibility

(3) Independent Consultant (IC)

An IC functions as an Independent Design Checker and Independent Certification Engineer.

As Independent Design Checker, the IC shall review and confirm that the Final Engineering Design for Section Pr, including the operation and maintenance facilities and all other toll road facilities as approved by the TRB, are within the standards and specifications agreed upon for the Case Study Expressway.

As Independent Certification Engineer, the IC shall carry out periodic inspections of the construction of Section Pr and the entire toll road facilities as may be approved by the TRB to ensure that the same is in compliance with the relevant approved designs and construction specifications.

(4) Design

The Grantor shall provide the basic design for the construction of Section Pr of the Case Study Expressway. For Section Pu of the Case Study Expressway, the detailed design has been completed and will be constructed under a separate construction contract with the Grantor. For Section Pr, the detailed design shall be made by the Grantee based on the basic design provided by the Grantor. In preparing the detailed design, the Grantee shall conform with the agreed Toll Road Design Standards and Specifications.

(5) ROW

The Grantor shall procure and provide to the Grantee the required road ROW where the project is to be constructed, inclusive of areas covered in Section Pu and Section Pr of the Case Study Expressway identified for the construction of the toll road facilities as approved by the TRB. The Grantor shall likewise be obligated to ensure the availability of the land required for the ROW throughout the term of the TCA in a way that will enable the Grantee to effectively, unimpededly and continuously perform the construction in accordance with the TCA.

(6) Substantial completion

The Case Study Expressway, in its entirety or segments thereof, shall be considered as substantially complete if its construction has reached such a state as to make it possible to determine whether the same sufficiently conforms to the Final Engineering Design and complies with all laws, rules and regulations for the operation of toll roads.

The issuance of a Certification of Substantial Completion shall constitute an acknowledgment by the Grantor that the completed section is suitable for operation as a toll road.

(7) Early completion

Revenues earned by the Grantee due to an early completion shall be considered as additional revenues to the Grantee as bonus.

(8) Liquidated damage for delay

If the Grantee fails to comply with the Time for Completion (Substantial Completion of the entire Case Study Expressway as a toll road facility certified by the Grantor), the Grantee shall pay to the Grantor Seven Million Five Hundred Thousand Pesos (₱ 7.5 million) per day as liquidated damages for a period after the date scheduled as such until the date stated in a Certificate of Substantial Completion for the entire Case Study Expressway issued by the Grantor; however, the amount for liquidated damages shall not exceed ten percent (10%) of the total estimated construction cost.

(9) Ownership of the toll road

The Case Study Expressway, except its toll road facilities of a fixed and permanent nature, shall be owned by the Philippine Government, without prejudice to the rights and entitlements of the Grantee under the TCA. The legal transfer of ownership of the Case Study Expressway except the toll road facilities thereof shall be deemed to occur automatically upon the Grantor's issuance of the Certificate of Substantial Completion thereof. Meanwhile, the ownership of toll road facilities shall be retained by the Grantee throughout the duration of the concession period and then transferred to the Grantor free of charge upon the termination of the concession period.

(10) Operation and maintenance

Full operation of the Case Study Expressway as a toll road facility and public utility shall be authorized as soon as the Toll Operation Certificate is issued by the TRB for the entire Case Study Expressway.

The Grantee shall prepare and submit for approval by the TRB a draft Toll Operation and Maintenance Manual and Procedures (TOMMP) in accordance with the Minimum Standards for Operation and Maintenance (MSOM) annexed to the Draft TCA, not later than six months before the intended Operation Date of the Case Study Expressway, which document, as may from time to time and at anytime be revised or amended by an agreement between the Grantee and the TRB, shall codify the procedures, mechanisms and standards to be met in the operation and maintenance of the Case Study Expressway throughout the duration of the concession period.

Subject to the terms and conditions of the TCA, the operation and maintenance of the Case Study Expressway shall be the exclusive right, privilege, responsibility, and obligation of the Grantee through the Operations Company.

The Grantee, through the Operations Company, shall perform the operation and maintenance of the Case Study Expressway starting from the operation date until the expiration of the concession period, inclusive of allowable adjustment thereof.

(11) Concession period

The Draft TCA shall indicate the commencement and expiry dates of the concession period for the Case Study Expressway which shall correspond to the period needed for the achievement of the agreed target cumulative revenue (**TCR**) at the base year's price level. In the event that the **TCR** was unable to be reached by the agreed expiration date the Grantee shall have an extension option of the concession period of five (5) years in maximum where the concession shall be terminated upon the achievement of the **TCR**.

(12) Operation and maintenance supervision

The TRB shall have the right to inspect any part of the operation and maintenance of the Case Study Expressway and all duly approved toll-related and non-toll-related facilities, taking into account at all times the flow of traffic and level of service required to ensure that the annual routine/ regular and heavy repairs/ periodic maintenance works on the Case Study Expressway are duly implemented by the Grantee and/or Operations Company in line with the agreed scope of operation and maintenance, the TOMMP and pertinent laws, rules, regulations and guidelines issued by the TRB. The TRB's overhead expenses for such supervision shall be shouldered by the Grantee, through the Operations Company, and shall accordingly provide such amounts needed in accordance with the procedures, controls and corresponding budget as may be approved by the TRB; however, the total annual expenses shall in no case exceed two (2%) percent of the total annual budge for operation and maintenance in the financial projections.

(13) Toll rate

The base toll rate for the Case Study Expressway shall be at the 2005 year price as follows:

Class I Vehicles	Class II Vehicles	Class III Vehicle
₱ 4.0/km	₱ 8.0/km	₱ 10.4/km

Class I Vehicles shall cover light vehicles, such as cars, jeepneys, taxis, vans, pick-ups, and the like; **Class II Vehicles** shall include medium-weight vehicles, such as buses and two (2)-axle trucks; **Class III Vehicles** shall refer to heavy vehicles, such as trucks with three (3) axles and more.

Any subsequent toll rate adjustments shall be made upon request and through a formal application by the Grantee and/or the Operations Company in accordance with toll rate adjustment formula.

As recommended in Chapter 2.3.2, frequent review and revisions of toll rates are desirable in order to assure operators proper revenue and to avoid abrupt toll rate hikes, which invite public clamor. In this Chapter and in the Concession Agreement in Volume II, however, a toll rate adjustment every three years was assumed, which is consistent with the current TRB policy. It is highly recommended by this Study to change such policy and adopt a more frequent review. If such recommendation is accepted, the policy can be thoroughly discussed and once adopted, the adjustment period should be changed to every year instead of every three years.

Adjustments in toll rates shall be of two kinds, namely: (a) periodic and (b) interim. Periodic adjustment in toll rates shall be subject to the following provisions:

1) The TRB shall allow the Grantee a periodic adjustment in the prevailing toll rate setting on respective **Toll Review Dates** (dates every three years calculated from the Operation Date), which shall be the Toll Rate calculated through application of the following formula, subject to rounding:

$$TRn = TRo\,(K+1)^{n}$$

where,

i) Until all principal and interests on loans denominated in a currency other than in Philippine Peso have been fully repaid

$$K = 0.25\,(CPIc-CPI_R)/CPI_R + 0.2(Erc-ER_R)/ER_R$$

ii) After all principal and interests on loans denominated in a currency other than in Philippine peso have been fully repaid

$$K = (CPIc-CPI_R)/CPI_R$$

n = Number of years between any periodic adjustment and its succeeding periodic or interim adjustment.

Definitions:

TRn = Toll rate for the succeeding three (3) concession years

Tro = Toll rate at the last Toll Review Date before rounding

CPIc = Consumer price index (CPI) for N.C.R. determined by the National Statistics Office (NSO) for the month immediately prior to the Toll Review Date

CPI_R = CPI for NCR at the last Toll Review Date

Erc = The exchange rate between the Philippine peso and the currency in which the Loans are denominated calculated by taking the average rate as published by the Bangko Sentral ng Pilipinas (BSP) over the 6 month preceding the Toll Review Date.

ER_R = The exchange rate used in the formula aforesaid at the last Toll Review Date.

For purposes of adjusting the toll rates, all three (3) vehicle classifications shall be subject to the same rate of adjustment as indicated in the formula above.

2) The toll as adjusted shall be the toll rates as hereinafter set out for the immediate succeeding three (3) years and shall be enforced and collected by the Grantee, on the first day of January of the year immediately succeeding the Toll Review Date.

3) Increase of toll in real term

Through the concession period, the base toll rate (TR_b) expressed at the year 2005 price shall be increased in real term on corresponding Toll Review Dates as follows:

TR_b	Class I Vehicle	Class II Vehicle	Class III Vehicle
2005	₱ 4.0/km	₱ 8.0/km	₱ 10.4/km
2015	₱ 10.0 + ₱ 4.0/km	₱ 20.0 + ₱ 8.0/km	₱ 26.0 + ₱ 10.4/km
2020	₱ 20.0 + ₱ 4.0/km	₱ 40.0 + ₱ 8.0/km	₱ 56.0 + ₱ 10.4/km

Toll rates after year 2015 shall be composed of a fixed toll portion as entrance fee and a proportional toll portion to traveling distance.

As the base toll rate corresponding to the designated years above is expressed at the year 2005 price, actual toll rate shall be calculated based on the following formula:

$IA_a = IA_b\,(1+K)$

Where

$K = (CPI_c - CPI_b)/CPI_b$

Definitions:

IA_a = Toll rate at the adjustment year price

IA_b = Toll rate at the year 2005 price

CPI_b = CPI for NCR in year 2005 determined by NSO

CPI_c = CPI for NCR determined by the NSO for the month immediately prior to the corresponding toll review date

(14) Toll collection

Throughout the term of the operation and maintenance of the Case Study Expressway as a toll road facility, the Grantee, through its Operations Company, shall collect tolls in accordance with the TCA and the TOMMP.

The toll revenues collected by the Grantee, through the Operations Company, shall be deposited daily in the designated account duly opened and maintained for such purpose.

The Operations Company shall submit to both the Grantor and the Grantee daily toll collection reports in a manner and form that may be mutually agreed upon from time to time by all parties. Non-compliance with such submissions may prejudice any request for adjustment subsequently made at the instance solely of the Operations Company.

(15) Calculation of Cumulative Revenue

The Cumulative Revenue (CR) shall be calculated through application of the following formula:

$$CR = \sum_{t=i}^{e} Rt$$

Where

Rt = NRt x Aft

Definitions:

Rt = Toll revenue at year-t expressed at a price level of the base year 20__

NRt = Nominal toll revenue at the year-t price

Aft = Adjustment factor to convert a price level from year- t to the base year 20__

e = the end year of concession

I = the beginning year of operation

The CR shall be monthly calculated to compare with the Target Cumulative Revenue by the Grantee, a result of which shall be submitted to the Grantor for approval.

(16) Default and termination

This section specifically describes the following:

1) Incidences of default by the Grantee, Operations Company and Grantor
2) Due process in case of Grantee's default, Operator's default and Grantor's default
3) Consequences of termination due to Grantee's default, Operator's default and Grantor's default
4) Condition and consequences of termination

(17) Settlement of Disputes

Any dispute or controversy of any kind (such dispute or controversy being referred to as a "Dispute"), whether involving all or any two of the parties, which may arise out of or in connection with this TCA, except as may otherwise be provided in the TCA or by law, shall be resolved within 60 days from its occurrence through amicable means such as, but not limited to, mutual discussion.

If the dispute cannot be settled amicably within the 60 day period, the dispute shall be settled with finality by arbitration under Executive Order No. 1008, entitled, "Construction Industry Arbitration Law". The respective parties shall abide by and implement the arbitration award. The place of arbitration shall be in Metro Manila or other places as may be chosen by the party initiating the arbitration. The arbitration proceedings shall be in the English language.

(18) Force majeure

If an event of force majeure prevents any party from performing its obligations as stated in the TCA, or if the occurrence of force majeure adversely affects the ability of the Grantee, by itself or through the Operations Company, to exercise its rights and to enjoy the benefits, the affected party shall immediately notify the other parties of the occurrence of the event, and of its subsequent cessation; provided, that such occurrence or cessation of occurrence is known to the party serving notice of force majeure.

If an event of force majeure, or the results thereof, prevents the Grantee and/or the Operations Company from performing its obligations or, in the opinion of the Grantee, adversely affects any of its rights or benefits under the TCA, and provided that the force majeure results in physical damage to the toll road facilities and/or endangers the safety of person/s, the Grantee, by itself or through the Operations Company, shall be responsible for taking such actions and precautions as may be required or necessary to mitigate any resulting damage, loss or peril to safety by utilizing any insurance proceeds received by or payable under any insurance policy covering force majeure, except business interruption insurance.

If the Grantee and/or the Operations Company serves notice to the Grantor that the insurance proceeds received or payable by reason of any such damage is insufficient to be able to undertake or perform the required reconstruction or repair work on the damaged toll road or toll road facility, the Grantee and/or the Operations Company shall have the option to provide any funding shortfall, and/or undertake or cause the performance of the required reconstruction and/or repair work on the damaged toll road.

If the Grantor notifies the Grantee and/or the Operations Company that the Grantor is unable to provide the funding required for the reconstruction and/or repair work on the damaged toll road or toll road facility, so as to reinstate the same upon terms and conditions satisfactory to the Grantee and/or the Operations Company, or if the Grantee and/or the Operations Company is of the opinion that any delay in the reconstruction and/or repair of the damaged toll road or toll road facility will adversely affect any of its rights and/ or benefits under the TCA; then the Grantee and/or the Operations Company and the Grantor shall negotiate with each other promptly and in good faith with a view to achieving agreement on the following matters: (a) how and by what means the required reconstruction and/or repair work on the damaged toll road or toll road facility can be accomplished expeditiously; and/or (b) the measures required for the protection of the rights and benefits of the Grantee's and/or the Operations Company's rights and benefits; Provided, however, that if no such agreement is reached within six months from the commencement of negotiations between them, the TCA may be deemed terminated, in which case the Grantor shall be subject to the obligations set forth in Section 11.04 C: Termination by reason of the Grantor's default.

(19) Annexes

Annexes to be made consist of the following five documents:

Annex A:	Financial Model proposed by the Proponent
Annex B:	Proof of Minimum Equity Requirement
Annex C:	Toll Road Design Standards and Specification for the R10/C3/R9+R10/C5 Link
Annex D:	Environmental Clearance Certificate for the R10/C3/R9+R10/C5 Link
Annex E:	Grantor's Minimum Standards for Operation and Maintenance

The annexes mentioned above are those attached in the bidding documents.

5.2.4 Bid Drawings

The basic design for the whole section of the Case Study Expressway was carried out in this Study and detailed in Chapter 4 of this report. The Case Study Expressway is planned to be divided into a private-funded section Pr and a public-funded section Pu to facilitate the implementation of the project under a public-private partnership scheme. The demarcation of both the sections is as follows:

a. Section Pr (R10):

Length	8.5 kilometers
Number of lanes	2 x 2 lanes
Lane width	3.25 meters
Number of interchanges	1
Number of junction	0
On-ramp	4
Off-ramp	4

b. Section Pu (C3/R9):

Length	7.1 kilometers
Number of lanes	2 x 2 lanes
Lane width	3.25 meters
Number of junction	2
On-ramp	3
Off-ramp	4

Section Pu, excluding toll road facilities, will be constructed by the DPWH in a separate contract. The Proponent shall undertake the design and construction of Section Pr and the provision of toll road facilities for the entire Case Study Expressway Expressway, the operation and maintenance of both the Sections as a toll road during the concession period, and the financing thereof.

The detailed design for the Section Pu will be undertaken by the DPWH. Meanwhile, that for the Section Pr shall be undertaken by the Proponent based on the basic design i.e. Bid Drawings, provided.

The Bid Drawings to be attached to the Bid Documents is provided for the bidders with the following main purposes:

1) To provide clear understanding of demarcation of both the Sections.
2) To give structural features of the Project including location, alignment, road elevation, foundation, surrounding environment.
3) To make a construction plan and construction schedule at a practical level..
4) To estimate the project cost
5) To anticipate possible problems for the implementation of the project
6) To judge the necessity of additional technical investigations

5.3 Contract Management and Project Monitoring System

The project shall be implemented under the TCA through the project life from the beginning of design and construction phase up to the end of operation and maintenance phase. The contract management and project monitoring system shall be the most suitable for each phase.

(1) During design and construction phase

Monitoring and management of the project during the design and construction phase are in general carried out against the following four factors: construction progress, quality of construction, construction budget/ cost, and safety/ environment. However, as for construction budget/ cost the proponent shall be fully responsible for cost overrun under the TCA so that monitoring and management for this factor may be less important for the Government except the cases due to variations caused by the Government, in which the Government shall pay for it.

The Independent Consultant (IC) is procured to assist the Government in managing the contract and monitoring the project during the design and construction phase. The IC functions as both an Independent Design Checker and an Independent Certification Engineer. The scope of services of the IC includes checking of the detailed engineering design prepared by the proponent (through its designer), periodic inspection of the construction, certification of claims, and certification of the operation and maintenance manual. The IC shall report directly to the DPWH.

The Detailed Engineering Design of the project shall be certified by the IC prior to the start of construction. The Proponent shall be solely responsible for the Detailed Design regardless of any approvals issued thereon by the Government.

The Proponent is required to construct the project in accordance with the approved Detailed Engineering. The IC is engaged to certify that the works are being carried out in accordance with the Detailed Engineering Design. The IC shall issue a Construction Completion Report to the Government after works are completed and after the necessary inspections and tests have taken place and been passed.

The proponent shall shoulder the cost of the services of the IC, which is estimated to be approximately 3% of the project construction cost.

The IC is required to manage and monitor the project in close communication with a Project Manager for the Section Pu, which will be implemented in parallel with the Section Pr, to complete the connection portion in a timely manner.

(2) During operation and maintenance phase

Full operation of the Case Study Expressway as a toll road facility and public utility shall be authorized as soon as the TOC is issued by the TRB for the entire Case Study Expressway.

The operation and maintenance of the entire Case Study Expressway shall be undertaken by the Proponent throughout the concession period in accordance with the TCA, the TOC, and the approved TOMMP prepared by the Proponent based on the MSOM issued by the TRB. In this regard, the TRB shall have the right to inspect and check on the operation and maintenance on site including, from time to time, the verification and audit of toll revenues, financial books and all relevant records.

Moreover, as for supervision of operation and maintenance for the Case Study Expressway, the TRB shall have the right to inspect any part of the operation and maintenance of the Case Study Expressway and all duly approved toll-related and non-toll-related facilities, taking into account at all times the flow of traffic and level of service required to ensure that the annual routine/ regular and heavy repairs/ periodic maintenance works on the Case Study Expressway are duly implemented by the proponent and/or Operations Company in line with the agreed scope of operation and maintenance, the TOMMP, and pertinent laws, rules, regulations and guidelines issued by the TRB.

In this regard, the TRB's overhead expenses for such supervision shall be shouldered by the proponent, through the Operations Company, and shall accordingly provide such amounts needed therefore, in accordance with the procedures, controls and corresponding budget as may be approved by the TRB; however, the total annual expenses shall in no case exceed two percent of the total annual budge for operation and maintenance in the financial projections.

5.4 Points to Keep in Mind at Contract Negotiation

Contract negotiations with the proponent shall be conducted from a viewpoint of whether the proposal is technically and financially viable and whether a proponent's profit is at a reasonable level. The following are important points to consider when negotiating with the proponent:

(1) Financial viability

A BOT scheme assumes that sufficient revenues are earned to recover investments and to assure operating profits for the private sector. Financial viability of a project depends on three main factors; that is, revenue, costs, and risks that affect the revenue and cost stream.

Revenue:

Revenue projection solely depends on traffic volume projection to be estimated by the bidders as toll rates are initially given by the Government. A table of traffic volume projection is given in the bid documents; however, it is indicative only and it is expected that the bidder shall confirm and assume responsibility for the traffic volumes.

The traffic volumes estimated by the bidder shall be carefully checked in examining assumptions of his estimates, method of estimates, etc. especially if there is a discrepancy more than ±10% from the traffic volumes given.

Costs:

Project cost is divided into costs for engineering and construction of the facilities and the other costs such as financing and insurance costs. The proponent is responsible for the project cost under this TCA; however, appropriateness of the project cost shall be carefully checked and confirmed because that will affect the continuity of the project.

Risks:

It is important to review risk allocations set out in the draft TCA that would affect the revenue and cost streams. Various risks were examined from a standpoint of fairness for each party and based on a principle that risks should be allocated to the most efficient entity in managing and handling them on the basis of cause for its liability. On the basis of the same principle, risk allocations shall be continuously reviewed to reduce extra expenses and make the project more viable.

Profitability:

Financial viability of a project is represented by the FIRR. Profitability of BOT projects differ from project to project depending on their characteristics. However, BOT projects that are formulated in a PPP scheme have a reasonable profitability, which means not too high nor too low.

Judging from empirical values of international institutions, an FIRR of 15 to 17% would be considered acceptable and reasonable for BOT projects under a PPP scheme. The profitability of the proposal shall be reviewed on this point.

(2) Technical viability

In BOT projects, it is very important to set proper target levels of products or services. Therefore, verification of the technical viability of a BOT project should emphasize an examination and setting of minimum specifications and requirements, which public sector requires at least as public facility. In this context, confirming the minimum specifications and requirements of the facility, it is desirable to accept new technology and practical know-how that would be proposed by the proponent. This would help the Government to estimate and review the project cost.

(3) Management of Implementation Schedule of Entire Section

The public-funded Section Pu and the private-funded Section Pr are scheduled to be implemented in parallel. In this PPP scheme, the implementation schedule for each section should be appropriately managed to realize the simultaneous opening.

One of the crucial matters for the project should be its financial closure. If the finance closure is delayed so long, simultaneous opening of the entire section becomes impossible, so that it might cause huge damages to the entire project. Therefore, in the Bid Documents, Award of Concession is set six months ahead of an assumed issuance of Notice to Proceed for the public-funded Section Pu, taking into consideration incentives to financiers as well as time necessary for financing.

The Government should manage the implementation schedule of both the Sections and make every necessary adjustment for simultaneous opening of the entire section.

(4) Appropriateness of Operation and Maintenance

The proponent shall prepare and submit for the approval of the TRB a draft TOMMP in accordance with the MSOM not later than six months before the intended Operation Date of the Case Study Expressway. Although the TOMMP may from time to time and at anytime be revised or amended by agreement between the Proponent and the TRB under the TCA, it is important that the TRB has the TOMMP made as appropriately as possible through approval procedures.

ANNEXES

ANNEX A

Behavioral Value-of-Time (VOT)

ANNEX A: Behavioral Value-of-Time (VOT)

(1) Willingness-To-Pay Survey

The WTP Survey covered six vehicle types as shown in the following Table.

Vehicle type	Interviewee	Survey Site
Car/Jeep	Trip maker	Sites across Manila
Taxi	Trip maker	Sites across Manila
HOV Taxi	Trip maker	Sites across Manila
Class 1 Freight	Driver/Operator/Owner	Port Area
Class 2 Freight	Operator	N/A
Class 3 Freight	Operator	N/A

The questions include: (i) basic information about the trip and trip-maker; (ii) the preference of interviewee (ordinary road or expressway) given travel time savings and toll fee; and, (iii) declared VOT. For Class 3 freight additional questions were asked regarding their Value of Time caused by delays due to waiting for the Truck Ban.

(2) Model Development

The model form adopted is the Logit Model. The model is theoretically sound and is well accepted and widely used. It has the following general form:

$$prob(a) = \frac{\exp[U_a]}{\sum_A \exp[U_x]}$$

where,
prob(a) .... Probability that an individual will choose alternative, *a* among other alternatives from choice set *A*. For this study a binary choice set – expressway or ordinary road – is used.
U_x .... Utility of alternative, *x*; which is a function of its attributes

The form and parameters of the utility function is determined based on the results of the WTP survey. The linear utility function is used for simplicity without necessarily compromising model fitness and it has the following form.

$$U = \beta_{xway} XWAY + \beta_{tt} TT + \beta_{tf} TF$$

where, *TT*……………Travel time (or waiting time) in minutes
TF……………Toll fee in pesos
XWAY ………Expressway bonus (*XWAY* = 1 if expressway; otherwise 0)
β_{xway}, β_{tt}, β_{tf}…...Parameters

Two methodologies to estimate the parameters were tried; namely, Maximum Likelihood Estimation and Regression Estimation. It was decided to use the results derived from the Regression Method as it yielded more reasonable parameters.

In other studies, an "expressway bonus"; i.e., a positive constant is added to the utility of the expressway to account for the smoother flow and safety of using expressways. However, statistical tests on the "expressway bonus" parameter show that it is not significantly different from zero; thus, the "expressway bonus" is not used in this study. Moreover, some studies include trip purpose (business or private) or derive different models for different trip purposes. Tests however show that parameters for models for private trips and for business trips are not significantly different. Thus, a combined model for private and business trip is recommended in this study.

The parameters of the utility function for each vehicle type are summarized in the following Table.

Vehicle Type	β_{tt}		β_{tf}		R^2_{adj}
	parameter	**t-stat**	**parameter**	**t-stat**	
Car/Jeep	-0.08508	-7.29	-0.06071	-9.12	0.65
Taxi	-0.08146	-7.50	-0.06275	-9.42	0.67
HOV Taxi	-0.08091	-7.63	-0.10906	-9.46	0.66
Class 1 Freight	-0.06388	-6.63	-0.04471	-8.23	0.59
Class 2 Freight	-0.14920	-2.66	-0.06456	-3.53	0.39
Class 3 Freight (journey time)	-0.06615	-3.52	-0.02048	-4.11	0.36
Class 3 Freight (waiting time)	-0.05153	-5.45	-0.01839	-5.80	0.53

The developed models have relatively good fit. Notable exceptions are Class 2 Freight and Class 3 Freight (journey time); however, an adjusted R^2 of nearly 0.40 is considered to be relatively good for transportation models.

(3) Value of Time

The value of time – the monetary equivalent of a unit travel time saving – of each vehicle type is equal to the ratio of β_{tt} and β_{tf}. Also, from the WTP Survey, respondents were asked to state or declare their VOT's. The following Table summarizes and compares the results.

		$VOT_1 = \beta_{tt} / \beta_{tf}$	VOT_2 as declared*	VOT_1 / VOT_2
Car/Jeep		84.1	90	0.93
Taxi		77.9	79	0.99
HOV Taxi		44.5	56	0.79
Freight	Class 1	85.7	87	0.99
	Class 2	138.7	233	0.60
	Class 3 (journey)	193.8	251	0.77
	Class 3 (waiting)	168.1	179	0.94

*Mean value *Values in Pesos/hour*

The estimates of VOT from the two methodologies generally coincide except for Class 2 freight. To further examine Class 2 Freight VOT, the traffic diversion rates at Skyway were examined. From April 2000 to September 2001 the observed share of traffic using the elevated section (or diversion rate) is 12% for Class 2 traffic. Numerical experiments show that using Class 2 Freight VOT of 233 P/hr resulted in diversion rates that grossly overestimate the observed values. On the other hand, using Class 2 Freight VOT of 138.7P/hr resulted in diversion rates that are reasonably close to the observed values.

To further confirm the estimated VOT, a comparison is made with VOT estimates from previous studies summarized in the following Table. Private and public trip VOT's are comparable with the results of the study. Unfortunately there is no information available on freight VOT for comparison.

Source	Value of Time (P/hr)
Metro Manila Urban Transportation Integration Study, 1996	Private = 74.4 Public = 60.0
Cavite Busway System F/S, 2002	Bus = 71.9 Jeepney = 33.5 Car = 79.3
North Luzon Tollway Extension F/S, 1999	Car = 84.0
DPWH, 1996	Car = 61.32 Jeepney = 63.96 Bus = 244.50
C6 Pre-F/S, 1996	Car = 52.2 Jeepney = 35.4 Bus = 220.8
C6 South F/S, 1997	Business = 127.4 Commuter = 58.7 Leisure = 43.6 Peak = 66.4 Inter-peak = 77.8 All day = 70.2
Pasig Expressway F/S, 1997	Business = 148.6 Commuter = 52. Personal Business = 50.4 Peak = 64.8 Inter-peak = 85.2

<u>For the Study the following values are recommended.</u>

<table>
<tr><th colspan="2">Vehicle Type</th><th>Value of Time (P/hr)</th></tr>
<tr><td colspan="2">Car/Jeep</td><td>84.1</td></tr>
<tr><td colspan="2">Taxi</td><td>77.9</td></tr>
<tr><td colspan="2">HOV Taxi</td><td>44.5</td></tr>
<tr><td rowspan="4">Freight</td><td>Class 1</td><td>85.7</td></tr>
<tr><td>Class 2</td><td>138.7</td></tr>
<tr><td>Class 3 (journey)</td><td>193.8</td></tr>
<tr><td>Class 3 (waiting)</td><td>168.1</td></tr>
</table>

ANNEX B

TICS Fundamental Services Summary by Service Category

ANNEX B: TICS Fundamental Services Summary by Service Category

Service Category	Service Name
Traveler Information	Pre-trip Information (1) This service provides single mode, multi-modal and inter-modal transportation information at home, work, hotels, major public locations, such as shopping centres, and on portable terminals. Pre-trip information includes current information on network status, traffic conditions, road and weather information, prevailing traffic regulations and tolls.
	On-trip Driver Information (2) On-trip driver (user) Information *includes*: incidents, park & ride options, parking, prevailing traffic conditions, public transport schedules (timetable and actual), regulations, roadworks, both planned and emergency, tolls, weather, roadside phones (roadside services, including callboxes).
	On-trip Public Transport Information (3) On-trip Public Transport Information is provided to the traveller once the trip has started. The type of information provided may *include*: a. boarding point information, b. fare information, c. interchange possibilities, d. route choice, e. time of next service, f. where to get off.
	Personal Information Services (4) This service provides information either in a pre-trip, or on-trip context. This information is complementary to service 1 (Pre-trip Information) and service 2 (On-trip Driver Information), providing a 'yellow pages' type function.
	Route Guidance & Navigation (5) This service provides information on community and/or individual user optimum route options for specified destinations. Best route options may be calculated taking account of network and public transport information and may incorporate multi-modal options such as Park and Ride.

Cont'd… TICS Fundamental Services Summary by Service Category

Service Category	Service Name
Traffic Management	Transportation Planning Support (6) This service covers the use of TICS systems to provide data regarding traffic flows and travel demand for transportation planning purposes.
	Traffic Control (7) This service covers the management and control of traffic flows through the use of TICS technologies. It includes the following: a) adaptive traffic signal control, b) directional variable message signing, c) implementation of predefined traffic management strategies, d) integration of interurban and urban control, e) ramp metering, f) route guidance integrated with traffic control, g) speed control, h) tidal flow (e.g. directional lane control).
	Incident Management (8) This service provides the capability for detecting and responding to various incidents on the transport network.
	Demand Management (9) This service is the development and implementation of management and control strategies designed to influence the demand for travel. These strategies influence the overall level of demand for travel at different times of the day and relative demand for different modes of transport, through the management of pricing structures, area access control or zone entry regulations.
	Policing/Enforcing Traffic Regulations (10) This service covers the application of TICS technologies to the enforcement of traffic laws and regulations.
	Infrastructure Maintenance Management (11) This service covers the application of TICS technologies to the management of road, communication and computer infrastructure.

Cont'd… TICS Fundamental Services Summary by Service Category

Service Category	Service Name
Vehicle	Vision Enhancement (12) The service is the application of TICS technologies to the enhancement of driver perception through the use of in-vehicle equipment.
	Automated Vehicle Operation (13) This service is the application of TICS technologies to completely automate the driving process, creating a 'hands off' driving environment.
	Longitudinal Collision Avoidance (14) Longitudinal collision avoidance includes the use of sensors and control systems to detect potential for collisions either prompting the driver to take action or automatically initiate avoiding action. This includes the application of obstacle detection systems.
	Lateral Collision Avoidance (15) Lateral collision avoidance is the use of systems (such as sensors and control systems) to monitor the potential hazards involved in lane keeping, lane changing, entering and leaving high speed roads and overtaking.
	Safety Readiness (16) Safety readiness is the use of monitoring and warning systems for both private car driver and vehicle.
	Pre-crash Restraint Deployment (17) This service uses TICS technologies to determine the velocity, mass and direction of vehicle and objects involved in a potential collision and the number, location and major physical characteristics of occupants.
Commercial Vehicle	Commercial Vehicle Pre-clearance (18) Commercial vehicle pre-clearance allows commercial vehicles, including trucks and buses to have credentials and other documents, safety status and weights checked automatically at normal road speeds. A principal objective being to effect preclearances with minimal disruption to the vehicle journey and the traffic flow.
	Commercial Vehicle Administrative Processes (19) This is complementary to service 18 (Commercial Vehicle Pre-clearance). It enables hauliers and shippers to purchase annual and ad-hoc credentials, using communications and computer technologies.
	Automated Roadside Safety Inspection (20) Automated roadside safety inspection is the use of TICS systems to enable roadside access to safety performance records of hauliers, vehicles and drivers..
	Commercial Vehicle On-board Safety Monitoring (21) This service covers the use of on board monitoring systems to oversee the safety status of commercial vehicles, commercial vehicle drivers and cargo during the entire course of the trip.
	Commercial Vehicle Fleet Management (22) At a multi-modal level commercial fleet management includes logistics and freight management systems. It also covers the use of Automatic Vehicle Location (AVL) and vehicle-to-control centre communications to provide vehicle location and other status information to the fleet operators dispatched.

Cont'd… TICS Fundamental Services Summary by Service Category

Service Category	Service Name
Public Transport	Public Transport Management (23) This service covers the application of TICS technologies to the operation, planning and management of public transport operations. It includes the provision of real time information on vehicle location and status, enabling the identification of departures from schedules and dynamic rescheduling.
	Demand Responsive Public Transport (24) This service covers the provision of on-demand transport services to individual travellers. This will provide demand responsive transport services to the user, while enabling transport operators to dispatch and schedule vehicles.
	Shared Transport Management (25) Shared transport management provides real-time ride matching services to users at home, office, or other locations.
Emergency	Emergency Notification and Personal Security (26) This service applies TICS technologies to provide both driver/personal security services and automatic incident notification for private car drivers and goods vehicle drivers.
	Emergency Vehicle Management (27) Emergency vehicle management includes the application of fleet management, route guidance and traffic signal priority techniques to the management of emergency vehicles such as fire, police and ambulance.
	Hazardous Materials & Incident Notification (28) This service covers the use of TICS technologies to provide authorities with data on the nature, location and condition of hazardous goods cargoes.
Electronic Payment	Electronic Financial Transactions (29) This service includes the use of electronic, or 'cashless' payment systems for transportation.
Safety	Public Travel Security (30) Public travel security includes the surveillance and monitoring systems for public transport facilities, car parks and on-board public transport vehicles.
	Safety Enhancement for Vulnerable Road Users (31) This service covers the application of TICS technologies to the enhancement of safety levels for vulnerable road user groups (particularly elderly or disabled and road maintenance workers).
	Intelligent Junctions and Links (32) This service covers the application of TICS technologies to the provision of monitoring and warning systems at junctions (including modal, multi-modal or inter-modal), both signal controlled and priority.

ANNEX C

Road Communication Standard

ANNEX C: Road Communication Standard

(1) What is the Road Communication Standard (RCS)?

The road communication standard serves as a common language to correctly transmit road-related information and plays a major role with the system architecture (an overall scheme of the ITS system) in the comprehensive and effective promotion of ITS.

The road communication standard forms a part of the ITS platform (figure 1). Here, the ITS platform is a system foundation on which each ITS application can be used under common rules, and functions as tangible and intangible social infrastructure utilizing information technologies (IT).

The main purpose of the road communication standard is to solve the major problem in the field of road telecommunication, i.e. standardizing the telecommunication method and message format (Figure 2), and thereby ensuring the interconnection, interoperability, and device compatibility of the systems which will form part of the Smartway (in the future.

The road communication standard is designed to standardize the message interpretation function and message transfer function. The message interpretation function correctly conveys the meaning of the messages to the application according to a message interpretation rule established between the sender and the receiver. The message transfer function precisely transmits the messages under a standardized communication rule. The road communication standard allocates the former function to the data dictionary (definition of words) and the message set (grammar), and the latter function to the protocol (sentence structure) (Figure 3).

Figure1: ITS Platform

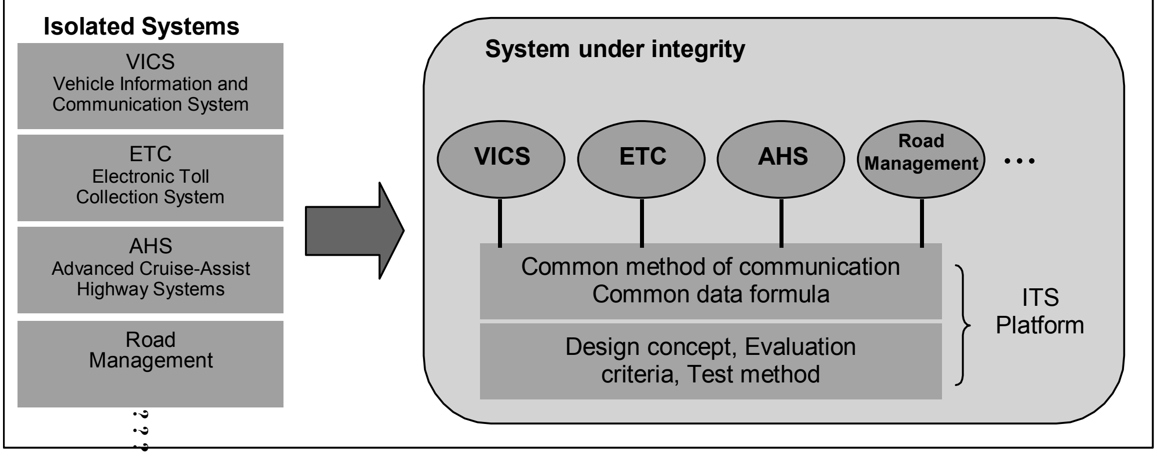


Figure2: The purpose of RCS

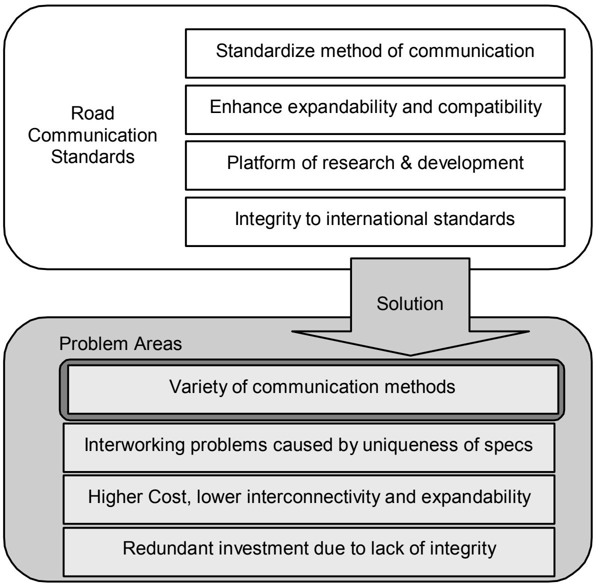
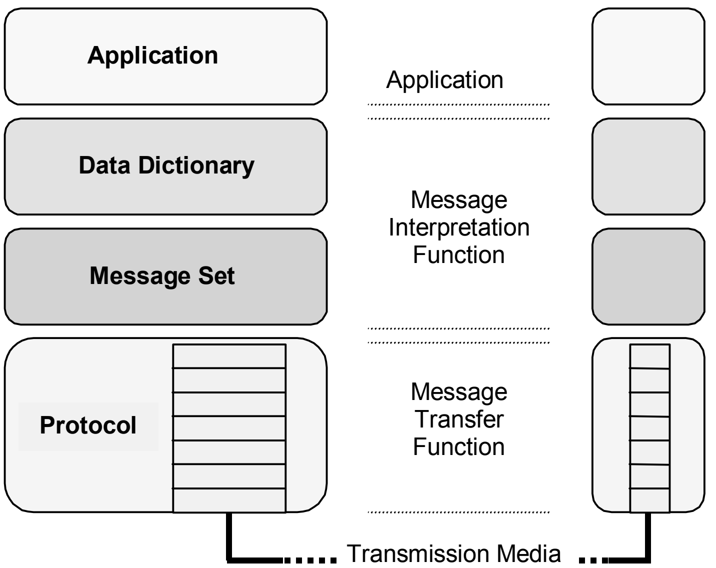


Figure3: Role of each component in road telecommunication



(2) Procedure for developing Road Communication Standard

RCS has been developed under the following object-oriented modeling method which is based on the system architecture (Figure 4):

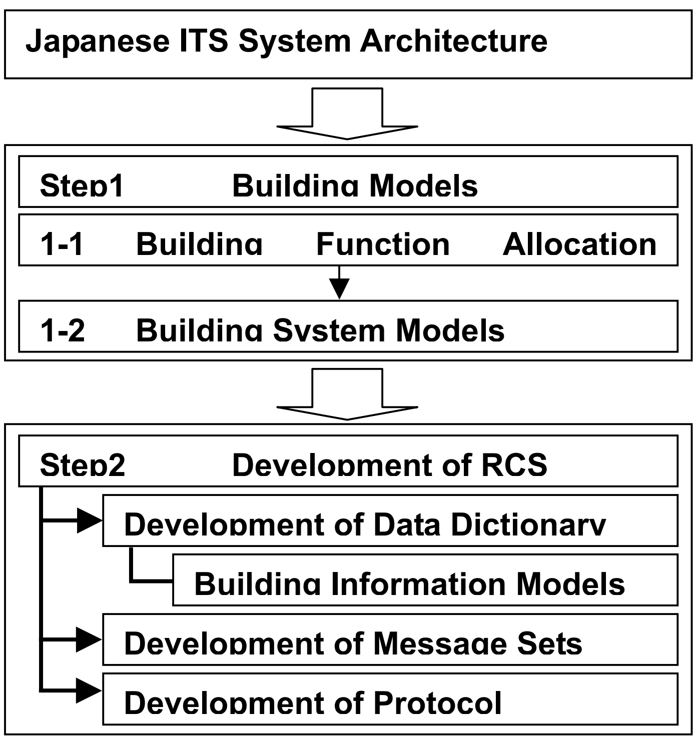
1) Identify systems that were introduced by the road administrator in the past along with those that may be introduced in the future, and set up services to be introduced in the future.

2) Based on the system architecture, develop function allocation models in which function objects capable of fulfilling the purposes of the services in step (1) are logically arranged, and set abstract messages which drive the function objects.

3) Develop system models, in which information functions to realize the purposes of the function objects are arranged, for each system identified in step (1), and then extract telecommunication cross sections to be standardized.

4) Develop separate standards for the message set, data dictionary, and protocol, all of which are necessary for the telecommunication cross sections.

Figure4: Procedure for developing Road Communication Standard



(3) Characteristics of RCS

Message Set Development

Just like human being communicate with each other through conversation, various messages are exchanged within the ITS system and thereby activating necessary functions to provide uses with services.

Generally the message set is prepared for each function, and works as a basic model to make correct messages.

The road communication standard is designed to be able to be applied to various systems including the identified ones. Basic communication processing functions common for various systems serve as "components," each of which integrates corresponding message set.

Where it is necessary to simultaneously develop two or more systems or expand the functions of the systems in future, message sets are combined for the corresponding component, which allows necessary be effectively prepared in a simple manner.

Data Dictionary Development

The Data Dictionary defines the meaning and format of the data (word) forming the message set, and is provided with an information model, which makes the data elements consistent with the system architecture and clarifies the relations between them.

Protocol Standard Development

Taking into consideration the characteristics of each component, the protocol standard is designed to combine the communication protocol which will be used in the future. The communication protocol basically consists if three parts: IP (Internet Protocol) which has been widely used on the Internet in recent years, a protocol dependent on applications, and a protocol dependent on transmission media. The combination of the three parts offers flexibility for various systems.

ANNEX D

Horizontal Alignment of the Original Route and Link Route

ANNEX D: Horizontal Alignment of the Original Route and Link Route

Table D.1 Original Route (R10-C3-R9) Determination of Horizontal Alignment

	X-Coordinate	Y-Coordinate	Tangent angle	Element		Length	Accum.Distance
BP	1615119.691105	495710.638494	355 40 35.3543				0.0000
TC-01	1615708.687577	495666.108544	355 40 35.3543	Straight line		590.6774	590.6774
CT-01	1615895.380789	495635.683905	345 48 42.1998	Circle	R= 1100.0000	189.3899	780.0673
IP- 1	IPX= 1615803.3470	IPY= 495658.9520		TL1= 94.9296	TL2= 94.9296		
TC-02	1615971.611811	495616.411085	345 48 42.1998	Straight line		78.6296	858.6968
CT-02	1616150.987667	495586.564220	355 17 38.9783	Circle	R= 1100.0000	182.0497	1040.7466
IP- 2	IPX= 1616060.0620	IPY= 495594.0490		TL1= 91.2332	TL2= 91.2332		
TC-03	1616869.603124	495527.409541	355 17 38.9783	Straight line		721.0461	1761.7927
CT-03	1617086.004861	495526.377724	4 9 34.0694	Circle	R= 1400.0000	216.6202	1978.4129
IP- 3	IPX= 1616977.7640	IPY= 495518.5060		TL1= 108.5267	TL2= 108.5267		
TC-04	1617330.296958	495544.143656	4 9 34.0694	Straight line		244.9373	2223.3501
CT-04	1618114.071131	495444.682215	341 22 33.9880	Circle	R= 2000.0000	795.2892	3018.6393
IP- 4	IPX= 1617732.2040	IPY= 495573.3720		TL1= 402.9684	TL2= 402.9684		
TS-05	1618843.270364	495198.940999	341 22 33.9880	Straight line		769.4935	3788.1328
SC-05	1618915.228912	495177.984866	348 32 17.0888	Clothoid	A= 150.0000	75.0000	3863.1328
CS-05	1619170.491117	495244.576890	40 42 16.0536	Circle	R= 300.0000	273.1425	4136.2753
ST-05	1619223.042009	495298.014665	47 51 59.1544	Clothoid	A= 150.0000	75.0000	4211.2753
IP- 5	IPX= 1619065.6280	IPY= 495124.0062		TL1= 234.6447	TL2= 234.6447		
TS-06	1619585.784715	495698.997452	47 51 59.1544	Straight line		540.7120	4751.9873
SC-06	1619618.630925	495736.686187	51 2 58.3103	Clothoid	A= 150.0000	50.0000	4801.9873
CS-06	1619718.582264	496010.663983	88 51 53.8771	Circle	R= 450.0000	297.0017	5098.9891
ST-06	1619717.721052	496060.649706	92 2 53.0330	Clothoid	A= 150.0000	50.0000	5148.9891
IP- 6	IPX= 1619725.1450	IPY= 495853.0490		TL1= 207.7334	TL2= 207.7334		
TC-07	1619674.037478	497282.202088	92 2 53.0330	Straight line		1222.3332	6371.3223
CT-07	1619672.986055	497461.451337	88 37 26.7164	Circle	R= 3000.0000	179.2790	6550.6013
IP- 7	IPX= 1619670.8330	IPY= 497371.8110		TL1= 89.6662	TL2= 89.6662		

Cont'd… Table D.1 Original Route (R10-C3-R9) Determination of Horizontal Alignment

	X-Coordinate	Y-Coordinate	Tangent angle	Element		Length	Accum.Distance
TC-08	1619673.057823	497464.439341	88 37 26.7164	Straight line		2.9889	6553.5902
CT-08	1619672.582301	497626.147838	91 42 46.3682	Circle	R= 3000.0000	161.7288	6715.3189
IP- 8	IPX= 1619675.0000	IPY= 497545.3000		TL1= 80.8840	TL2= 80.8840		
TC-09	1619671.803344	497652.196179	91 42 46.3682	Straight line		26.0600	6741.3789
CT-09	1619653.904542	497770.644124	105 28 23.3538	Circle	R= 500.0000	120.0810	6861.4600
IP- 9	IPX= 1619670.0000	IPY= 497712.5000		TL1= 60.3308	TL2= 60.3308		
TC-10	1619647.805392	497792.677034	105 28 23.3538	Straight line		22.8615	6884.3215
CT-10	1619629.868019	497912.475917	91 33 28.8392	Circle	R= 500.0000	121.4325	7005.7540
IP- 10	IPX= 1619631.5270	IPY= 497851.4820		TL1= 61.0165	TL2= 61.0165		
TC-11	1619626.090601	498051.356031	91 33 28.8392	Straight line		138.9315	7144.6855
CT-11	1619624.614783	498101.067300	91 50 34.6606	Circle	R=10000.0000	49.7332	7194.4187
IP- 11	IPX= 1619625.4145	IPY= 498076.2135		TL1= 24.8667	TL2= 24.8667		
TS-12	1619606.088945	498676.817991	91 50 34.6606	Straight line		576.0487	7770.4674
SC-12	1619603.144120	498735.645913	94 54 40.9081	Clothoid	A= 180.0000	58.9091	7829.3765
CS-12	1619592.140464	498807.535981	102 29 35.5190	Circle	R= 550.0000	72.7804	7902.1569
ST-12	1619577.354046	498864.551402	105 33 41.7665	Clothoid	A= 180.0000	58.9091	7961.0660
IP- 12	IPX= 1619603.0130	IPY= 498772.4130		TL1= 95.6445	TL2= 95.6445		
TS-13	1619577.333533	498864.625060	105 33 41.7665	Straight line		0.0765	7961.1424
SC-13	1619559.878917	498934.456199	100 58 40.5820	Clothoid	A= 180.0000	72.0000	8033.1424
CS-13	1619552.782004	499052.130619	85 55 28.8701	Circle	R= 450.0000	118.2280	8151.3704
SC-13	1619564.803415	499114.768363	69 37 37.9919	Oval clothoid	A= 120.0000	64.0000	8215.3704
IP- 13	IPX= 1619532.1557	IPY= 499026.8535		TL1= 168.4016	TL2= 93.7811		
CS-14	1619626.984051	499190.407548	31 31 39.5235	Circle	R= 150.0000	99.7445	8315.1148
ST-14	1619665.267197	499209.157870	23 22 44.0844	Clothoid	A= 80.0000	42.6667	8357.7815
IP- 14	IPX= 1619587.3463	IPY= 499175.4725		TL1= 64.7547	TL2= 84.8904		

Cont'd… Table D.1 Original Route (R10-C3-R9) Determination of Horizontal Alignment

	X-Coordinate	Y-Coordinate	Tangent angle	Element		Length	Accum.Distance
TC-15	1619779.188088	499258.406069	23 22 44.0844	Straight line		124.1103	8481.8918
CT-15	1619826.917444	499278.746295	22 47 3.7591	Circle	R= 5000.0000	51.8829	8533.7747
IP- 15	IPX= 1619803.0000	IPY= 499268.7000		TL1= 25.9417	TL2= 25.9417		
TC-16	1619976.111980	499341.414040	22 47 3.7591	Straight line		161.8217	8695.5964
CT-16	1620024.977360	499362.245538	23 23 35.1432	Circle	R= 5000.0000	53.1206	8748.7170
IP- 16	IPX= 1620000.6000	IPY= 499351.7000		TL1= 26.5606	TL2= 26.5606		
TC-17	1620077.881786	499385.131758	23 23 35.1432	Straight line		57.6425	8806.3595
CT-17	1620122.342345	499403.732512	22 0 44.5874	Circle	R= 2000.0000	48.1959	8854.5554
IP- 17	IPX= 1620100.0000	IPY= 499394.7000		TL1= 24.0991	TL2= 24.0991		
TC-18	1620366.398640	499502.399029	22 0 44.5874	Straight line		263.2462	9117.8016
CT-18	1620403.788999	499518.106481	23 33 41.5633	Circle	R= 1500.0000	40.5569	9158.3585
IP- 18	IPX= 1620385.2000	IPY= 499510.0000		TL1= 20.2797	TL2= 20.2797		
TC-19	1620455.898506	499540.830927	23 33 41.5633	Straight line		56.8489	9215.2074
CT-19	1620500.604928	499560.587588	24 7 17.9044	Circle	R= 5000.0000	48.8775	9264.0849
IP- 19	IPX= 1620478.3000	IPY= 499550.6000		TL1= 24.4389	TL2= 24.4389		
TS-20	1620601.417431	499605.728903	24 7 17.9044	Straight line		110.4577	9374.5426
SC-20	1620664.852569	499635.710847	27 38 55.0300	Clothoid	A= 200.0000	70.1754	9444.7180
CS-20	1620720.045935	499668.720622	34 6 59.6255	Circle	R= 570.0000	64.3455	9509.0636
ST-20	1620776.470802	499710.423957	37 38 36.7512	Clothoid	A= 200.0000	70.1754	9579.2390
IP- 20	IPX= 1620695.1500	IPY= 499647.7000		TL1= 102.7004	TL2= 102.7004		
TS-21	1620888.812793	499797.075023	37 38 36.7512	Straight line		141.8772	9721.1162
SC-21	1620941.237607	499833.684858	29 29 41.3120	Clothoid	A= 120.0000	64.0000	9785.1162
CS-21	1621013.148483	499859.462435	9 56 49.9706	Circle	R= 225.0000	76.7632	9861.8794
ST-21	1621076.892602	499864.495169	1 47 54.5315	Clothoid	A= 120.0000	64.0000	9925.8794
IP- 21	IPX= 1620971.9500	IPY= 499861.2000		TL1= 104.9943	TL2= 104.9943		
EP	1622440.521130	499907.312734	1 47 54.5315	Straight line		1364.3006	11290.1800

Table D.2 Link Route to C-5 Expressway Determination of Horizontal Alignment

	X-Coordinate	Y-Coordinate	Tangent angle	Element		Length	Accum.Distance
BP	1615119.691105	495710.638494	355 40 35.3543				0.0000
TC-01	1615708.687577	495666.108544	355 40 35.3543	Straight line		590.6774	590.6774
CT-01	1615895.380789	495635.683905	345 48 42.1998	Circle	R= 1100.0000	189.3899	780.0673
IP- 1	IPX= 1615803.3470	IPY= 495658.9520		TL1= 94.9296	TL2= 94.9296		
TC-02	1615971.611811	495616.411085	345 48 42.1998	Straight line		78.6296	858.6968
CT-02	1616150.987667	495586.564220	355 17 38.9783	Circle	R= 1100.0000	182.0497	1040.7466
IP- 2	IPX= 1616060.0620	IPY= 495594.0490		TL1= 91.2332	TL2= 91.2332		
TC-03	1616869.603124	495527.409541	355 17 38.9783	Straight line		721.0461	1761.7927
CT-03	1617086.004861	495526.377724	4 9 34.0694	Circle	R= 1400.0000	216.6202	1978.4129
IP- 3	IPX= 1616977.7640	IPY= 495518.5060		TL1= 108.5267	TL2= 108.5267		
TC-04	1617330.296958	495544.143656	4 9 34.0694	Straight line		244.9373	2223.3501
CT-04	1618114.071131	495444.682215	341 22 33.9880	Circle	R= 2000.0000	795.2892	3018.6393
IP- 4	IPX= 1617732.2040	IPY= 495573.3720		TL1= 402.9684	TL2= 402.9684		
TC-05	1618915.315100	495174.661817	341 22 33.9880	Straight line		845.5193	3864.1586
CT-05	1619345.914004	494945.925093	322 40 7.9509	Circle	R= 1500.0000	489.7542	4353.9128
IP- 5	IPX= 1619149.4530	IPY= 495095.7570		TL1= 247.0760	TL2= 247.0760		
TC-06	1619819.983919	494584.373448	322 40 7.9509	Straight line		596.2062	4950.1191
CT-06	1619994.834740	494456.910829	325 8 54.8894	Circle	R= 5000.0000	216.3951	5166.5141
IP- 6	IPX= 1619906.0300	IPY= 494518.7500		TL1= 108.2144	TL2= 108.2144		
TS-07	1620258.675853	494273.185100	325 8 54.8894	Straight line		321.5078	5488.0220
SC-07	1620304.694089	494245.079333	335 27 42.5545	Clothoid	A= 90.0000	54.0000	5542.0220
CS-07	1620510.852362	494339.066321	73 33 15.8488	Circle	R= 150.0000	256.8058	5798.8277
ST-07	1620519.816294	494392.238308	83 52 3.5139	Clothoid	A= 90.0000	54.0000	5852.8277
IP- 7	IPX= 1620489.7380	IPY= 494112.2850		TL1= 281.5645	TL2= 281.5645		
TS-08	1620547.670674	494651.492567	83 52 3.5139	Straight line		260.7463	6113.5741

Table D.2 Link Route to C-5 Expressway Determination of Horizontal Alignment (2/2)

	X-Coordinate	Y-Coordinate	Tangent angle	Element		Length	Accum.Distance
SC-08	1620555.981320	494715.745241	80 9 17.5545	Clothoid	A= 180.0000	64.8000	6178.3741
CS-08	1620641.512340	494920.536669	54 30 34.0975	Circle	R= 500.0000	223.7984	6402.1724
ST-08	1620681.369233	494971.614071	50 47 48.1381	Clothoid	A= 180.0000	64.8000	6466.9724
IP- 8	IPX= 1620567.0000	IPY= 494831.4000		TL1= 180.9428	TL2= 180.9428		
TC-09	1620722.401253	495021.918391	50 47 48.1381	Straight line		64.9165	6531.8889
CT-09	1620852.981803	495229.621865	64 53 21.0556	Circle	R= 1000.0000	245.9601	6777.8490
IP- 9	IPX= 1620800.5280	IPY= 495117.7000		TL1= 123.6038	TL2= 123.6038		
TS-10	1621061.967144	495675.538604	64 53 21.0556	Straight line		492.4598	7270.3088
SC-10	1621104.915253	495754.482639	54 34 33.3905	Clothoid	A= 150.0000	90.0000	7360.3088
CS-10	1621348.618513	495856.358940	350 47 50.1021	Circle	R= 250.0000	278.2870	7638.5958
ST-10	1621434.973232	495831.467910	340 29 2.4370	Clothoid	A= 150.0000	90.0000	7728.5958
IP- 10	IPX= 1621177.7697	IPY= 495922.6292		TL1= 272.8810	TL2= 272.8810		
EP	1621845.807000	495685.855000	340 29 2.4370	Straight line		435.8756	8164.4714

ANNEX E

Cross-section of Superstructures, Substructures and Foundations

ANNEX E: Cross-section of Superstructures, Substructures and Foundations

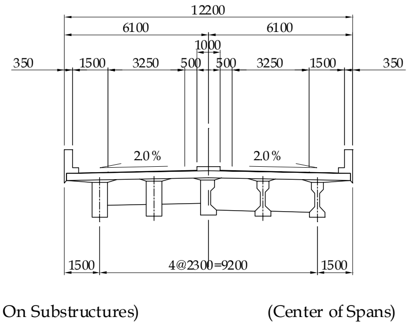
SUMMARY

1.	Throughway:	Superstructures:	14 Types
		Substructures & Foundations:	28 Types
		(Abutment: 2 Types, Pier: 26 Types)	
2.	Rampway:	Superstructures:	3 Types
		Substructures & Foundations:	10 Types
		(Abutment: 3 Types, Pier: 7 Types)	

(1) Throughway

<u>Superstructures</u>

<Sup-1 (Span: 30m)>



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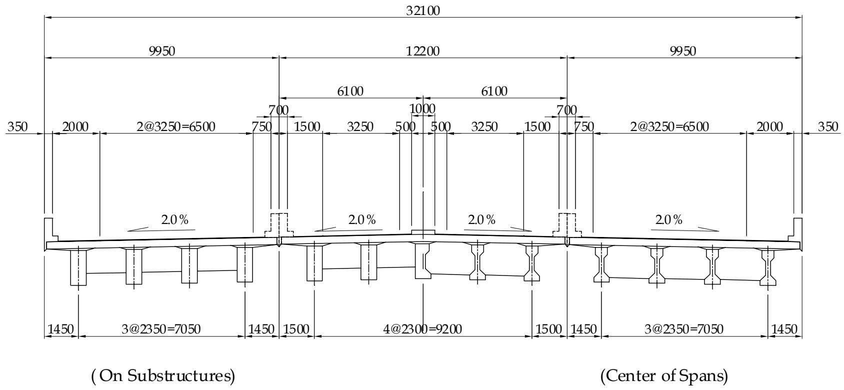

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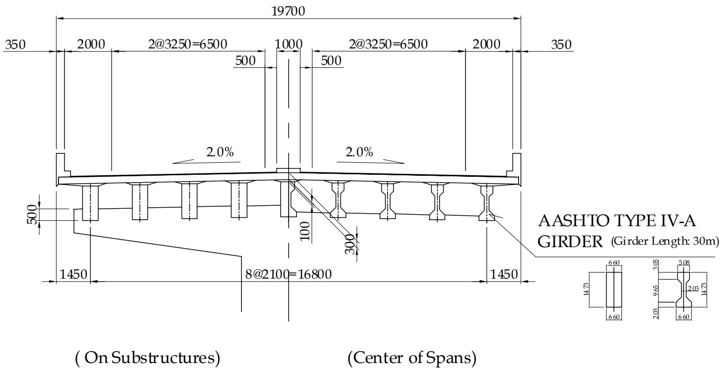

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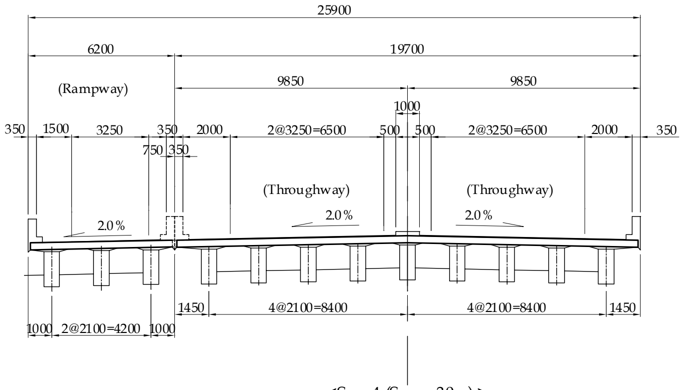

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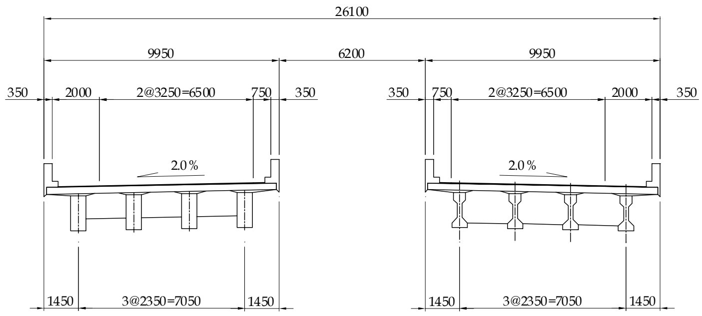

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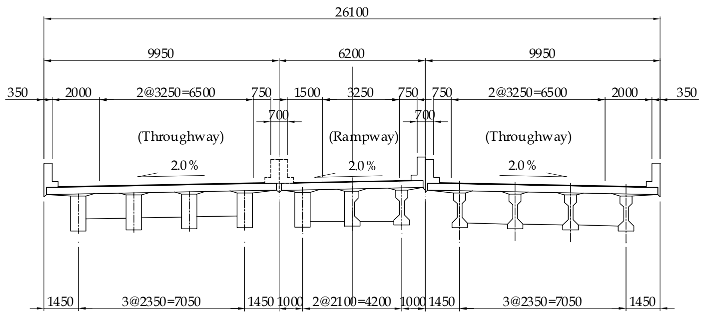

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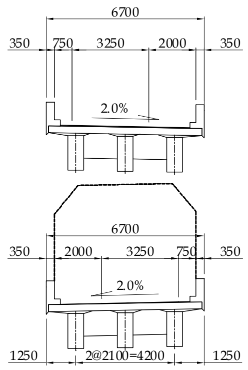

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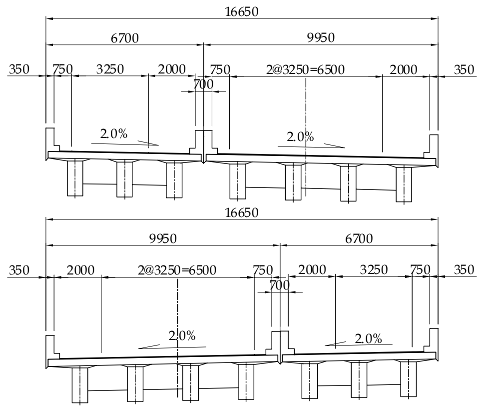

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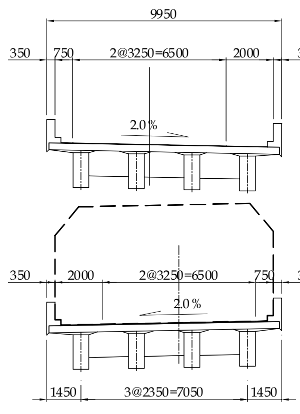

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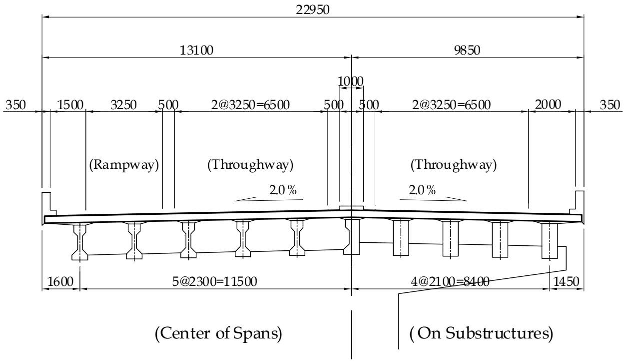

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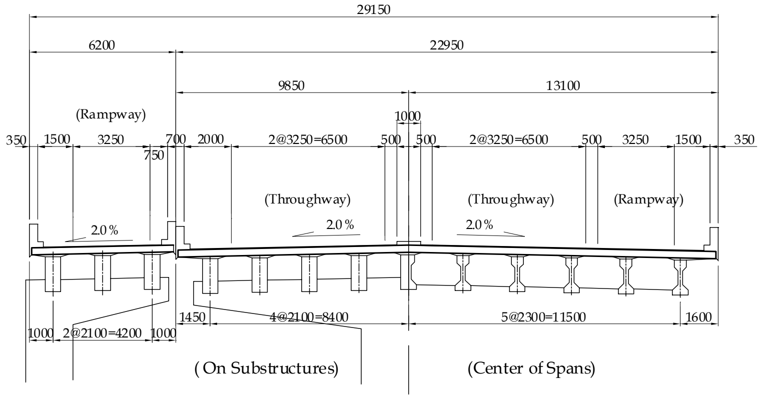

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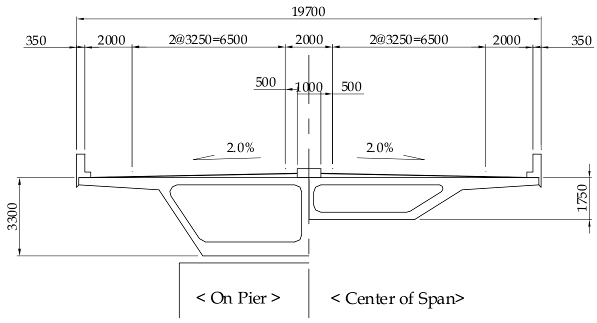

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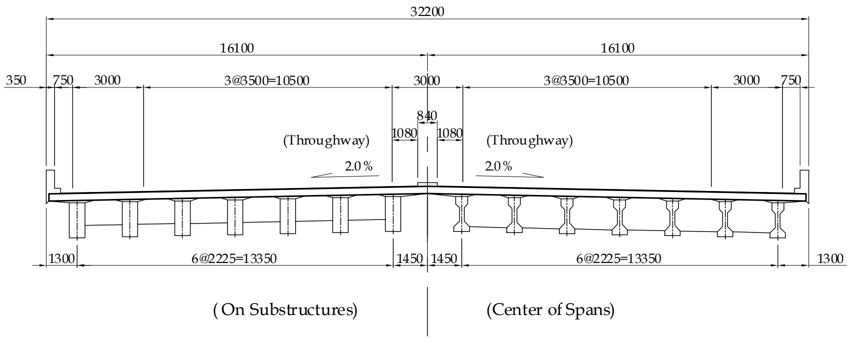

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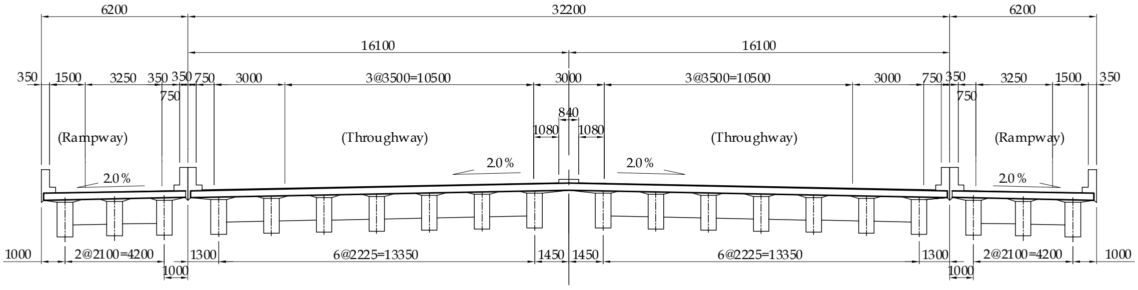

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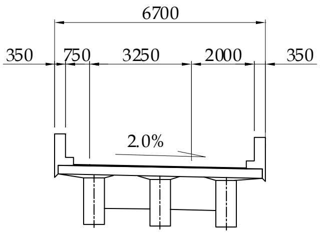

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Substructures and Foundations

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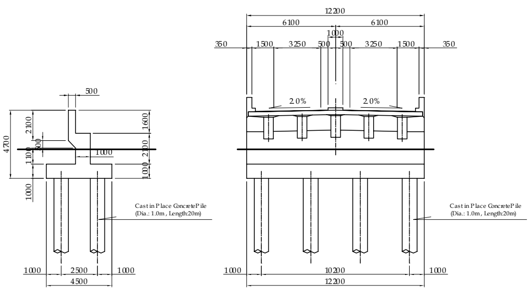

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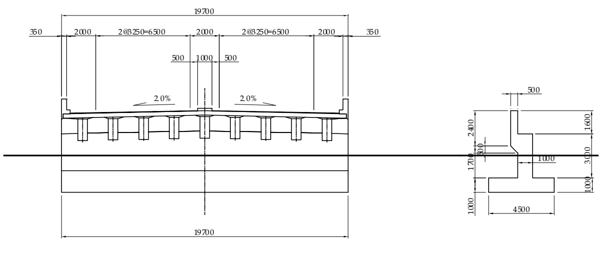

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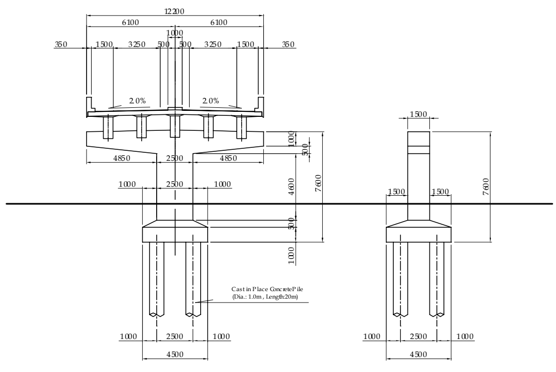

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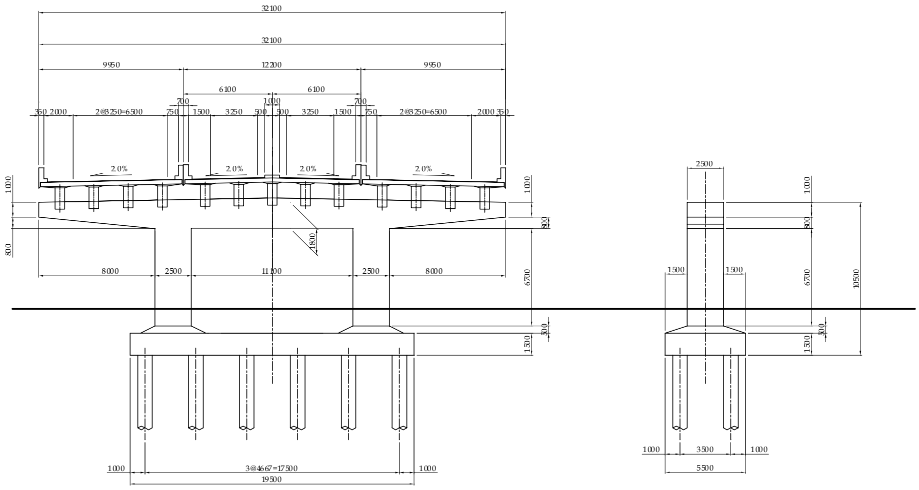

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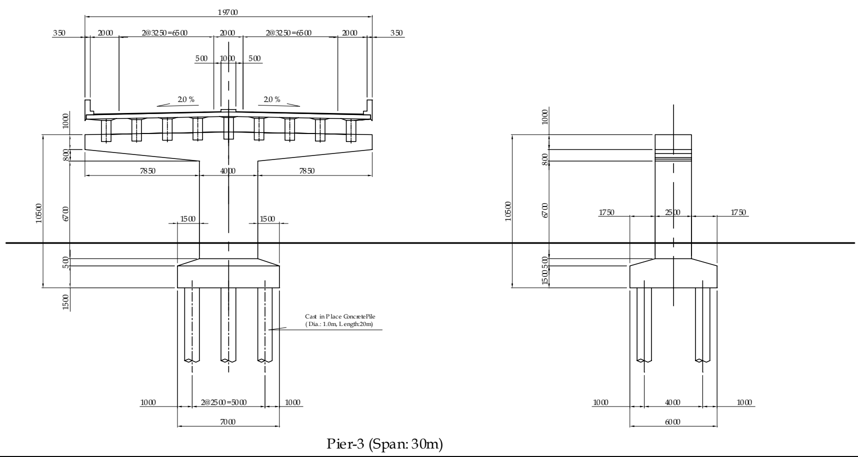

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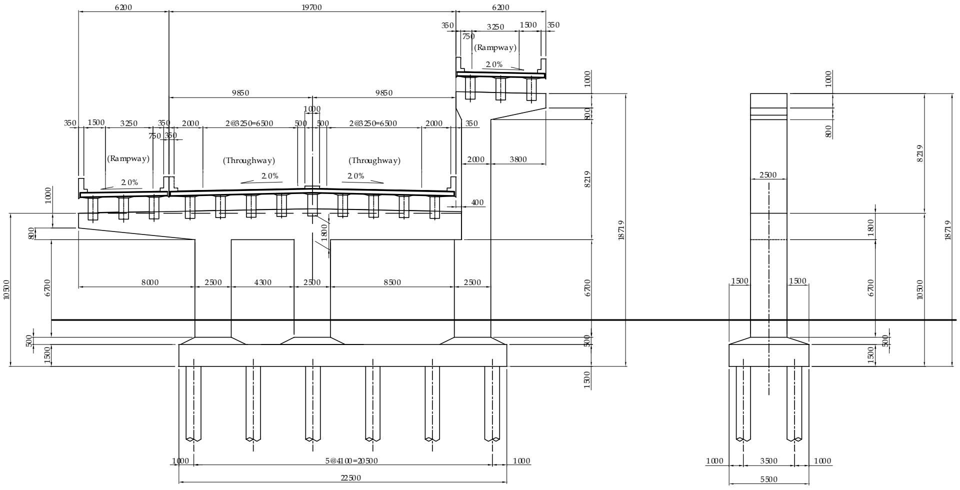

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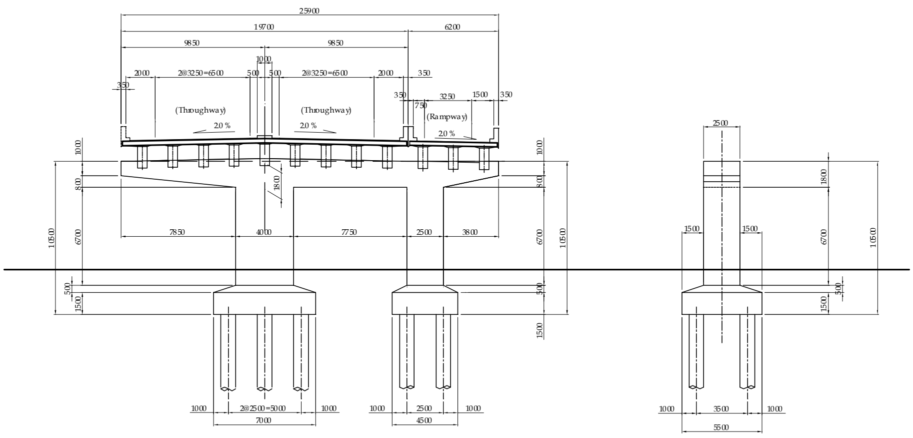

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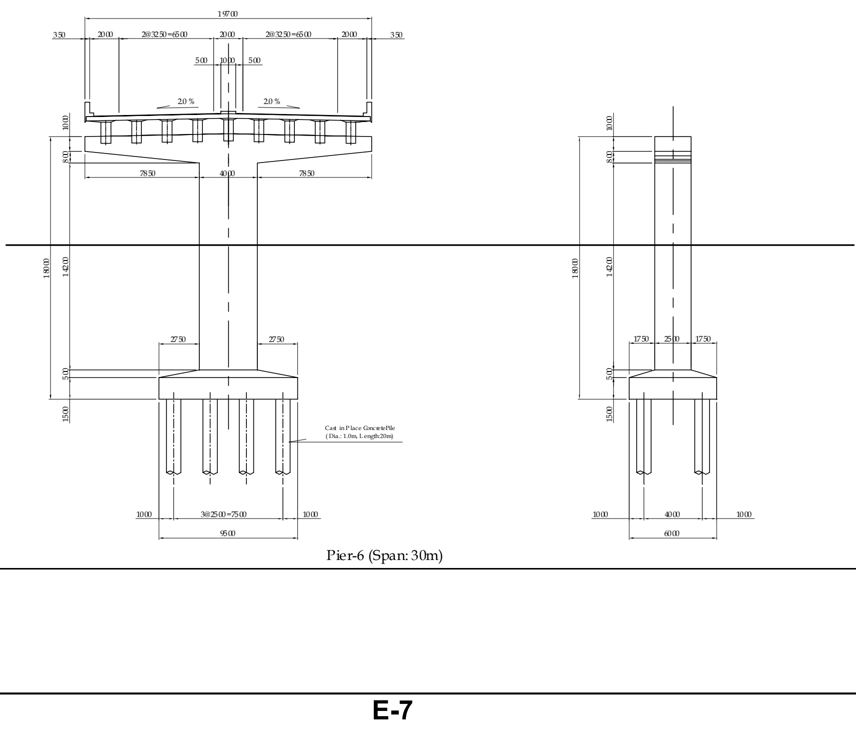

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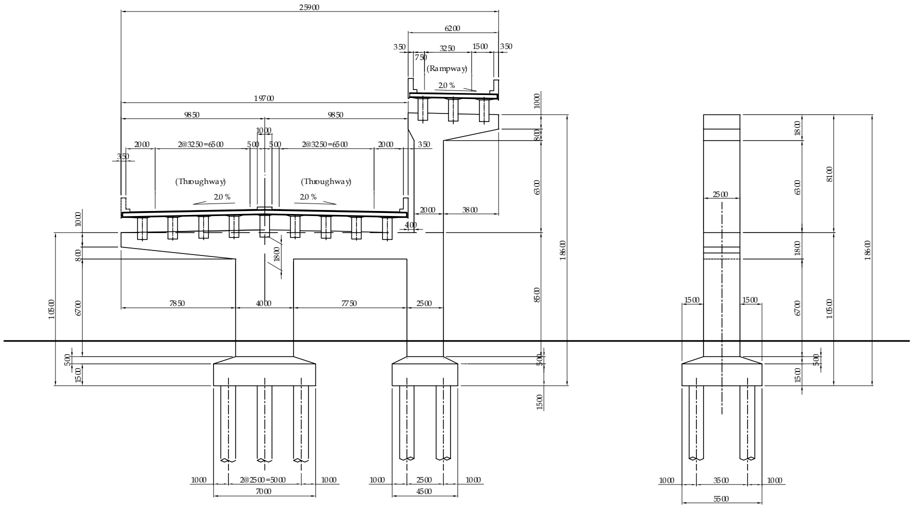

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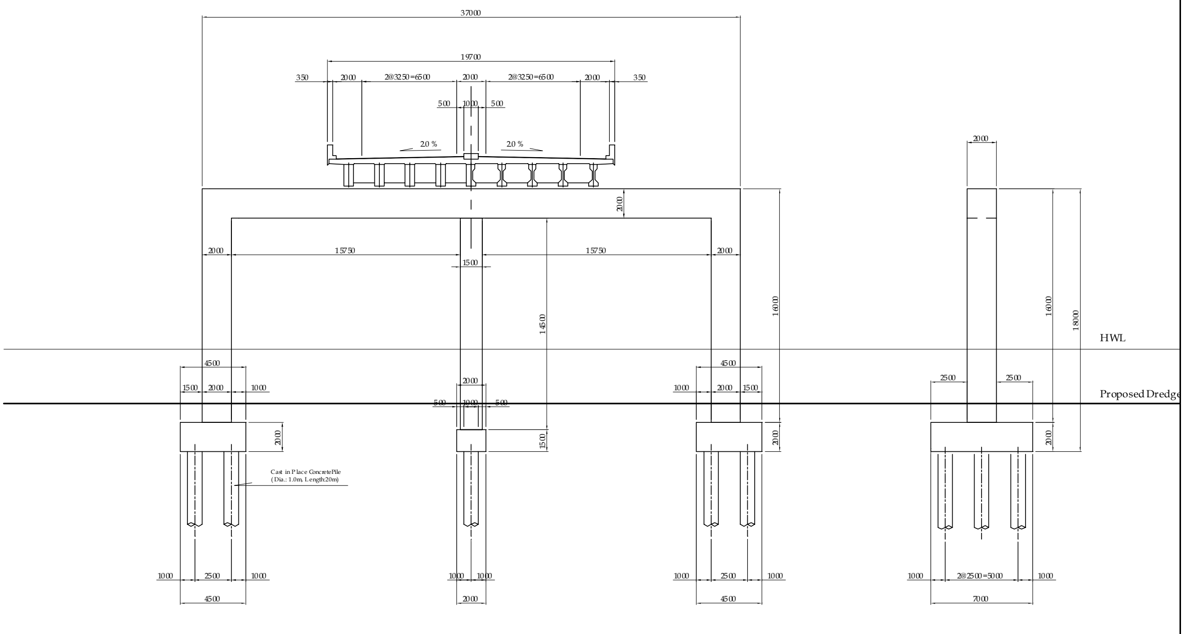

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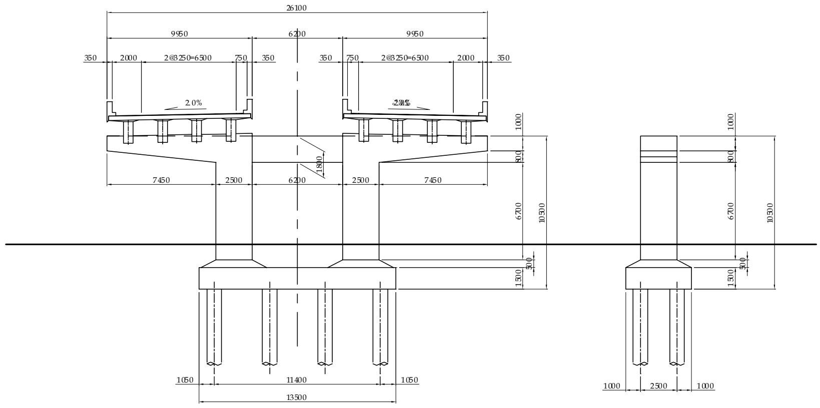

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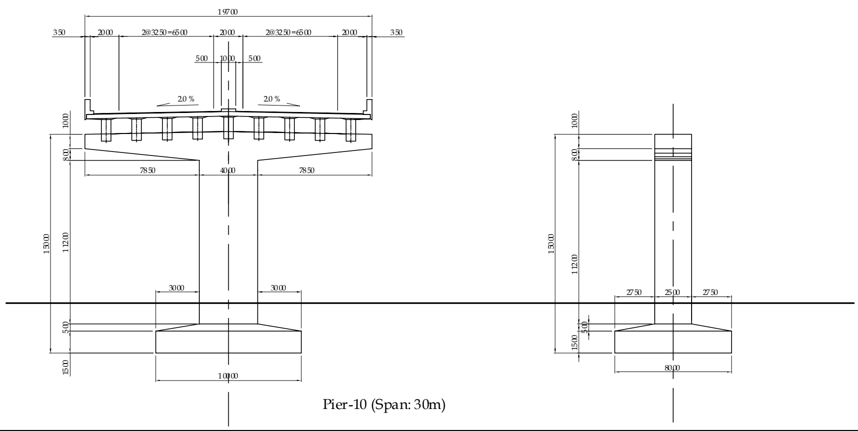

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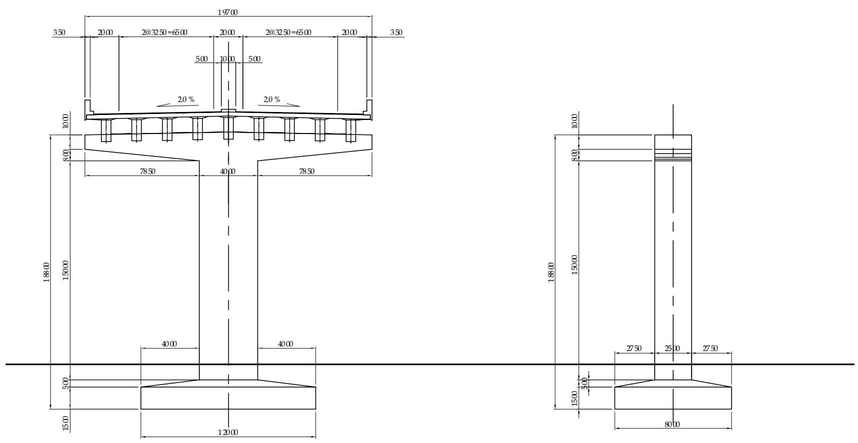

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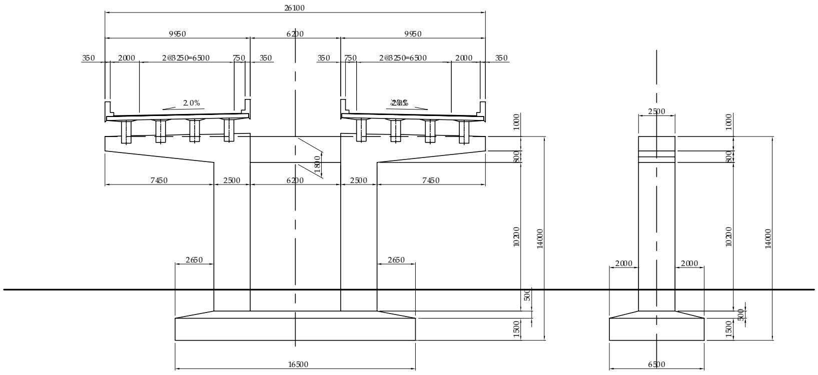

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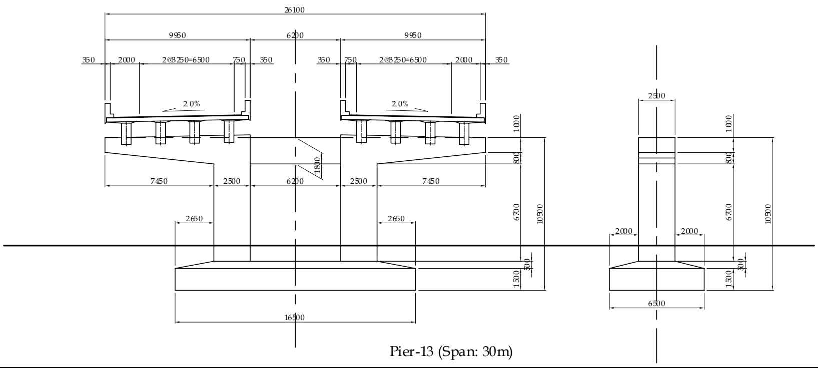

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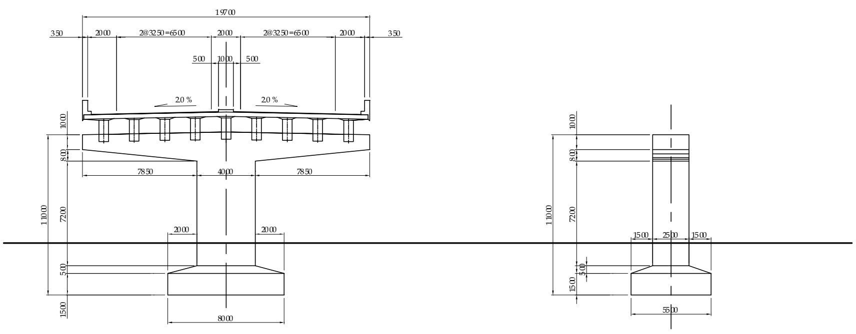

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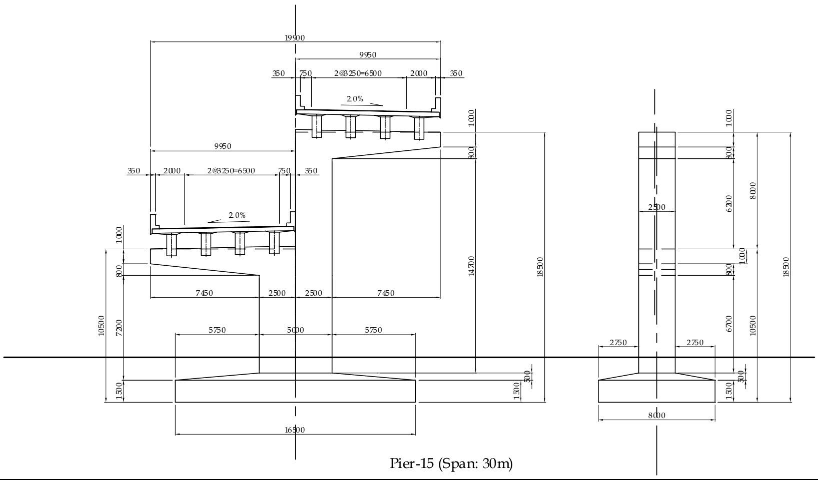

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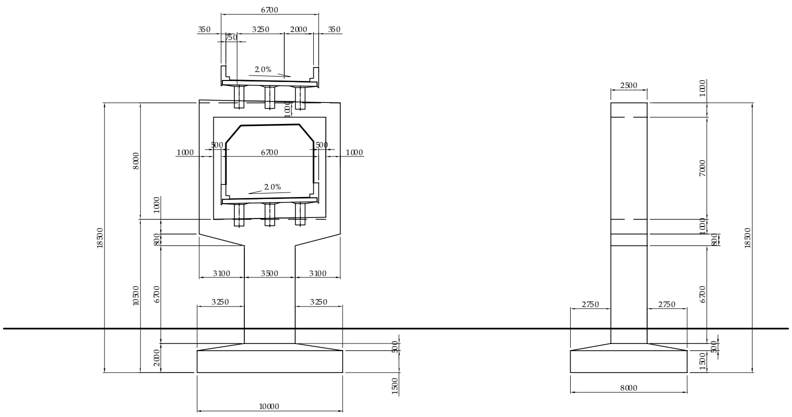

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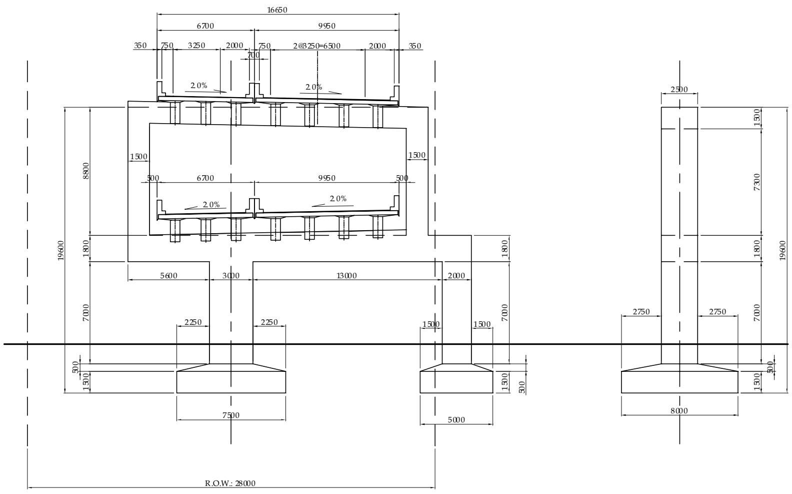

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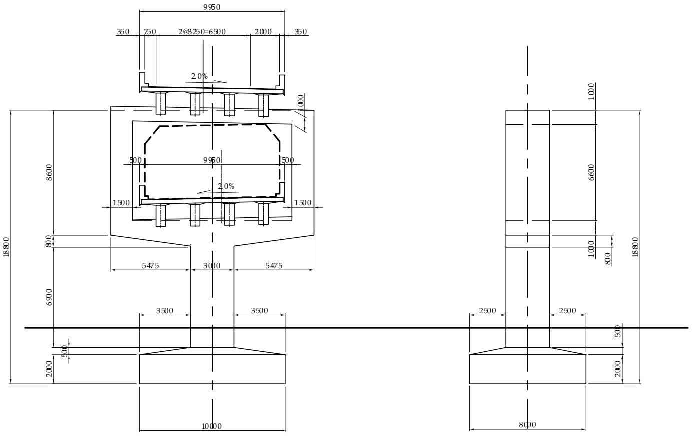

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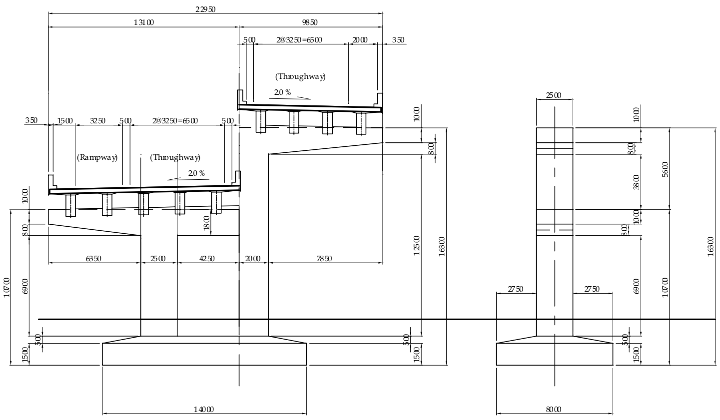

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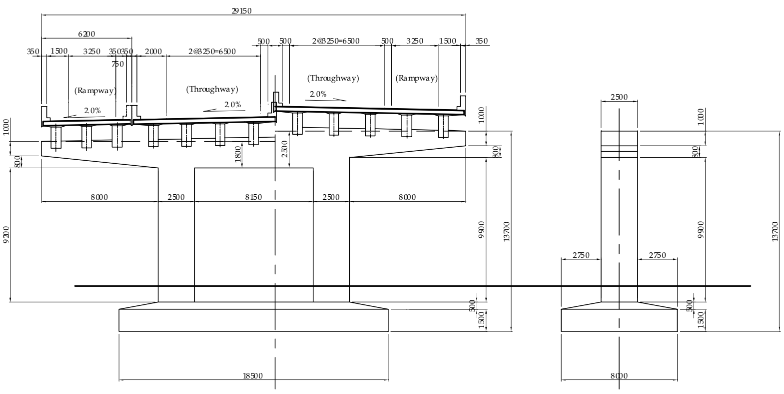

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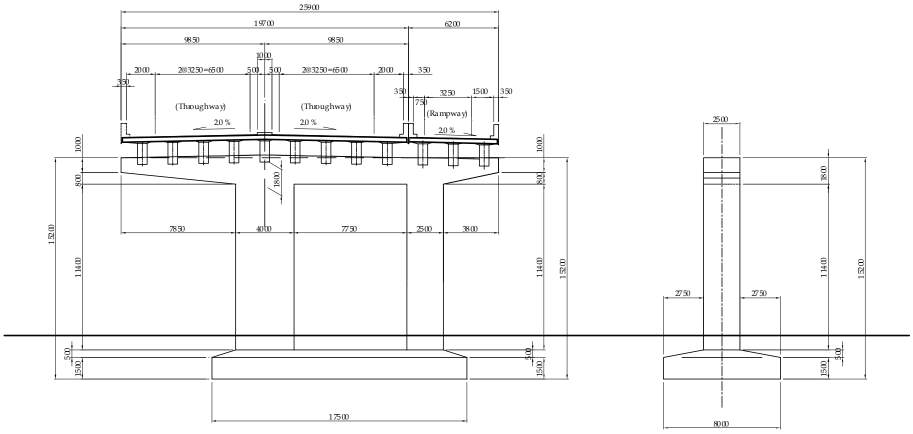

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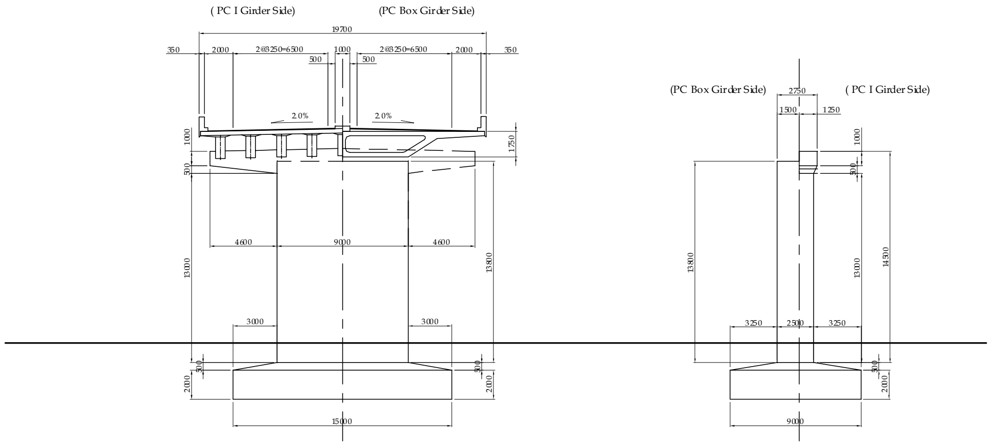

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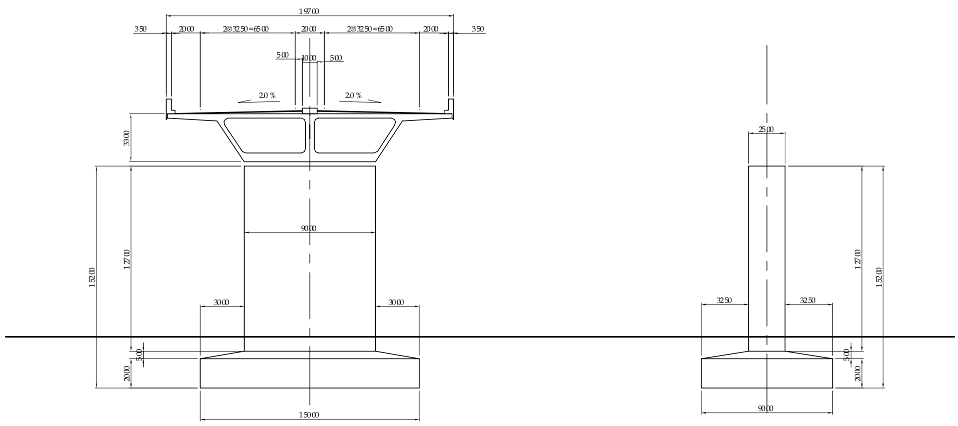

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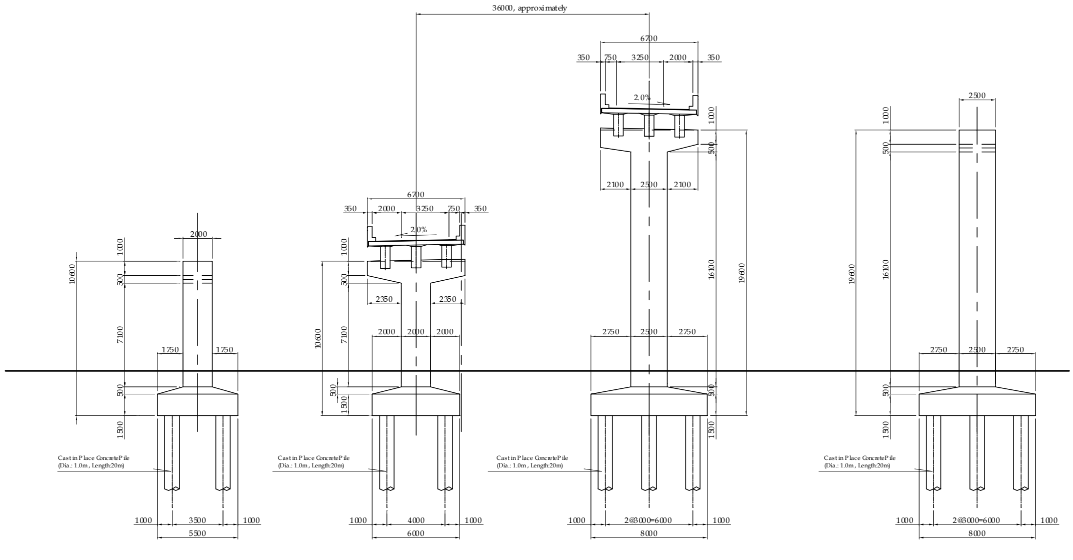

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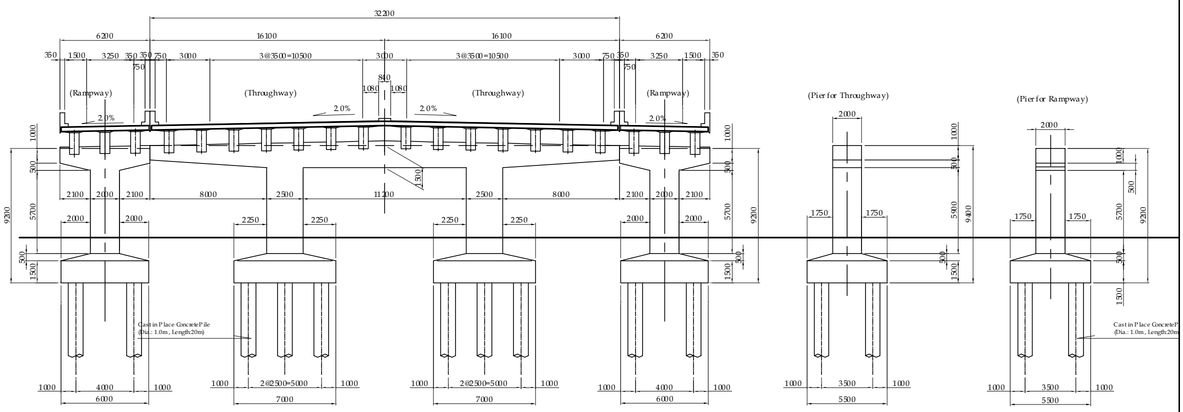

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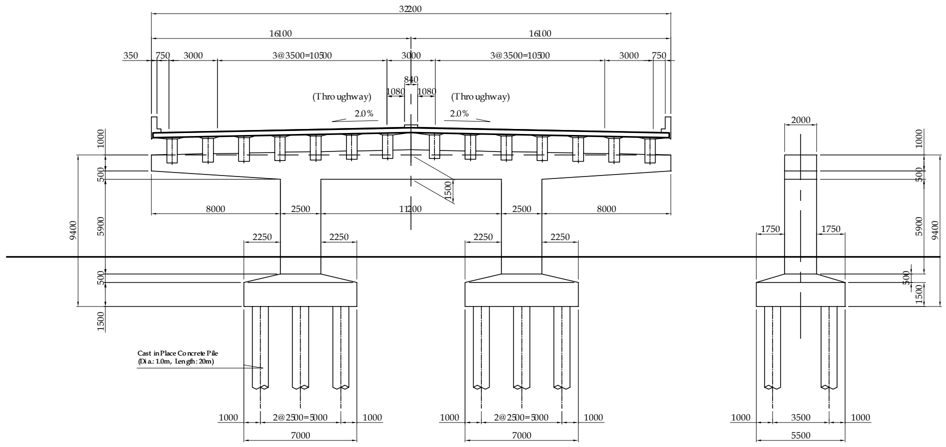

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(2) Rampway

Superstructures

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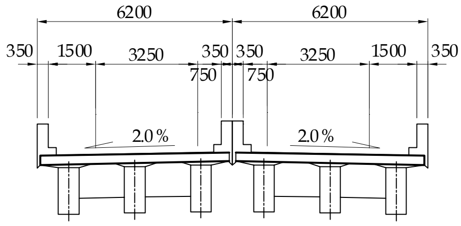

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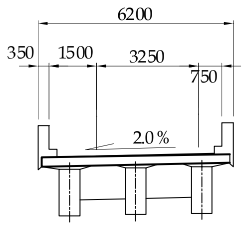

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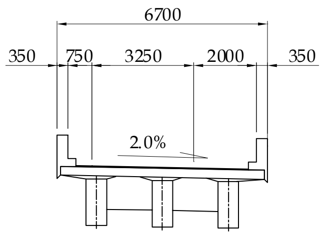

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Substructures and Foundations

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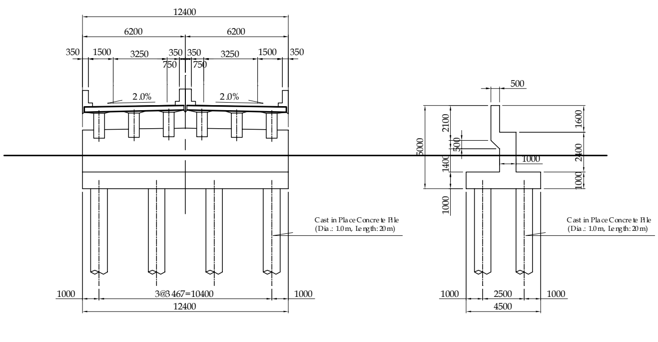

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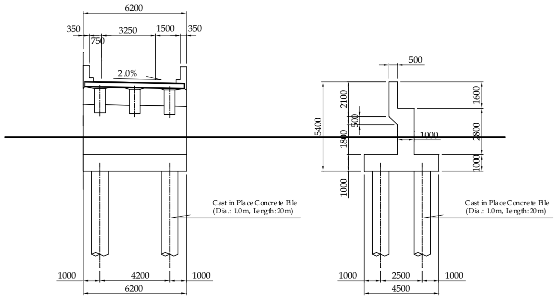

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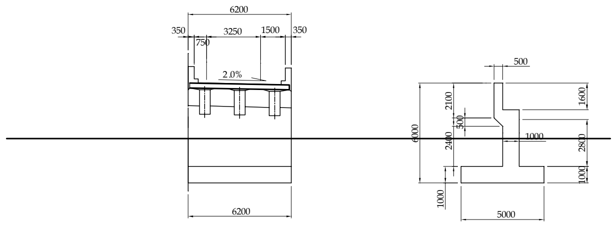

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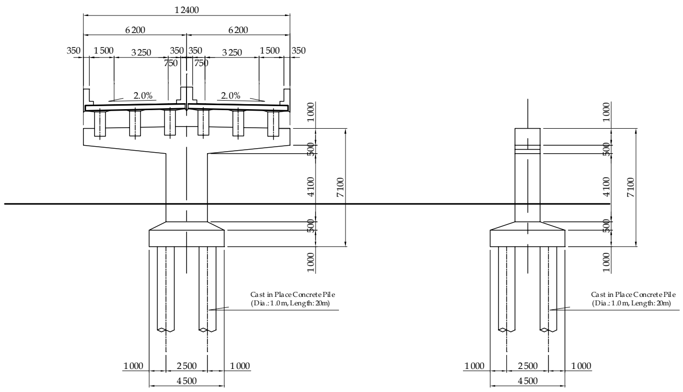

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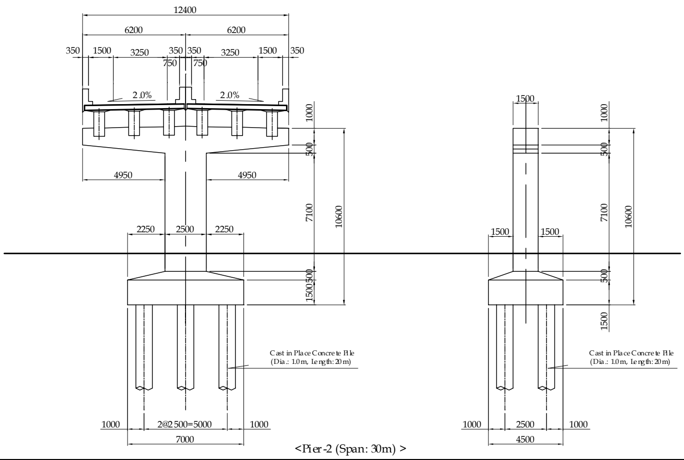

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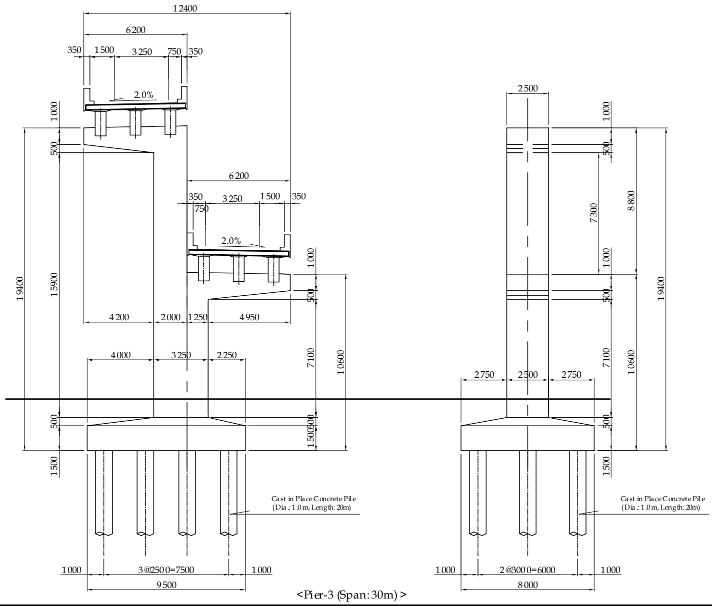

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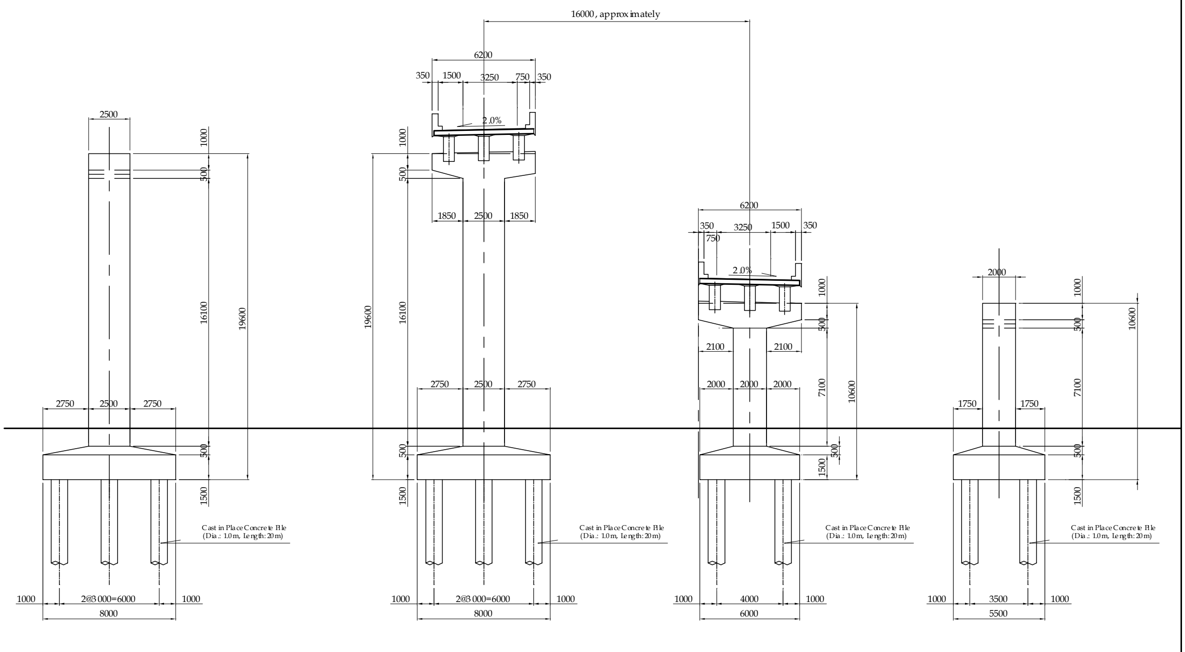

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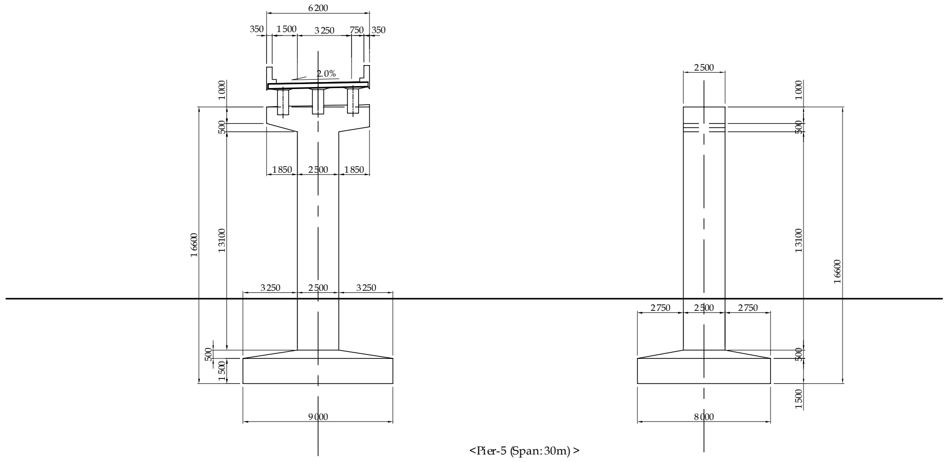

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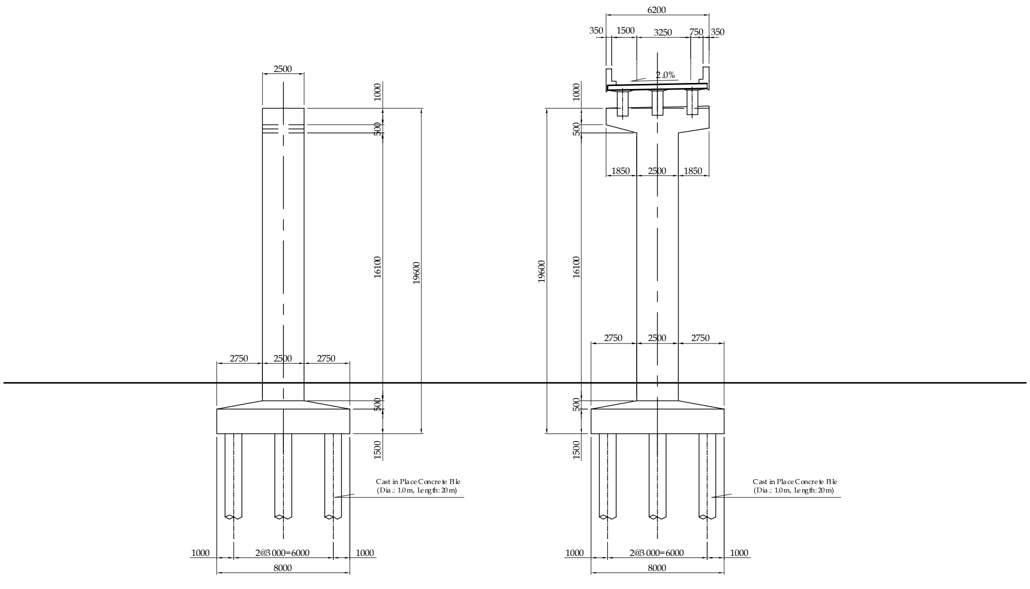

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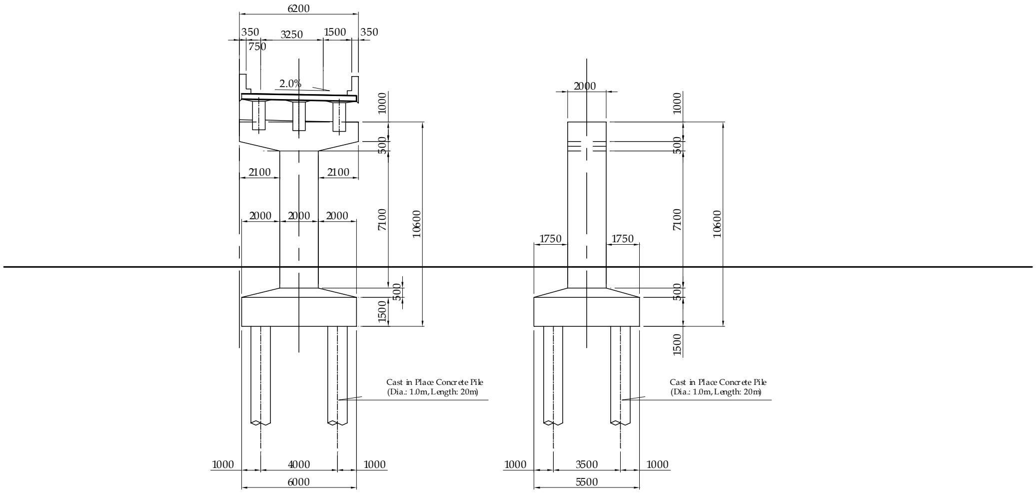

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ANNEX F

Cost Estimates

ANNEX F: Cost Estimates

Table F.1 List of Equipment Hourly Rate (ACEL 1998)

Description	Capacity	Operated Rental Cost (Peso / hr)
Plant		
Concrete Batching Plant	80 m^3 / hr	2,112.0
Asphalt Plant	50 m^3 / hr	1,206.0
Bentonite Plant		137.0
Heavy Equipment		
Bulldozer (D8K), 300HP with Roper	33 t	3,504.0
Bulldozer (D7G), 200HP	21 t	2,012.0
Bulldozer (D6D), 140HP	15 t	1,452.0
Wheel Loader, (WA180-1), 110HP	1.55 m^3	1,023.0
Wheel Loader	0.70 m^3	1,247.0
Crawler Loader	1.53 m^3	1,594.0
Backhoe, YS 1200, 170HP	0.67 m^3	1,581.0
Backhoe, YS 750-2	1.38 m^3	1,854.0
Crawler Crane	30 t	1,280.0
Crawler Crane	50 t	2,041.0
Crawler Crane	60 t	2,296.0
Truck Mounted Crane	21 - 25 t	1,162.0
Truck Mounted Crane	46 - 50 t	1,886.0
Truck Mounted Crane	121 - 140 t	4,826.0
Dump Truck	7.0 m^3	709.0
Dump Truck	10.0 m^3	918.0
Trailer (Low Bed)	60 t	4,973.0
Boring / Drilling Machine	18,000 kg-m	11,488.0
Diesel Pile Hummer w / Lead	25 t	1,135.0
Light Equipment		
Pneumatic Roller (Self-propelled)	25 t	716.0
Vibratory Sheep Roller	35 hp	432.0
Vibratory Roller / Plate Compactor	12 hp	206.0
Vibratory Smooth Roller	10 t	502.0
Vibratory Steel Drum Roller	10 t	1,414.0
Vibratory Tandem Drum Roller	10 t	1,387.0
Motor Grader, 120G, 125HP		638.0
Motor Grader, 120G, 135HP		1,491.0
Transit Mixer	5.0 m^3	1,066.0
Concrete Pump, 130HP	60 m^3/min	928.0
Gritone Pump		29.0
Concrete Vibrator	30 mm dia.	55.0
Generator Set	351-400 kW	750.0
Generator Set	501-600 kW	1,225.0
Portable Air Compressor, 330 CFM		576.0
Portable Air Compressor, 600 CFM		1,182.0
Concrete Paver / Finisher	120 HP	1,308.0
Concrete Cutter	25 cm dia.	154.0
Concrete Breaker	30 kg	55.0
Asphalt Sprayer	90 hp	723.0
Asphalt Paver / Finisher	142 HP	2,378.0
Pile Vibratory Driver (Electric Driven)		565.0

Table F.2 Unit Cost of Major Construction Item

(1) Earth Work

Item No. : **E 1** Unit : **m3**

Work Item : **Excavation for Structures** Unit Price : **196.1**

Item	Q'ty	Unit	Unit Cost	Total Cost
A. Labor				
Forman	1.10	hr.	38.9	42.8
Skilled Labor	2.20	hr.	33.8	74.4
Un-skilled Labor	11.00	hr.	26.3	289.3
Total A :				406.5
B. Equipment				
Hydraulic Excavator 0.67cu.m.	1.10	hr.	1,581.0	1,739.1
Wheel Loader, 1-3/4 cu.yd.	1.10	hr.	1,023.0	1,125.3
Dump Truck, 10 tons	1.10	hr.	709.0	779.9
Dewatering Pump, 4" dia.	4.40	hr.	77.4	340.7
Minor Tool (5% of Labor)	1.00	L.S.		20.3
Total B:				4,005.4
Total A + Total B				4,411.8
C. Output	22.5 m / hr.			22.5
D. Unit Cost (Labor & Equipment) = (A+B)/C				196.1
E. Materials				
Total E:				0.0
Estimation Direct Cost = D+E				196.1
Total Direct Cost	1/ 1.0			**196.1**

Cont'd… Table F.2 Unit Cost of Major Construction Item

Item No. : **E 2** Unit : **m3**

Work Item : **Back Filling for Structures** Unit Price : **228.9**

Item	Q'ty	Unit	Unit Cost	Total Cost
A. Labor				
Forman	1.10	hr.	38.9	42.8
Skilled Labor	2.20	hr.	33.8	74.4
Un-skilled Labor	6.60	hr.	26.3	173.6
Total A :				290.7
B. Equipment				
Vibratory Plate Compactor, 12 HP	2.20	hr.	206.0	453.2
Dump Truck, 10 tons	0.28	hr.	709.0	195.0
Hydraulic Excavator 0.67cu.m.	0.28	hr.	1,581.0	434.8
Total B:				1,083.0
Total A + Total B				1,373.7
C. Output	6.0 m^3 / hr.			6.0
D. Unit Cost (Labor & Equipment) = (A+B)/C				228.9
E. Materials				
Total E:				0.0
Estimation Direct Cost = D+E				228.9
Total Direct Cost	1/ 1.0			**228.9**

Cont'd… Table F.2 Unit Cost of Major Construction Item

Item No. : **E 3** Unit : **m3**

Work Item : **Road Embankment** Unit Price : **200.2**

Item	Q'ty	Unit	Unit Cost	Total Cost
A. Labor				
Forman	1.10	hr.	38.9	42.8
Skilled Labor	2.20	hr.	33.8	74.3
Un-skilled Labor	6.60	hr.	26.3	173.8
Total A :				290.9
B. Equipment				
Motor Grader	1.10	hr.	638.0	701.8
Bulldozer (D7G), 200HP	1.10	hr.	2,012.0	2,213.2
Vibratory Sheep Roller	0.55	hr.	432.0	237.6
Vibratory Tandem Drum Roller	1.10	hr.	1,387.0	1,525.7
Dump Truck	5.50	hr.	1,387.0	7,628.5
Water Tank	0.55	hr.	1,341.0	737.6
Minor Tool (5% of Labor)	1.00	L.S.		29.1
Total B:				13,073.4
Total A + Total B				13,364.3
C. Output	75.00	cu.m/hr		75.0
D. Unit Cost (Labor & Equipment) = (A+B)/C				178.2
E. Materials				
Borrow Material Royalty	1.10	cu.m	20.0	22.0
Total E:				22.0
Estimation Direct Cost = D+E				200.2
Total Direct Cost	1/ 1.0			**200.2**

Cont'd… Table F.2 Unit Cost of Major Construction Item

Item No. : **E 4** Unit : **m**

Work Item : **Temporary Sheet Pile Retaining Wall (Type-4; L = 10 m)** Unit Price : **20,703.2**

Item	Q'ty	Unit	Unit Cost	Total Cost
A. Labor				
Forman	6.60	hr.	38.9	256.7
Skilled Labor	24.20	hr.	33.8	818.0
Un-skilled Labor	13.75	hr.	26.3	361.6
Total A :				1,436.3
B. Equipment				
Pile Vibratory Driver (Electric Driven)	2.20	hr.	565.0	1,243.0
Truck Mounted Crane, 25 t	6.60	hr.	1,162.0	7,669.2
Generator Set, 75 kw	2.20	hr.	152.0	334.4
Welding Machine	6.05	hr.	85.0	514.3
Gas Cutter	6.05	hr.	64.0	387.2
Minor Tool (10% of Labor)	1.00	L.S.		143.6
Total B:				10,291.7
Total A + Total B				11,728.0
C. Output				1.0
D. Unit Cost (Labor & Equipment) = (A+B)/C				11,728.0
E. Materials				
Sheet Pile (Type-4), 10 m long	1,902.00	kg	3.9	7,417.8
H-Shape Steel Pile	475.00	kg	1.8	855.0
Welding Rods	5.00	kg	55.0	275.0
Minor Tools (5% of Above)	1.00	L.S.		427.4
Total E:				8,975.2
Estimation Direct Cost = D+E				20,703.2
Total Direct Cost (per Retaining Length)	1/ 1.0			**20,703.2**

Cont'd… Table F.2 Unit Cost of Major Construction Item

Item No. : **E 5** Unit : **m2**

Work Item : **Removal of Existing Cement Concrete Pavement** Unit Price : **191.6**

Item	Q'ty	Unit	Unit Cost	Total Cost
A. Labor				
Forman	1.10	hr.	38.9	42.8
Un-skilled Labor	11.00	hr.	26.3	289.3
Total A :				332.1
B. Equipment				
Backhoe Pavement Breaker	1.10	hr.	3,406.9	3,747.5
Loader Wheel type 3/4 cu.yd.	1.10	hr.	683.0	751.3
Dump Truck, 10 tons	2.20	hr.	991.0	2,180.2
Total B:				6,679.0
Total A + Total B				7,011.1
C. Output	36.6 m / hr.			36.6
D. Unit Cost (Labor & Equipment) = (A+B)/C				191.6
E. Materials				
Total E:				0.0
Estimation Direct Cost = D+E				191.6
Total Direct Cost	1/ 1.0			**191.6**

Cont'd… Table F.2 Unit Cost of Major Construction Item

(2) Road Pavement Work

Item No. : **R 1** — Unit : **m3**

Work Item : **Sub-base Course (t = 40 cm)** — Unit Price : **347.9**

Item	Q'ty	Unit	Unit Cost	Total Cost
A. Labor				
Forman	1.10	hr.	38.9	42.8
Un-skilled Labor	2.20	hr.	26.3	57.9
Total A :				100.7
B. Equipment				
Motor Grader	1.10	hr.	1,491.0	1,640.1
Vibratory Tandem Roller	1.10	hr.	1,387.0	1,525.7
Smooth Roller	1.10	hr.	502.0	552.2
Water Truck	0.55	hr.	1,341.0	737.6
Minor Tool (5% of Labor)	1.00	L.S.		5.0
Total B:				4,460.6
Total A + Total B				4,561.3
C. Output	40.00	cu.m/hr		40.0
D. Unit Cost (Labor & Equipment) = (A+B)/C				114.0
E. Materials				
Coarse Aggregate	0.33	cu.m	247.1	81.5
Fine Aggregate	0.39	cu.m	231.9	90.4
Soil	0.38	cu.m	162.8	61.9
Total E:				233.8
Estimation Direct Cost = D+E				347.9
Total Direct Cost	1/ 1.0			**347.9**

Cont'd… Table F.2 Unit Cost of Major Construction Item

Item No. : **R 2** Unit : **m3**
Work Item : **Base Course (t = 20 cm)** Unit Price : **474.9**

Item	Q'ty	Unit	Unit Cost	Total Cost
A. Labor				
Forman	1.10	hr.	38.9	42.8
Un-skilled Labor	2.20	hr.	26.3	57.9
Total A :				100.7
B. Equipment				
Motor Grader	1.10	hr.	1,491.0	1,640.1
Vibratory Tandem Roller	1.10	hr.	1,387.0	1,525.7
Smooth Roller	1.10	hr.	502.0	552.2
Water Truck	0.55	hr.	1,341.0	737.6
Minor Tool (5% of Labor)	1.00	L.S.		5.0
Total B:				4,460.6
Total A + Total B				4,561.3
C. Output	20.00	cu.m/hr		20.0
D. Unit Cost (Labor & Equipment) = (A+B)/C				228.1
E. Materials				
Coarse Aggregate	0.55	cu.m	247.1	135.9
Fine Aggregate	0.31	cu.m	231.9	71.9
Soil	0.24	cu,m	162.8	39.1
Total E:				246.8
Estimation Direct Cost = D+E				474.9
Total Direct Cost	1/ 1.0			**474.9**

Cont'd… Table F.2 Unit Cost of Major Construction Item

Item No. : **R 3** Unit : **m2**

Work Item : **Asphalt Course (t = 10 cm)** Unit Price : **627.4**

Item	Q'ty	Unit	Unit Cost	Total Cost
A. Labor				
Forman	3.52	hr.	38.9	136.9
Assistant Forman	3.52	hr.	37.1	130.6
Skilled Laborer	4.40	hr.	26.3	115.7
Total A :				383.2
B. Equipment				
Asphalt Paver	3.52	hr.	2,378.0	8,370.6
Pneumatic Timer Roller	3.52	hr.	716.0	2,520.3
Tandem Roller	3.52	hr.	1,470.0	5,174.4
Water Truck	1.10	hr.	1,341.0	1,475.1
Asphalt Distributor	0.11	hr.	974.0	107.1
Air Compressor	0.04	hr.	379.0	16.7
Minor Tools (10% of Labor)	1.00	L.S.		38.3
Total B:				17,702.5
Total A + Total B				18,085.8
C. Output	100 sq.m			100.0
D. Unit Cost (Labor & Equipment) = (A+B)/C				180.9
E. Materials				
Asphalt Concrete	0.26	ton	1,610.0	418.6
Cut-back Asphalt MC 70	0.0015	ton	18,231.6	27.3
Water	0.01	m3	61.7	0.6
Total E:				446.6
Estimation Direct Cost = D+E				627.4
Total Direct Cost	1/ 1.0			**627.4**

Cont'd… Table F.2 Unit Cost of Major Construction Item

Item No. : **R 4** Unit : **m2**

Work Item : **Cement Concrete Pavement (t = 23 cm)** Unit Price : **861.6**

Item	Q'ty	Unit	Unit Cost	Total Cost
A. Labor				
Forman	1.10	hr.	38.9	42.8
Mason	2.20	hr.	33.8	74.4
Equipment Checker	1.10	hr.	33.8	37.2
Skilled Labor	2.20	hr.	33.8	74.4
Un-skilled Labor	6.60	hr.	26.3	173.6
Total A :				402.3
B. Equipment				
Concrete Paver Finisher	1.10	hr.	3,334.0	3,667.4
Concrete Vibrator, 75mm	2.20	hr.	29.9	65.7
Concrete Cutter, 30HP	1.10	hr.	42.9	47.2
Form Rail Set	1.10	hr.	58.2	64.1
Dump Truck, 8 cu.m	1.10	hr.	407.0	447.7
Water Tank Truck (500-1000 gals)	1.10	hr.	968.0	1,064.8
Miscellaneous Tools (10% of Labor)	1.00	L.S.		40.2
Total B:				5,397.1
Total A + Total B				*5,799.3*
C. Output	100 m2 / hr.			100.0
D. Unit Cost (Labor & Equipment) = (A+B)/C				58.0
E. Materials				
Ready Mix Concrete Class A	0.24	cu.m.	2,350.3	564.1
12mm Marine Plywood (3 use)	0.13	sq.m.	650.0	84.5
Form Lumber and Framework (3 uses)	3.11	bdft/m2	25.0	77.8
C.W. Nails	0.10	sq. m.	32.6	3.3
Form Oil	0.01	sq.m.	95.0	1.0
Miscellaneous / Consumables (10% of the above)	1.00	L.S.		73.1
Total E:				803.6
Estimation Direct Cost = D+E				861.6
Total Direct Cost	1/ 1.0			**861.6**

Cont'd… Table F.2 Unit Cost of Major Construction Item

(3) Concrete Structure Work

Item No. : **S 1** Unit : **m**

Work Item : **In-stute Borehole Pile (diameter 1.0 m, 3 m steel casing)** Unit Price : **28,624.1**

Item	Q'ty	Unit	Unit Cost	Total Cost
A. Labor				
Forman	29.70	hr.	38.9	1,155.0
Equipment Checker	29.70	hr.	37.1	1,101.0
Skilled Laborer	79.20	hr.	33.8	2,673.8
Un-skilled Labor	59.40	hr.	26.3	1,564.6
Total A :				6,494.4
B. Equipment				
Drilling Rig	22.00	hr.	12,267.0	269,874.0
Crawler Loader, 1.53 cu.yd.	13.20	hr.	1,594.0	21,040.8
Water Pump	22.00	hr.	57.0	1,254.0
Crawler Crane, 60 t	39.60	hr.	2,296.0	90,921.6
Injection Pump	22.00	hr.	260.0	5,720.0
Generator Set, 600kw	22.00	hr.	1,225.0	26,950.0
Dump Truck 9 to 10 tons	13.20	hr.	918.0	12,117.6
Vibratory Pile Driver	28.60	hr.	565.0	16,159.0
Minor Tool (10% of Labor)	1.00	L.S.		649.4
Total B:				444,686.4
Total A + Total B				451,180.8
C. Output Pile Length : L = 20 m				1.0
D. Unit Cost (Labor & Equipment) = (A+B)/C				451,180.8
E. Materials				
Length of Pile = 20m				
Ready Mix Concrete class-A	17.59	cu.m.	2,350.3	41,342.5
Reinforcing Steel incl. Tie Wire	1,570.80	kgs.	30.3	47,595.2
Bentonite	18.00	kgs.	500.0	9,000.0
Steel Casing, t = 9 mm x 3 m (10 times use)	69.92	kgs.	45.0	3,146.4
Temporary Flood Matting (15 % of Materials)	1.00	L.S.		15,162.6
Misc. Materials, 5 % of Materials	1.00	L.S.		5,054.2
Total E:				121,300.9
Estimation Direct Cost = D+E				572,481.8
Total Direct Cost	1/ 20.0			**28,624.1**

Cont'd… Table F.2 Unit Cost of Major Construction Item

Item No. : **S 2** | Unit : **m3**

Work Item : **Lean Concrete** | Unit Price : **2,795.2**

Item	Q'ty	Unit	Unit Cost	Total Cost
A. Labor				
Assistant Forman	4.40	hr.	37.1	163.2
Skilled Laborer	17.60	hr.	33.8	594.9
Un-skilled Labor	22.00	hr.	26.3	578.6
Total A :				1,336.7
B. Equipment				
Transit Mixer	2.20	hr.	1,066.0	2,345.2
Concrete Vibrator	4.40	hr.	55.0	242.0
Minor Tools (5% of above)	1.00	L.S.		129.4
Total B:				2,716.6
Total A + Total B				4,053.3
C. Output 10.00 cu.m.				10.0
D. Unit Cost (Labor & Equipment) = (A+B)/C				405.3
E. Materials				
Lean Concrete (Delivered to Site)	1.05	cu.m.	2,005.8	2,106.1
Formworks	0.20	sht.	850.0	170.0
Miscellaneous (5 % of above)	1.00	L.S.	142.8	113.8
Total E:				2,389.9
Estimation Direct Cost = D+E				2,795.2
Total Direct Cost	1/ 1.0			**2,795.2**

Cont'd… Table F.2 Unit Cost of Major Construction Item

Item No. : **S 3** Unit : **kg**
Work Item : **Reinforcing Steel Bars, Grade 60** Unit Price : **30.3**

Item	Q'ty	Unit	Unit Cost	Total Cost
A. Labor				
Forman	1.10	hr.	38.9	42.8
Steelman	6.60	hr.	33.8	223.1
Un-skilled Labor	8.80	hr.	26.3	231.4
Total A :				497.3
B. Equipment				
Shearing Machine	1.10	hr.	42.6	46.8
Bar Bender, 50mm	1.10	hr.	370.8	407.9
Bar cutter, 25mm	1.10	hr.	370.8	407.9
Minor Tools (5% of Labor)	1.00	L.S.		24.9
Total B:				887.5
Total A + Total B				1,384.8
C. Output 130.0 kg / hr				130.0
D. Unit Cost (Labor & Equipment) = (A+B)/C				10.7
E. Materials				
Reinforcing Bar, Grade 60	1.00	kg	18.0	18.0
G.I. Wires, Ga. 16	0.02	kg	35.0	0.7
Wastage, 5% of the above	1.00	L.S.		0.9
Total E:				19.6
Estimation Direct Cost = D+E				30.3
Total Direct Cost	1/ 1.0			**30.3**

Cont'd… Table F.2 Unit Cost of Major Construction Item

Item No. : **S 4** Unit : **m3**
Work Item : **Structure Concrete (Footing)** Unit Price : **4,993.3**

Item	Q'ty	Unit	Unit Cost	Total Cost
A. Labor				
Forman	8.80	hr.	38.9	342.3
Mason	17.60	hr.	33.8	594.9
Equipment Checker	8.80	hr.	26.3	231.4
Skilled Laborer	22.00	hr.	33.8	743.6
Un-skilled Labor	22.00	hr.	26.3	578.6
Total A :				2,490.8
B. Equipment				
Transit Mixer	17.60	hr.	1,066.0	18,761.6
Concrete Vibrator, 75mm	17.60	hr.	55.0	968.0
Concrete Pump	8.80	hr.	928.0	8,166.4
Crawler Crane 10 ton	8.80	hr.	526.0	4,628.8
Minor Tools (10% of Labor)	1.00	L.S.		249.1
Total B:				32,773.9
Total A + Total B				35,264.7
C. Output 50.0 cu.m.				50.0
D. Unit Cost (Labor & Equipment) = (A+B)/C				705.3
E. Materials				
Ready Mix Concrete Class A	1.05	cu.m.	2,350.3	2,467.8
12mm Marine Plywood	0.60	sht.	850.0	510.0
Form Lumber and Frameworks	50.00	bd ft	15.0	750.0
C.W.Nails	12.00	kg	28.0	336.0
Form Oils	1.00	gal	20.0	20.0
Misc. Material, 5% of the above	1.00	L.S.		204.2
Total E:				4,288.0
Estimation Direct Cost = D+E				4,993.3
Total Direct Cost		1/ 1.0		**4,993.3**

Cont'd… Table F.2 Unit Cost of Major Construction Item

Item No. : **S 5** | Unit : **m3**

Work Item : **Structure Concrete (Columns, Coping)** | Unit Price : **5,841.0**

Item	Q'ty	Unit	Unit Cost	Total Cost
A. Labor				
Forman	17.60	hr.	38.9	684.6
Mason	35.20	hr.	33.8	1,189.8
Equipment Checker	17.60	hr.	26.3	462.9
Skilled Labor	44.00	hr.	33.8	1,487.2
Un-skilled Labor	44.00	hr.	26.3	1,157.2
Total A :				4,981.7
B. Equipment				
Transit Mixer	17.60	hr.	1,066.0	18,761.6
Concrete Vibrator, 75mm	35.20	hr.	55.0	1,936.0
Concrete Pump	17.60	hr.	928.0	16,332.8
Crawler Crane 10 ton	17.60	hr.	526.0	9,257.6
Minor Tools (10% of Labor)	1.00	L.S.		498.2
Total B:				46,786.2
Total A + Total B				51,767.8
C. Output 50.0 cu.m.				50.0
D. Unit Cost (Labor & Equipment) = (A+B)/C				1,035.4
E. Materials				
Ready Mix Concrete Class A	1.05	cu.m.	2,350.3	2,467.8
12mm Marine Plywood	0.90	sht.	850.0	765.0
Form Lumber and Frameworks	60.00	bd ft	15.0	900.0
C.W.Nails	15.00	kg	28.0	420.0
Form Oils	1.20	gal	20.0	24.0
Misc. Material, 5% of the above	1.00	L.S.		228.8
Total E:				4,805.7
Estimation Direct Cost = D+E				5,841.0
Total Direct Cost	1/ 1.0			**5,841.0**

Cont'd… Table F.2 Unit Cost of Major Construction Item

Item No. : **S 6** Unit : **each**

Work Item : **Priestess Concrete Girder (AASHTO type-4, Span-30m)** Unit Price : **700,925.0**

Item	Q'ty	Unit	Unit Cost	Total Cost
A. Labor				
Forman	16.50	hr.	38.9	641.7
Skilled Laborer	147.40	hr.	33.8	4,976.2
Un-skilled Laborer	145.20	hr.	26.3	3,824.6
Total A :				9,442.5
B. Equipment				
Election Equipment 1 set	3.60	day	51,400.0	184,885.8
Trailer, 60 t	5.50	hr.	4,973.0	27,351.5
Miscellaneous Tools (5% of Labor)	1.00	L.S.		472.1
Total B:				212,709.4
Total A + Total B				222,151.9
C. Output				1.0
D. Unit Cost (Labor & Equipment) = (A+B)/C				222,151.9
E. Materials				
Pre-cast Girder (30m-span)	1.00	nos	445,714.4	445,714.4
Electrometric Bearing Pad	2.00	nos	5,130.0	10,260.0
Miscellaneous / Consumables (5% of the above)	1.00	L.S.		22,798.7
Total E:				478,773.1
Estimation Direct Cost = D+E				700,925.0
Total Direct Cost	1/ 1.0			**700,925.0**

Cont'd… Table F.2 Unit Cost of Major Construction Item

Item No. : **S 7** Unit : **m3**

Work Item : **Structure Concrete (Diaphragm : Pre-stress)** Unit Price : **6,022.5**

Item	Q'ty	Unit	Unit Cost	Total Cost
A. Labor				
Forman	13.20	hr.	38.9	513.5
Mason	17.60	hr.	33.8	594.9
Equipment Checker	8.80	hr.	26.3	231.4
Skilled Labor	28.60	hr.	33.8	966.7
Un-skilled Labor	28.60	hr.	26.3	752.2
Total A :				3,058.7
B. Equipment				
Transit Mixer	17.60	hr.	1,066.0	18,761.6
Concrete Vibrator, 75mm	17.60	hr.	55.0	968.0
Concrete Pump	8.80	hr.	928.0	8,166.4
Crawler Crane 10 ton	8.80	hr.	526.0	4,628.8
Minor Tools (10% of Labor)	1.00	L.S.		305.9
Total B:				32,830.7
Total A + Total B				35,889.3
C. Output 50.0 cu.m.				50.0
D. Unit Cost (Labor & Equipment) = (A+B)/C				717.8
E. Materials				
Ready Mix Concrete Class A	1.05	cu.m.	2,350.3	2,467.8
12mm Marine Plywood	0.60	sht.	850.0	510.0
Form Lumber and Frameworks	83.33	bd ft	15.0	1,250.0
C.W.Nails	15.00	kg	28.0	420.0
Form Oils	1.00	gal	20.0	20.0
HTS Wire-Strand (Tendons) (inclu. Stressing, anchoring, etc)	2.00	m	183.0	366.0
Cement Grouting (5 % of HTS)	1.00	L.S.		18.3
Misc. Material, 5% of the above	1.00	L.S.		252.6
Total E:				5,304.7
Estimation Direct Cost = D+E				6,022.5
Total Direct Cost	1/ 1.0			**6,022.5**

Cont'd… Table F.2 Unit Cost of Major Construction Item

Item No. : **S 8** Unit : **m3**

Work Item : **Structure Concrete (Deck Slab, Curb & Parapet, Center Me** Unit Price : **5,606.4**

Item	Q'ty	Unit	Unit Cost	Total Cost
A. Labor				
Forman	8.80	hr.	38.9	342.3
Mason	17.60	hr.	33.8	594.9
Equipment Checker	8.80	hr.	26.3	231.4
Skilled Labor	22.00	hr.	33.8	743.6
Un-skilled Labor	22.00	hr.	26.3	578.6
Total A :				2,490.8
B. Equipment				
Transit Mixer	17.60	hr.	1,066.0	18,761.6
Concrete Vibrator, 75mm	17.60	hr.	55.0	968.0
Concrete Pump	8.80	hr.	928.0	8,166.4
Crawler Crane 10 ton	8.80	hr.	526.0	4,628.8
Minor Tools (10% of Labor)	1.00	L.S.		249.1
Total B:				32,773.9
Total A + Total B				35,264.7
C. Output 50.0 cu.m.				50.0
D. Unit Cost (Labor & Equipment) = (A+B)/C				705.3
E. Materials				
Ready Mix Concrete Class A	1.05	cu.m.	2,350.3	2,467.8
12mm Marine Plywood	0.60	sht.	850.0	510.0
Form Lumber and Frameworks	83.33	bd ft	15.0	1,250.0
C.W.Nails	15.00	kg	28.0	420.0
Form Oils	1.00	gal	20.0	20.0
Misc. Material, 5% of the above	1.00	L.S.		233.4
Total E:				4,901.2
Estimation Direct Cost = D+E				5,606.4
Total Direct Cost	1/ 1.0			**5,606.4**

Cont'd… Table F.2 Unit Cost of Major Construction Item

Item No. : **S 9** Unit : **m3**

Work Item : **Temporary Timbering for Coping Concrete Work** Unit Price : **463.0**

Item	Q'ty	Unit	Unit Cost	Total Cost
A. Labor				
Forman	15.40	hr.	38.9	599.1
Skilled Labor	79.20	hr.	33.8	2,677.0
Un-skilled Labor	93.50	hr.	26.3	2,459.1
Total A :				5,735.1
B. Equipment				
Truck Mounted Crane, 25 t	8.80	hr.	1,162.0	10,225.6
Total B:				10,225.6
Total A + Total B				15,960.7
C. Output 100.0 cu.m. (Timbering Space)				100.0
D. Unit Cost (Labor & Equipment) = (A+B)/C				159.6
E. Materials				
Sheet Pile (Type-2)	15.00	kg	3.9	58.5
Timbering Material Rental	1.00	L.S.	-	244.9
Total E:				303.4
Estimation Direct Cost = D+E				463.0
Total Direct Cost	1/ 1.0			**463.0**

Table F.3 Base Cost of Elevated Expressway Structure

(1) Superstructure

Structure Type: **PC I-shape Girder**
Lane and Span.: **1-lane (W=6.2 m) , 30m-span** Unit Cost: **3.85 Million Pesos**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1. PC-Girder (AASHTO, IVA)	3.0	each	700,925	2,102,775
2. Diaphragm	7.2	m^3	6,022	43,061
3. Structure Concrete	90.0	m^3	5,606	504,580
4. Reinforcing Bar	21,351.5	kg	30	646,681
5. Metal Bridge Railing	60.0	m	3,690	221,400
6. Cast Iron Pipe	6.6	m	2,439	16,000
7. Galvanized Iron Pipe	21.0	m	2,011	42,231
8. Asphalt Pavement (t=10cm)	150.0	m^2	627	94,113
9. Other Accessories (5 % above)	1.0	L.S.		183,542
Total :				**3,854,383**

Structure Type: **PC I-shape Girder**
Lane and Span.: **1-lane (W=6.2 m) , 40m-span** Unit Cost: **5.45 Million Pesos**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1. PC-Girder (AASHTO, VI)	3.0	each	1,051,000	3,153,000
2. Diaphragm	7.2	m^3	6,022	43,061
3. Structure Concrete	118.5	m^3	5,606	664,364
4. Reinforcing Bar	27,692.0	kg	30	838,718
5. Metal Bridge Railing	80.0	m	3,690	295,200
6. Cast Iron Pipe	6.6	m	2,439	16,000
7. Galvanized Iron Pipe	26.0	m	2,011	52,286
8. Asphalt Pavement (t=10cm)	200.0	m^2	627	125,484
9. Other Accessories (5 % above)	1.0	L.S.		259,406
Total :				**5,447,518**

Structure Type: **PC I-shape Girder**
Lane and Span.: **1-lane (W=6.7 m) , 30m-span** Unit Cost: **3.92 Million Pesos**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1. PC-Girder (AASHTO, IVA)	3.0	each	700,925	2,102,775
2. Diaphragm	7.2	m^3	6,022	43,061
3. Structure Concrete	94.5	m^3	5,606	529,809
4. Reinforcing Bar	22,417.0	kg	30	678,952
5. Metal Bridge Railing	60.0	m	3,690	221,400
6. Cast Iron Pipe	6.6	m	2,439	16,000
7. Galvanized Iron Pipe	21.0	m	2,011	42,231
8. Asphalt Pavement (t=10cm)	165.0	m^2	627	103,525
9. Other Accessories (5 % above)	1.0	L.S.		186,888
Total :				**3,924,640**

Cont'd… Table F.3 Base Cost of Elevated Expressway Structure

Structure Type: **PC I-shape Girder**
Lane and Span.: **1-lane (W=6.7 m) , 40m-span** Unit Cost: **5.76 Million Pesos**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1. PC-Girder (AASHTO, VI)	3.0	each	1,051,000	3,153,000
2. Diaphragm	7.2	m^3	6,022	43,061
3. Structure Concrete	158.0	m^3	5,606	885,819
4. Reinforcing Bar	29,889.0	kg	30	905,259
5. Metal Bridge Railing	80.0	m	3,690	295,200
6. Cast Iron Pipe	6.6	m	2,439	16,000
7. Galvanized Iron Pipe	26.0	m	2,011	52,286
8. Asphalt Pavement (t=10cm)	220.0	m^2	627	138,033
9. Other Accessories (5 % above)	1.0	L.S.		274,433
Total :				**5,763,090**

Structure Type: **PC I-shape Girder**
Lane and Span.: **2-lane (W=9.95 m) , 30m-span** Unit Cost: **5.24 Million Pesos**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1. PC-Girder (AASHTO, IVA)	4.0	each	700,925	2,803,700
2. Diaphragm	12.5	m^3	6,022	75,100
3. Structure Concrete	126.6	m^3	5,606	709,776
4. Reinforcing Bar	30,915.0	kg	30	936,334
5. Metal Bridge Railing	60.0	m	3,690	221,400
6. Cast Iron Pipe	6.6	m	2,439	16,000
7. Galvanized Iron Pipe	30.0	m	2,011	60,330
8. Asphalt Pavement (t=10cm)	262.5	m^2	627	164,698
9. Other Accessories (5 % above)	1.0	L.S.		249,367
Total :				**5,236,705**

Structure Type: **PC I-shape Girder**
Lane and Span.: **2-lane (W=12.2 m) , 30m-span** Unit Cost: **6.46 Million Pesos**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1. PC-Girder (AASHTO, IVA)	5.0	each	700,925	3,504,625
2. Diaphragm	16.2	m^3	5,606	90,600
3. Structure Concrete	155.8	m^3	5,841	910,030
4. Reinforcing Bar	38,203.5	kg	30	1,157,083
5. Metal Bridge Railing	60.0	m	3,690	221,400
6. Cast Iron Pipe	6.6	m	2,439	16,000
7. Galvanized Iron Pipe	30.0	m	2,011	60,330
8. Asphalt Pavement (t=10cm)	300.0	m^2	627	188,226
9. Other Accessories (5 % above)	1.0	L.S.		307,415
Total :				**6,455,709**

Cont'd… Table F.3 Base Cost of Elevated Expressway Structure

Structure Type: **PC I-shape Girder**
Lane and Span.: **4-lane (W=19.7 m) , 30m-span** Unit Cost: **10.77 Million Pesos**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1. PC-Girder (AASHTO, IVA)	9.0	each	700,925	6,308,325
2. Diaphragm	28.6	m^3	6,022	172,242
3. Structure Concrete	234.8	m^3	5,606	1,316,394
4. Reinforcing Bar	58,854.0	kg	30	1,782,532
5. Metal Bridge Railing	60.0	m	3,690	221,400
6. Cast Iron Pipe	6.6	m	2,439	16,000
7. Galvanized Iron Pipe	54.7	m	2,011	110,002
8. Asphalt Pavement (t=10cm)	525.0	m^2	627	329,396
9. Other Accessories (5 % above)	1.0	L.S.		512,815
Total :				**10,769,106**

Structure Type: **PC I-shape Girder**
Lane and Span.: **4-lane (W=19.7 m) , 40m-span** Unit Cost: **15.26 Million Pesos**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1. PC-Girder (AASHTO, VI)	9.0	each	1,051,000	9,459,000
2. Diaphragm	28.6	m^3	6,022	172,242
3. Structure Concrete	308.7	m^3	5,606	1,730,710
4. Reinforcing Bar	75,692.0	kg	30	2,292,511
5. Metal Bridge Railing	80.0	m	3,690	295,200
6. Cast Iron Pipe	6.6	m	2,439	16,000
7. Galvanized Iron Pipe	65.0	m	2,011	130,715
8. Asphalt Pavement (t=10cm)	700.0	m^2	627	439,195
9. Other Accessories (5 % above)	1.0	L.S.		726,779
Total :				**15,262,352**

Structure Type: **PC I-shape Girder**
Lane and Span.: **5-lane (W=22.95 m) , 30m-span** Unit Cost: **12.13 Million Pesos**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1. PC-Girder (AASHTO, IVA)	10.0	each	700,925	7,009,250
2. Diaphragm	36.4	m^3	6,022	219,037
3. Structure Concrete	269.3	m^3	5,606	1,509,536
4. Reinforcing Bar	68,321.8	kg	30	2,069,285
5. Metal Bridge Railing	60.0	m	3,690	221,400
6. Cast Iron Pipe	6.6	m	2,439	16,000
7. Galvanized Iron Pipe	58.0	m	2,011	116,638
8. Asphalt Pavement (t=10cm)	622.5	m^2	627	390,570
9. Other Accessories (5 % above)	1.0	L.S.		577,586
Total :				**12,129,302**

Cont'd… Table F.3 Base Cost of Elevated Expressway Structure

Structure Type: **PC I-shape Girder**
Lane and Span.: **6-lane (W=32.2 m) , 30m-span** Unit Cost: **16.65 Million Pesos**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1. PC-Girder (AASHTO, IVA)	14.0	each	700,925	9,812,951
2. Diaphragm	47.1	m^3	6,022	283,537
3. Structure Concrete	361.7	m^3	5,606	2,027,852
4. Reinforcing Bar	91,867.5	kg	30	2,782,424
5. Metal Bridge Railing	60.0	m	3,690	221,400
6. Cast Iron Pipe	6.6	m	2,439	16,000
7. Galvanized Iron Pipe	72.0	m	2,011	144,792
8. Asphalt Pavement (t=10cm)	904.8	m^2	627	567,691
9. Other Accessories (5 % above)	1.0	L.S.		792,832
Total :				**16,649,479**

Structure Type: **PC Box Girder**
Lane and Span.: **4-lane , 45m-span** Unit Cost: **31.00 Million Pesos**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1. PC-Box Girder	611.1	m^3	45,000	27,499,500
2. Concrete Cross Beam	61.6	m^3	6,022	370,983
3. Structure Concrete	48.8	m^3	5,606	273,314
4. Reinforcing Bar	23,928.0	kg	30	724,716
5. Cast Iron Pipe	6.6	m	2,439	16,000
6. Galvanized Iron Pipe	72.0	m	2,011	144,792
7. Asphalt Pavement (t=10cm)	787.5	m^2	627	494,094
8. Other Accessories (5 % above)	1.0	L.S.		1,476,170
Total :				**30,999,570**

Structure Type: **PC Box Girder**
Lane and Span.: **4-lane , 60 m-span** Unit Cost: **42.06 Million Pesos**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1. PC-Box Girder	815.0	m^3	45,000	36,675,000
2. Concrete Cross Beam	136.9	m^3	6,022	824,474
3. Structure Concrete	65.1	m^3	5,606	364,980
4. Reinforcing Bar	44,507.0	kg	30	1,347,999
5. Cast Iron Pipe	6.6	m	2,439	16,000
6. Galvanized Iron Pipe	86.0	m	2,011	172,946
7. Asphalt Pavement (t=10cm)	1,050.0	m^2	627	658,793
8. Other Accessories (5 % above)	1.0	L.S.		2,003,010
Total :				**42,063,201**

Cont'd… Table F.3 Base Cost of Elevated Expressway Structure

(2) Substructure for Throughway

Structure No.: **Abut-1** Unit Cost: **6.30 Million Pesos**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1. Excavation for Structures	188.8	m^3	196.1	37,012
2. Backfilling for Structures	115.8	m^3	228.9	26,519
3. Sheet Pile Retaining Wall (L=10m) unit: side length	37.4	m	20,703.2	774,300
4. In-situ Concrete Pile (D=1.0m)	160.0	m	28,624.1	4,579,854
5. Lean Concrete	5.8	m^3	2,795.2	16,296
6. Structure Concrete				
1) Footing	54.9	m^3	4,993.3	274,132
2) Wall	40.0	m^3	5,841.0	233,641
6. Reinforcing Bar	11,843.0	kg	30.3	358,693
Total :				**6,300,447**

Structure No.: **Abut-2** Unit Cost: **2.85 Million Pesos**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1. Excavation for Structures	296.0	m^3	196.1	58,040
2. Backfilling for Structures	178.4	m^3	228.9	40,844
3. Sheet Pile Retaining Wall (L=10m) unit: side length	52.4	m	20,703.2	1,084,848
5. Lean Concrete	9.3	m^3	2,795.2	25,884
6. Structure Concrete				
1) Footing	88.7	m^3	4,993.3	442,656
2) Wall	85.2	m^3	5,841.0	497,654
6. Reinforcing Bar	23,245.0	kg	30.3	704,030
Total :				**2,853,955**

Structure No.: **Pier-1** Unit Cost: **3.56 Million Pesos**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1. Excavation for Structures	78.7	m^3	196.1	15,432
2. Backfilling for Structures	46.5	m^3	228.9	10,646
3. Sheet Pile Retaining Wall (L=10m) unit: side length	22.0	m	20,703.2	455,470
4. In-situ Concrete Pile (D=1.0m)	80.0	m	28,624.1	2,289,927
5. Lean Concrete	2.2	m^3	2,795.2	6,149
6. Structure Concrete				
1) Footing	26.3	m^3	4,993.3	131,074
2) Column	17.3	m^3	5,841.0	100,757
3) Coping	23.8	m^3	5,841.0	139,075
7. Reinforcing Bar	10,763.8	kg	30.3	326,007
8. Timbering for Coping	181.7	m^3	463.0	84,127
Total :				**3,558,665**

Cont'd… Table F.3 Base Cost of Elevated Expressway Structure

Structure No.: **Pier-2** Unit Cost: **10.83 Million Pesos**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1. Excavation for Structures	342.6	m^3	196.1	67,167
2. Backfilling for Structures	172.8	m^3	228.9	39,562
3. Sheet Pile Retaining Wall (L=10m) unit: side length	47.0	m	20,703.2	973,050
4. In-situ Concrete Pile (D=1.0m)	200.0	m	28,624.1	5,724,818
5. Lean Concrete	9.2	m^3	2,795.2	25,800
6. Structure Concrete				
1) Footing	148.1	m^3	4,993.3	739,258
2) Column	83.8	m^3	5,841.0	489,185
3) Coping	121.3	m^3	5,841.0	708,223
7. Reinforcing Bar	55,001.0	kg	30.3	1,665,835
8. Timbering for Coping	849.3	m^3	463.0	393,221
Total :				**10,826,119**

Structure No.: **Pier-3** Unit Cost: **6.54 Million Pesos**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1. Excavation for Structures	173.6	m^3	196.1	34,040
2. Backfilling for Structures	88.1	m^3	228.9	20,170
3. Sheet Pile Retaining Wall (L=10m) unit: side length	30.0	m	20,703.2	621,096
4. In-situ Concrete Pile (D=1.0m)	120.0	m	28,624.1	3,434,891
5. Lean Concrete	4.5	m^3	2,795.2	12,467
6. Structure Concrete				
1) Footing	71.0	m^3	4,993.3	354,524
2) Column	67.0	m^3	5,841.0	391,348
3) Coping	68.1	m^3	5,841.0	397,481
7. Reinforcing Bar	34,021.5	kg	30.3	1,030,421
8. Timbering for Coping	527.7	m^3	463.0	244,325
Total :				**6,540,763**

Structure No.: **Pier-4** Unit Cost: **13.91 Million Pesos**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1. Excavation for Structures	473.5	m^3	196.1	92,850
2. Backfilling for Structures	232.1	m^3	228.9	53,148
3. Sheet Pile Retaining Wall (L=10m) unit: side length	60.0	m	20,703.2	1,242,192
4. In-situ Concrete Pile (D=1.0m)	240.0	m	28,624.1	6,869,781
5. Lean Concrete	12.9	m^3	2,795.2	36,170
6. Structure Concrete				
1) Footing	209.7	m^3	4,993.3	1,047,095
2) Column	166.7	m^3	5,841.0	973,814
3) Coping	131.6	m^3	5,841.0	768,853
7. Reinforcing Bar	78,297.9	kg	30.3	2,371,437
8. Timbering for Coping	983.3	m^3	463.0	455,268
Total :				**13,910,607**

Cont'd… Table F.3 Base Cost of Elevated Expressway Structure

Structure No.: **Pier-5** Unit Cost: **10.68 Million Pesos**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1. Excavation for Structures	272.0	m^3	196.1	53,340
2. Backfilling for Structures	134.3	m^3	228.9	30,736
3. Sheet Pile Retaining Wall (L=10m) unit: side length	53.0	m	20,703.2	1,097,269
4. In-situ Concrete Pile (D=1.0m)	200.0	m	28,624.1	5,724,818
5. Lean Concrete	6.8	m^3	2,795.2	18,952
6. Structure Concrete				
1) Footing	114.8	m^3	4,993.3	572,981
2) Column	108.9	m^3	5,841.0	635,969
3) Coping	104.9	m^3	5,841.0	612,722
7. Reinforcing Bar	53,937.5	kg	30.3	1,633,624
8. Timbering for Coping	636.4	m^3	463.0	294,653
Total :				**10,675,065**

Structure No.: **Pier-6** Unit Cost: **9.30 Million Pesos**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1. Excavation for Structures	227.9	m^3	196.1	44,677
2. Backfilling for Structures	109.6	m^3	228.9	25,090
3. Sheet Pile Retaining Wall (L=10m) unit: side length	35.0	m	20,703.2	724,612
4. In-situ Concrete Pile (D=1.0m)	160.0	m	28,624.1	4,579,854
5. Lean Concrete	6.0	m^3	2,795.2	16,799
6. Structure Concrete				
1) Footing	102.3	m^3	4,993.3	510,565
2) Column	142.0	m^3	5,841.0	829,424
3) Coping	73.0	m^3	5,841.0	426,102
7. Reinforcing Bar	52,336.0	kg	30.3	1,585,119
8. Timbering for Coping	1,206.2	m^3	463.0	558,471
Total :				**9,300,713**

Structure No.: **Pier-7** Unit Cost: **11.26 Million Pesos**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1. Excavation for Structures	272.0	m^3	196.1	53,340
2. Backfilling for Structures	134.3	m^3	228.9	30,736
3. Sheet Pile Retaining Wall (L=10m) unit: side length	53.0	m	20,703.2	1,097,269
4. In-situ Concrete Pile (D=1.0m)	200.0	m	28,624.1	5,724,818
5. Lean Concrete	6.8	m^3	2,795.2	18,952
6. Structure Concrete				
1) Footing	114.8	m^3	4,993.3	572,981
2) Column	151.6	m^3	5,841.0	885,673
3) Coping	103.9	m^3	5,841.0	606,764
7. Reinforcing Bar	62,250.9	kg	30.3	1,885,415
8. Timbering for Coping	834.8	m^3	463.0	386,512
Total :				**11,262,461**

Cont'd… Table F.3 Base Cost of Elevated Expressway Structure

Structure No.: **Pier-8** Unit Cost: **19.40 Million Pesos**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1. Excavation for Structures	347.2	m^3	196.1	68,079
2. Backfilling for Structures	183.3	m^3	228.9	41,966
3. Sheet Pile Retaining Wall (L=20m, Double) unit: side length	76.0	m	72,461.2	5,507,051
4. In-situ Concrete Pile (D=1.0m)	300.0	m	28,624.1	8,587,227
5. Lean Concrete	8.4	m^3	2,795.2	23,480
6. Structure Concrete				
1) Footing	147.0	m^3	4,993.3	734,015
2) Column	155.5	m^3	5,841.0	908,277
3) Coping	148.0	m^3	5,841.0	864,470
7. Reinforcing Bar	75,430.0	kg	30.3	2,284,575
8. Timbering for Coping	832.0	m^3	463.0	385,216
Total :				**19,404,356**

Structure No.: **Pier-9** Unit Cost: **8.83 Million Pesos**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1. Excavation for Structures	247.2	m^3	196.1	48,471
2. Backfilling for Structures	128.3	m^3	228.9	29,369
3. Sheet Pile Retaining Wall (L=10m) unit: side length	40.0	m	20,703.2	828,128
4. In-situ Concrete Pile (D=1.0m)	160.0	m	28,624.1	4,579,854
5. Lean Concrete	6.4	m^3	2,795.2	18,001
6. Structure Concrete				
1) Footing	98.1	m^3	4,993.3	489,793
2) Column	83.8	m^3	5,841.0	489,185
3) Coping	102.6	m^3	5,841.0	598,996
7. Reinforcing Bar	47,202.8	kg	30.3	1,429,648
8. Timbering for Coping	690.3	m^3	463.0	319,609
Total :				**8,831,054**

Structure No.: **Pier-10** Unit Cost: **4.66 Million Pesos**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1. Excavation for Structures	306.9	m^3	196.1	60,177
2. Backfilling for Structures	146.0	m^3	228.9	33,426
3. Sheet Pile Retaining Wall (L=10m) unit: side length	40.0	m	20,703.2	828,128
4. Lean Concrete	8.4	m^3	2,795.2	23,368
5. Structure Concrete				
1) Footing	142.5	m^3	4,993.3	711,545
2) Column	112.0	m^3	5,841.0	654,193
3) Coping	73.0	m^3	5,841.0	426,102
6. Reinforcing Bar	49,153.5	kg	30.3	1,488,730
7. Timbering for Coping	940.1	m^3	463.0	435,266
Total :				**4,660,936**

Cont'd… Table F.3 Base Cost of Elevated Expressway Structure

Structure No.: **Pier-11** Unit Cost: **5.57 Million Pesos**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1. Excavation for Structures	362.7	m^3	196.1	71,118
2. Backfilling for Structures	172.2	m^3	228.9	39,425
3. Sheet Pile Retaining Wall (L=10m) unit: side length	44.0	m	20,703.2	910,941
4. Lean Concrete	10.0	m^3	2,795.2	27,952
5. Structure Concrete				
1) Footing	170.5	m^3	4,993.3	851,358
2) Column	150.0	m^3	5,841.0	876,152
3) Coping	73.0	m^3	5,841.0	426,102
6. Reinforcing Bar	58,713.5	kg	30.3	1,778,277
7. Timbering for Coping	1,277.1	m^3	463.0	591,297
Total :				**5,572,621**

Structure No.: **Pier-12** Unit Cost: **5.91 Million Pesos**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1. Excavation for Structures	406.9	m^3	196.1	79,783
2. Backfilling for Structures	188.5	m^3	228.9	43,159
3. Sheet Pile Retaining Wall (L=10m) unit: side length	50.0	m	20,703.2	1,035,160
4. Lean Concrete	11.2	m^3	2,795.2	31,279
5. Structure Concrete				
1) Footing	194.7	m^3	4,993.3	972,146
2) Column	127.5	m^3	5,841.0	744,729
3) Coping	102.6	m^3	5,841.0	598,996
6. Reinforcing Bar	62,714.8	kg	30.3	1,899,466
7. Timbering for Coping	1,093.0	m^3	463.0	506,059
Total :				**5,910,775**

Structure No.: **Pier-13** Unit Cost: **5.20 Million Pesos**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1. Excavation for Structures	406.9	m^3	196.1	79,783
2. Backfilling for Structures	188.5	m^3	228.9	43,159
3. Sheet Pile Retaining Wall (L=10m) unit: side length	50.0	m	20,703.2	1,035,160
4. Lean Concrete	11.2	m^3	2,795.2	31,279
5. Structure Concrete				
1) Footing	194.7	m^3	4,993.3	972,146
2) Column	83.8	m^3	5,841.0	489,185
3) Coping	102.6	m^3	5,841.0	598,996
6. Reinforcing Bar	53,964.8	kg	30.3	1,634,451
7. Timbering for Coping	690.2	m^3	463.0	319,563
Total :				**5,203,720**

Cont'd… Table F.3 Base Cost of Elevated Expressway Structure

Structure No.: **Pier-14** Unit Cost: **3.38 Million Pesos**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1. Excavation for Structures	181.4	m^3	196.1	35,559
2. Backfilling for Structures	87.2	m^3	228.9	19,960
3. Sheet Pile Retaining Wall (L=10m) unit: side length	31.0	m	20,703.2	641,799
4. Lean Concrete	4.7	m^3	2,795.2	13,054
5. Structure Concrete				
1) Footing	79.5	m^3	4,993.3	396,967
2) Column	72.0	m^3	5,841.0	420,553
3) Coping	73.0	m^3	5,841.0	426,102
6. Reinforcing Bar	38,243.5	kg	30.3	1,158,295
7. Timbering for Coping	585.4	m^3	463.0	271,040
Total :				**3,383,328**

Structure No.: **Pier-15** Unit Cost: **6.30 Million Pesos**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1. Excavation for Structures	488.3	m^3	196.1	95,736
2. Backfilling for Structures	227.9	m^3	228.9	52,186
3. Sheet Pile Retaining Wall (L=10m) unit: side length	53.0	m	20,703.2	1,097,269
4. Lean Concrete	13.7	m^3	2,795.2	38,267
5. Structure Concrete				
1) Footing	234.1	m^3	4,993.3	1,169,031
2) Column	136.9	m^3	5,841.0	799,518
3) Coping	102.6	m^3	5,841.0	598,996
6. Reinforcing Bar	67,350.9	kg	30.3	2,039,881
7. Timbering for Coping	877.4	m^3	463.0	406,236
Total :				**6,297,121**

Structure No.: **Pier-16** Unit Cost: **4.12 Million Pesos**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1. Excavation for Structures	306.9	m^3	196.1	60,177
2. Backfilling for Structures	147.6	m^3	228.9	33,793
3. Sheet Pile Retaining Wall (L=10m) unit: side length	40.0	m	20,703.2	828,128
4. Lean Concrete	8.4	m^3	2,795.2	23,368
5. Structure Concrete				
1) Footing	142.2	m^3	4,993.3	709,997
2) Column	93.6	m^3	5,841.0	546,865
3) Coping	61.7	m^3	5,841.0	360,390
6. Reinforcing Bar	42,869.0	kg	30.3	1,298,389
7. Timbering for Coping	562.3	m^3	463.0	260,345
Total :				**4,121,452**

Cont'd… Table F.3 Base Cost of Elevated Expressway Structure

Structure No.: **Pier-17** Unit Cost: **7.40 Million Pesos**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1. Excavation for Structures	404.6	m^3	196.1	79,324
2. Backfilling for Structures	203.4	m^3	228.9	46,568
3. Sheet Pile Retaining Wall (L=10m) unit: side length	65.0	m	20,703.2	1,345,708
4. Lean Concrete	10.6	m^3	2,795.2	29,573
5. Structure Concrete				
1) Footing	178.1	m^3	4,993.3	889,307
2) Column	142.3	m^3	5,841.0	830,884
3) Coping	183.6	m^3	5,841.0	1,072,410
6. Reinforcing Bar	84,145.0	kg	30.3	2,548,530
7. Timbering for Coping	1,213.5	m^3	463.0	561,851
Total :				**7,404,154**

Structure No.: **Pier-18** Unit Cost: **5.02 Million Pesos**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1. Excavation for Structures	306.9	m^3	196.1	60,177
2. Backfilling for Structures	147.3	m^3	228.9	33,724
3. Sheet Pile Retaining Wall (L=10m) unit: side length	40.0	m	20,703.2	828,128
4. Lean Concrete	8.4	m^3	2,795.2	23,368
5. Structure Concrete				
1) Footing	142.3	m^3	4,993.3	710,297
2) Column	121.5	m^3	5,841.0	709,683
3) Coping	104.0	m^3	5,841.0	607,699
6. Reinforcing Bar	58,186.7	kg	30.3	1,762,321
7. Timbering for Coping	617.3	m^3	463.0	285,810
Total :				**5,021,207**

Structure No.: **Pier-19** Unit Cost: **5.53 Million Pesos**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1. Excavation for Structures	418.4	m^3	196.1	82,040
2. Backfilling for Structures	194.2	m^3	228.9	44,461
3. Sheet Pile Retaining Wall (L=10m) unit: side length	48.0	m	20,703.2	993,753
4. Lean Concrete	11.6	m^3	2,795.2	32,536
5. Structure Concrete				
1) Footing	201.5	m^3	4,993.3	1,006,150
2) Column	105.6	m^3	5,841.0	616,811
3) Coping	99.7	m^3	5,841.0	582,349
6. Reinforcing Bar	58,156.0	kg	30.3	1,761,392
7. Timbering for Coping	883.6	m^3	463.0	409,107
Total :				**5,528,600**

Cont'd… Table F.3 Base Cost of Elevated Expressway Structure

Structure No.: **Pier-20** Unit Cost: **6.48 Million Pesos**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1. Excavation for Structures	544.1	m^3	196.1	106,687
2. Backfilling for Structures	277.0	m^3	228.9	63,418
3. Sheet Pile Retaining Wall (L=10m) unit: side length	57.0	m	20,703.2	1,180,082
4. Lean Concrete	15.3	m^3	2,795.2	42,767
5. Structure Concrete				
1) Footing	239.2	m^3	4,993.3	1,194,397
2) Column	115.0	m^3	5,841.0	671,716
3) Coping	116.2	m^3	5,841.0	678,726
6. Reinforcing Bar	66,477.0	kg	30.3	2,013,413
7. Timbering for Coping	1,134.0	m^3	463.0	525,042
Total :				**6,476,249**

Structure No.: **Pier-21** Unit Cost: **7.13 Million Pesos**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1. Excavation for Structures	516.2	m^3	196.1	101,217
2. Backfilling for Structures	243.8	m^3	228.9	55,817
3. Sheet Pile Retaining Wall (L=10m) unit: side length	55.0	m	20,703.2	1,138,676
4. Lean Concrete	14.1	m^3	2,795.2	39,413
5. Structure Concrete				
1) Footing	242.1	m^3	4,993.3	1,208,878
2) Column	185.3	m^3	5,841.0	1,082,340
3) Coping	104.9	m^3	5,841.0	612,722
6. Reinforcing Bar	78,134.0	kg	30.3	2,366,472
7. Timbering for Coping	1,138.0	m^3	463.0	526,894
Total :				**7,132,429**

Structure No.: **Pier-22** Unit Cost: **7.62 Million Pesos**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1. Excavation for Structures	576.0	m^3	196.1	112,942
2. Backfilling for Structures	230.1	m^3	228.9	52,681
3. Sheet Pile Retaining Wall (L=10m) unit: side length	52.0	m	20,703.2	1,076,566
4. Lean Concrete	14.0	m^3	2,795.2	39,133
5. Structure Concrete				
1) Footing	309.4	m^3	4,993.3	1,544,927
2) Column	301.5	m^3	5,841.0	1,761,065
3) Coping	31.3	m^3	5,841.0	182,824
6. Reinforcing Bar	89,157.0	kg	30.3	2,700,330
7. Timbering for Coping	320.0	m^3	463.0	148,160
Total :				**7,618,628**

Cont'd… Table F.3 Base Cost of Elevated Expressway Structure

Structure No.: **Pier-23** Unit Cost: **6.72 Million Pesos**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1. Excavation for Structures	576.0	m^3	196.1	112,942
2. Backfilling for Structures	230.1	m^3	228.9	52,681
3. Sheet Pile Retaining Wall (L=10m) unit: side length	52.0	m	20,703.2	1,076,566
4. Lean Concrete	14.0	m^3	2,795.2	39,133
5. Structure Concrete				
1) Footing	309.4	m^3	4,993.3	1,544,927
2) Column	285.8	m^3	5,841.0	1,669,361
6. Reinforcing Bar	73,418.0	kg	30.3	2,223,637
Total :				**6,719,248**

Structure No.: **Pier-24** Unit Cost: **12.17 Million Pesos**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1. Excavation for Structures	392.2	m^3	196.1	76,893
2. Backfilling for Structures	199.3	m^3	228.9	45,638
3. Sheet Pile Retaining Wall (L=10m) unit: side length	63.0	m	20,703.2	1,304,301
4. In-situ Concrete Pile (D=1.0m)	260.0	m	28,624.1	7,442,263
5. Lean Concrete	10.3	m^3	2,795.2	28,679
6. Structure Concrete				
1) Footing	172.3	m^3	4,993.3	860,346
2) Column	129.0	m^3	5,841.0	753,491
3) Coping	40.3	m^3	5,841.0	235,101
7. Reinforcing Bar	47,118.5	kg	30.3	1,427,095
Total :				**12,173,807**

Structure No.: **Pier-25** Unit Cost: **15.86 Million Pesos**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1. Excavation for Structures	463.0	m^3	196.1	90,785
2. Backfilling for Structures	241.8	m^3	228.9	55,359
3. Sheet Pile Retaining Wall (L=10m) unit: side length	85.0	m	20,703.2	1,759,772
4. In-situ Concrete Pile (D=1.0m)	320.0	m	28,624.1	9,159,709
5. Lean Concrete	11.7	m^3	2,795.2	32,704
6. Structure Concrete				
1) Footing	254.8	m^3	4,993.3	1,272,043
2) Column	104.6	m^3	5,841.0	610,970
3) Coping	109.5	m^3	5,841.0	639,591
7. Reinforcing Bar	63,937.5	kg	30.3	1,936,498
8. Timbering for Coping	658.0	m^3	463.0	304,654
Total :				**15,862,085**

Cont'd… Table F.3 Base Cost of Elevated Expressway Structure

Structure No.: **Pier-26** Unit Cost: **11.16 Million Pesos**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1. Excavation for Structures	322.4	m^3	196.1	63,216
2. Backfilling for Structures	167.0	m^3	228.9	38,234
3. Sheet Pile Retaining Wall (L=10m) unit: side length	58.0	m	20,703.2	1,200,785
4. In-situ Concrete Pile (D=1.0m)	240.0	m	28,624.1	6,869,781
5. Lean Concrete	8.2	m^3	2,795.2	22,921
6. Structure Concrete				
1) Footing	137.3	m^3	4,993.3	685,330
2) Column	59.0	m^3	5,841.0	344,620
3) Coping	76.5	m^3	5,841.0	446,837
7. Reinforcing Bar	39,002.5	kg	30.3	1,181,283
8. Timbering for Coping	658.0	m^3	463.0	304,654
Total :				**11,157,662**

Item : **Road Construction (0+000 to 0+165)** Unit Cost: **0.09 Million Pesos per 1.0 m**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1. Excavation for Structures	8.0	m^3	196.1	1,569
2. Backfilling for Structures	5.7	m^3	228.9	1,305
3. Sheet Pile Retaining Wall (L=10m) unit: side length	2.0	m	20,703.2	41,406
4. Lean Concrete	0.3	m^3	2,795.2	950
5. Structure Concrete (Retaining Wall)				
1) Footing	1.5	m^3	4,993.3	7,490
2) Wall	1.8	m^3	5,841.0	10,631
6. Reinforcing Bar	514.0	kg	30.3	15,568
7. Road Embankment	11.5	m^3	200.2	2,302
8. Sub- base Course (t=40cm)	4.6	m^3	347.9	1,600
9. Base Course (t=20cm)	2.3	m^3	474.9	1,092
10. Asphalt Pavement (t=10cm)	11.5	m^2	627.4	7,215
Total :				**91,129**

Cont'd… Table F.3 Base Cost of Elevated Expressway Structure

(3) Substructure for Ramp

Structure No.: **Abut-1** Unit Cost: **6.35 Million Pesos**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1. Excavation for Structures	154.8	m^3	196.1	30,353
2. Backfilling for Structures	86.6	m^3	228.9	19,827
3. Sheet Pile Retaining Wall (L=10m) unit: side length	37.8	m	20,703.2	782,581
4. In-situ Concrete Pile (D=1.0m)	160.0	m	28,624.1	4,579,854
5. Lean Concrete	5.9	m^3	2,795.2	16,492
6. Structure Concrete				
1) Footing	55.8	m^3	4,993.3	278,626
2) Wall	44.3	m^3	5,841.0	258,932
7. Reinforcing Bar	12,772.0	kg	30.3	386,830
Total :				**6,353,495**

Structure No.: **Abut-2** Unit Cost: **2.20 Million Pesos**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1. Excavation for Structures	83.2	m^3	196.1	16,306
2. Backfilling for Structures	46.1	m^3	228.9	10,545
3. Sheet Pile Retaining Wall (L=10m) unit: side length	25.4	m	20,703.2	525,861
4. In-situ Concrete Pile (D=1.0m)	40.0	m	28,624.1	1,144,964
5. Lean Concrete	3.0	m^3	2,795.2	8,386
6. Structure Concrete				
1) Footing	27.9	m^3	4,993.3	139,313
2) Wall	24.7	m^3	5,841.0	143,981
7. Reinforcing Bar	6,883.0	kg	30.3	208,468
Total :				**2,197,824**

Structure No.: **Abut-3** Unit Cost: **1.05 Million Pesos**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1. Excavation for Structures	83.2	m^3	196.1	16,306
2. Backfilling for Structures	46.1	m^3	228.9	10,545
3. Sheet Pile Retaining Wall (L=10m) unit: side length	25.4	m	20,703.2	525,861
4. Lean Concrete	3.0	m^3	2,795.2	8,386
5. Structure Concrete				
1) Footing	27.9	m^3	4,993.3	139,313
2) Wall	24.7	m^3	5,841.0	143,981
6. Reinforcing Bar	6,883.0	kg	30.3	208,468
Total :				**1,052,860**

Cont'd… Table F.3 Base Cost of Elevated Expressway Structure

Structure No.: **Pier-1** Unit Cost: **3.53 Million Pesos**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1. Excavation for Structures	78.7	m^3	196.1	15,432
2. Backfilling for Structures	46.5	m^3	228.9	10,646
3. Sheet Pile Retaining Wall (L=10m) unit: side length	22.0	m	20,703.2	455,470
4. In-situ Concrete Pile (D=1.0m)	80.0	m	28,624.1	2,289,927
5. Lean Concrete	2.2	m^3	2,795.2	6,149
6. Structure Concrete				
1) Footing	26.3	m^3	4,993.3	131,074
2) Column	15.4	m^3	5,841.0	89,776
3) Coping	24.2	m^3	5,841.0	141,236
7. Reinforcing Bar	10,482.0	kg	30.3	317,472
8. Timbering for Coping	160.7	m^3	463.0	74,404
Total :				**3,531,587**

Structure No.: **Pier-2** Unit Cost: **5.21 Million Pesos**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1. Excavation for Structures	136.4	m^3	196.1	26,745
2. Backfilling for Structures	73.2	m^3	228.9	16,759
3. Sheet Pile Retaining Wall (L=10m) unit: side length	27.0	m	20,703.2	558,986
4. In-situ Concrete Pile (D=1.0m)	120.0	m	28,624.1	3,434,891
5. Lean Concrete	3.4	m^3	2,795.2	9,448
6. Structure Concrete				
1) Footing	56.1	m^3	4,993.3	279,924
2) Column	26.6	m^3	5,841.0	155,371
3) Coping	24.2	m^3	5,841.0	141,353
7. Reinforcing Bar	14,806.0	kg	30.3	448,435
8. Timbering for Coping	304.6	m^3	463.0	141,030
Total :				**5,212,941**

Structure No.: **Pier-3** Unit Cost: **10.76 Million Pesos**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1. Excavation for Structures	293.0	m^3	196.1	57,452
2. Backfilling for Structures	141.9	m^3	228.9	32,488
3. Sheet Pile Retaining Wall (L=10m) unit: side length	39.0	m	20,703.2	807,425
4. In-situ Concrete Pile (D=1.0m)	240.0	m	28,624.1	6,869,781
5. Lean Concrete	8.0	m^3	2,795.2	22,222
6. Structure Concrete				
1) Footing	135.0	m^3	4,993.3	674,096
2) Column	101.7	m^3	5,841.0	594,031
3) Coping	40.8	m^3	5,841.0	238,313
7. Reinforcing Bar	39,174.0	kg	30.3	1,186,477
8. Timbering for Coping	592.0	m^3	463.0	274,096
Total :				**10,756,380**

Cont'd… Table F.3 Base Cost of Elevated Expressway Structure

Structure No.: **Pier-4** Unit Cost: **12.10 Million Pesos**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1. Excavation for Structures	293.0	m^3	196.1	57,452
2. Backfilling for Structures	141.9	m^3	228.9	32,488
3. Sheet Pile Retaining Wall	63.0	m	20,703.2	1,304,301
(L=10m) unit: side length				
4. In-situ Concrete Pile (D=1.0m)	260.0	m	28,624.1	7,442,263
5. Lean Concrete	10.3	m^3	2,795.2	28,679
6. Structure Concrete				
1) Footing	172.3	m^3	4,993.3	860,346
2) Column	129.0	m^3	5,841.0	753,491
3) Coping	37.4	m^3	5,841.0	218,454
7. Reinforcing Bar	46,463.0	kg	30.3	1,407,242
Total :				**12,104,714**

Structure No.: **Pier-5** Unit Cost: **3.04 Million Pesos**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1. Excavation for Structures	279.0	m^3	196.1	54,706
2. Backfilling for Structures	137.6	m^3	228.9	31,503
3. Sheet Pile Retaining Wall	38.0	m	20,703.2	786,722
(L=10m) unit: side length				
4. Lean Concrete	7.5	m^3	2,795.2	20,964
5. Structure Concrete				
1) Footing	127.6	m^3	4,993.3	637,145
2) Column	81.9	m^3	5,841.0	478,379
3) Coping	20.9	m^3	5,841.0	122,252
6. Reinforcing Bar	30,125.9	kg	30.3	912,434
Total :				**3,044,106**

Structure No.: **Pier-6** Unit Cost: **8.27 Million Pesos**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1. Excavation for Structures	251.1	m^3	196.1	49,236
2. Backfilling for Structures	124.6	m^3	228.9	28,527
3. Sheet Pile Retaining Wall	36.0	m	20,703.2	745,315
(L=10m) unit: side length				
4. In-situ Concrete Pile (D=1.0m)	180.0	m	28,624.1	5,152,336
5. Lean Concrete	6.7	m^3	2,795.2	18,728
6. Structure Concrete				
1) Footing	113.6	m^3	4,993.3	567,239
2) Column	100.6	m^3	5,841.0	587,606
3) Coping	20.9	m^3	5,841.0	122,077
7. Reinforcing Bar	32,886.0	kg	30.3	996,030
Total :				**8,267,094**

Cont'd… Table F.3   Base Cost of Elevated Expressway Structure

Structure No.: **Pier-7**   Unit Cost: **3.85 Million Pesos**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1. Excavation for Structures	141.1	m^3	196.1	27,657
2. Backfilling for Structures	74.8	m^3	228.9	17,125
3. Sheet Pile Retaining Wall (L=10m) unit: side length	27.0	m	20,703.2	558,986
4. In-situ Concrete Pile (D=1.0m)	80.0	m	28,624.1	2,289,927
5. Lean Concrete	3.5	m^3	2,795.2	9,783
6. Structure Concrete				
1) Footing	58.8	m^3	4,993.3	293,356
2) Column	28.4	m^3	5,841.0	165,885
3) Coping	13.6	m^3	5,841.0	79,379
7. Reinforcing Bar	13,586.0	kg	30.3	411,484
Total :				**3,853,584**

Table F.4 Base Cost of Expressway Miscellaneous

1-lane Unit Cost (per Km) : **7.99 Million Peso**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1 Pavement Marking	560	m^2	350	196,000
2 Road Sign (small)	6	each	5,300	31,800
3 Road Sign (large)	4	each	15,900	63,600
4 Overhead Road Sign	2	each	170,000	340,000
5 Street Light	1	L.S.	-	3,510,000
6 Emergency Telephone and Communication System	1	L.S.	-	850,000
6 Noise Barrier	200	m	15,000	3,000,000
TOTAL				**7,991,400**

2-lane (without Center Media) Unit Cost (per Km) : **12.80 Million Peso**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1 Pavement Marking	800	m^2	350	280,000
2 Road Sign (small)	8	each	5,300	42,400
3 Road Sign (large)	5	each	15,900	79,500
4 Overhead Road Sign	2	each	230,000	460,000
5 Street Light	1	L.S.	-	5,090,000
6 Emergency Telephone and Communication System	1	L.S.	-	850,000
7 Noise Barrier	400	m	15,000	6,000,000
TOTAL				**12,801,900**

2-lane (with Center Media) Unit Cost (per Km) : **18.15 Million Peso**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1 Pavement Marking	800	m^2	350	280,000
2 Road Sign (small)	8	each	5,300	42,400
3 Road Sign (large)	5	each	15,900	79,500
4 Overhead Road Sign	2	each	230,000	460,000
5 Street Light	1	L.S.	-	5,090,000
6 Emergency Telephone and Communication System	1	L.S.	-	1,700,000
7 Center Median Guard Rail	2,000	m	2,250	4,500,000
8 Noise Barrier	400	m	15,000	6,000,000
TOTAL				**18,151,900**

Cont'd… Table F.4 Base Cost of Expressway Miscellaneous

4-lane Unit Cost (per Km) : **22.59 Million Peso**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1 Pavement Marking	1,000	m^2	350	350,000
2 Road Sign (small)	16	each	5,300	84,800
3 Road Sign (large)	10	each	15,900	159,000
4 Overhead Road Sign	2	each	340,000	680,000
5 Street Light	1	L.S.	-	6,120,000
6 Emergency Telephone and Communication System	1	L.S.	-	1,700,000
7 Center Median Guard Rail	2,000	m	2,250	4,500,000
8 Noise Barrier	600	m	15,000	9,000,000
TOTAL				**22,593,800**

5-lane Unit Cost (per Km) : **23.50 Million Peso**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1 Pavement Marking	1,250	m^2	350	437,500
2 Road Sign (small)	16	each	5,300	84,800
3 Road Sign (large)	10	each	15,900	159,000
4 Overhead Road Sign	2	each	390,000	780,000
5 Street Light	1	L.S.	-	6,840,000
6 Emergency Telephone and Communication System	1	L.S.	-	1,700,000
7 Center Median Guard Rail	2,000	m	2,250	4,500,000
8 Noise Barrier	600	m	15,000	9,000,000
TOTAL				**23,501,300**

6-lane Unit Cost (per Km) : **24.06 Million Peso**

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1 Pavement Marking	1,500	m^2	350	525,000
2 Road Sign (small)	16	each	5,300	84,800
3 Road Sign (large)	10	each	15,900	159,000
4 Overhead Road Sign	2	each	420,000	840,000
5 Street Light	1	L.S.	-	7,250,000
6 Emergency Telephone and Communication System	1	L.S.	-	1,700,000
7 Center Median Guard Rail	2,000	m	2,250	4,500,000
8 Noise Barrier	600	m	15,000	9,000,000
TOTAL				**24,058,800**

Table F.5 Base Cost of Reconstruction for At-grade Road

Unit Cost (per Km) : 8.60 Million Peso

Item	Q'ty	Unit	Unit Cost (P)	Total Cost (P)
1 Removal of PCC Pavement	3,000	m^2	192	574,682
2 Removal of Curb / Gutter	2,000	m	260	520,000
3 Pavement Base Course	600	m^3	475	284,947
4 PCC Pavement (t=23cm)	3,000	m^2	862	2,584,736
5 Curb / Gutter	2,000	m	580	3,510,000
6 Miscellaneous (15% of above)	1	L.S.	-	1,121,155
TOTAL				**8,595,520**

Table F.6 Direct Construction Cost of R10/C3/R9 Expressway

Route.: **R-10 (from 0+000 to 3+406)**

Item	Q'ty	Unit	Unit Cost (MP)	Total Cost (MP)
1. Elevated Road Structure				
1) Throughway L=3.41km				
Road Construction (0+000 to 0+165)	165	m	0.09	**15.04**
(Superstructure)				
PC I-Girder : 1-lane (W=6.2 m) 30m-span	7	each	3.85	26.98
PC I-Girder : 2-lane (W=9.95 m) 30m-span	3	each	5.24	15.71
PC I-Girder : 2-lane (W=12.2 m) 30m-span	12	each	6.46	77.47
PC I-Girder : 4-lane (W=19.7 m) 30m-span	96	each	10.77	1,033.83
sub-total				**1,153.99**
(Substructure)				
Abut-1 Type 30m-span	1	each	6.30	6.30
Pier-1 Type 30m-span	8	each	3.56	28.47
Pier-2 Type 30m-span	3	each	10.83	32.48
Pier-2 Type 40m-span	3	each	14.62	43.85
Pier-3 Type 30m-span	81	each	6.54	529.80
Pier-4 Type 30m-span	6	each	13.91	83.46
Pier-5 Type 30m-span	6	each	10.68	64.05
Pier-5 Type 30m-span	4	each	9.30	37.20
sub-total				**825.61**
2) On & Off Ramp (from PPA) L=0.46km				
(Superstructure)				
PC I-Girder : 1-lane (W=6.2 m) 30m-span	20	each	3.85	77.09
PC I-Girder : 1-lane (W=6.2 m) 40m-span	2	each	5.45	10.90
sub-total				**87.98**
(Substructure)				
Abut-1 Type 30m-span	1	each	6.35	6.35
Pier-1 Type 30m-span	3	each	3.53	10.59
Pier-2 Type 30m-span	3	each	5.21	15.64
Pier-3 Type 30m-span	1	each	10.76	10.76
Pier-3 Type 40m-span	2	each	14.52	29.04
Pier-4 Type 40m-span	1	each	16.34	16.34
sub-total				**88.73**
2. Expressway Miscellaneous				
1-lane	0.55	km	7.99	4.40
2-lane (with Center Media)	0.53	km	12.80	6.72
2-lane (without Center Media)	0.09	km	18.15	1.63
4-lane	2.88	km	22.59	65.07
sub-total				**77.82**
3. Re-construction of At-grade Road	3.41	km	8.60	**29.31**
TOTAL				**2,278.48**

Cont'd…Table F.6 Direct Construction Cost of R10/C3/R9 Expressway

Route.: **Interchange : R10/C3 (from 3+406 to 4+773)**

Item	Q'ty	Unit	Unit Cost (MP)	Total Cost (MP)
1. Elevated Road Structure				
1) Throughway L=1.37km				
(Superstructure)				
PC I-Girder : 1-lane (W=6.2 m) 30m-span	14	each	3.85	53.96
PC I-Girder : 4-lane (W=19.7 m) 30m-span	34	each	10.77	366.15
PC I-Girder : 4-lane (W=19.7 m) 40m-span	9	each	15.26	137.36
sub-total				**557.47**
(Substructure)				
Pier-3 Type 30m-span	6	each	6.54	39.24
Pier-3 Type 40m-span	6	each	8.83	52.98
Pier-4 Type 30m-span	7	each	13.91	97.37
Pier-4 Type 40m-span	4	each	18.78	75.12
Pier-5 Type 30m-span	11	each	10.68	117.43
Pier-7 Type 30m-span	7	each	11.26	78.84
Pier-8 Type 30m-span	2	each	19.40	38.81
sub-total				**499.79**
2) On & Off Ramp (R10 Extension to C3) L=1.24km				
(Superstructure)				
PC I-Girder : 1-lane (W=6.7 m) 30m-span	12	each	3.92	47.10
PC I-Girder : 1-lane (W=6.7 m) 40m-span	22	each	5.76	126.79
sub-total				**173.88**
(Substructure)				
Pier-6 Type 40m-span	7	each	11.16	78.12
Pier-7 Type 40m-span	10	each	5.20	52.02
sub-total				**130.15**
2. Expressway Miscellaneous				
1-lane	1.38	km	7.99	11.03
4-lane	1.66	km	22.59	37.51
sub-total				**48.53**
3. Re-construction of At-grade Road	1.37	km	8.60	**11.78**
TOTAL				**1,421.60**

Cont'd…Table F.6 Direct Construction Cost of R10/C3/R9 Expressway

Route.: **C3 (from 4+773 to 7+948)**

Item	Q'ty	Unit	Unit Cost (MP)	Total Cost (MP)
1. Elevated Road Structure				
1) Throughway L=3.18km				
(Superstructure)				
PC I-Girder : 1-lane (W=6.2 m) 30m-span	10	each	3.85	38.54
PC I-Girder : 2-lane (W=9.95 m) 30m-span	96	each	5.24	502.72
PC I-Girder : 4-lane (W=19.7 m) 30m-span	57	each	10.77	613.84
PC I-Girder : 4-lane (W=19.7 m) 40m-span	1	each	15.26	15.26
sub-total				**1,170.37**
(Substructure)				
Pier-3 Type 30m-span	17	each	6.54	111.19
Pier-9 Type 30m-span	30	each	8.83	264.93
Pier-10 Type 30m-span	34	each	4.66	158.47
Pier-11 Type 40m-span	2	each	5.57	11.15
Pier-12 Type 30m-span	14	each	5.91	82.75
Pier-13 Type 30m-span	4	each	5.20	20.81
Pier-14 Type 30m-span	5	each	3.38	16.92
sub-total				**666.22**
2) On & Off Ramp L=0.73km				
(Superstructure)				
PC I-Girder : 1-lane (W=6.2 m) 30m-span	19	each	3.85	73.23
sub-total				**73.23**
(Substructure)				
Abut-2 Type 30m-span	2	each	2.20	4.40
Abut-3 Type 30m-span	1	each	1.42	1.42
sub-total				**5.82**
2. Expressway Miscellaneous				
1-lane	0.87	km	7.99	6.95
2-lane (without Center Media)	2.88	km	18.15	52.28
4-lane	1.75	km	22.59	39.54
sub-total				**98.77**
3. Re-construction of At-grade Road	3.18	km	8.60	**27.33**
TOTAL				**2,041.75**

Cont'd…Table F.6 Direct Construction Cost of R10/C3/R9 Expressway

Route.: **Interchange : C3/R9 (from 7+948 to 8+638)**

Item	Q'ty	Unit	Unit Cost (MP)	Total Cost (MP)
1. Elevated Road Structure				
1) Throughway L=0.69km				
(Superstructure)				
PC I-Girder : 1-lane (W=6.7 m) 30m-span	16	each	3.92	62.79
PC I-Girder : 1-lane (W=6.7 m) 40m-span	8	each	5.76	46.10
PC I-Girder : 2-lane (W=9.95 m) 30m-span	26	each	5.24	136.15
sub-total				**245.05**
(Substructure)				
Pier-14 Type 30m-span	2	each	3.38	6.77
Pier-15 Type 30m-span	4	each	6.30	25.19
Pier-15 Type 40m-span	1	each	8.50	8.50
Pier-16 Type 30m-span	3	each	4.12	12.36
Pier-16 Type 40m-span	4	each	5.56	22.26
Pier-17 Type 30m-span	6	each	7.40	44.42
Pier-18 Type 30m-span	1	each	5.02	5.02
sub-total				**124.52**
2. Expressway Miscellaneous				
1-lane	0.80	km	7.99	6.39
2-lane (without Center Media)	0.78	km	18.15	14.16
sub-total				**20.55**
3. Re-construction of At-grade Road	0.69	km	8.60	**5.93**
TOTAL				**396.06**

Cont'd…Table F.6 Direct Construction Cost of R10/C3/R9 Expressway

Route.: **R9 (from 8+638 to 11+300)**

Item	Q'ty	Unit	Unit Cost (MP)	Total Cost (MP)
1. Elevated Road Structure				
1) Throughway L=2.66km				
(Superstructure)				
PC I-Girder : 1-lane (W=6.2 m) 30m-span	4	each	3.85	15.42
PC I-Girder : 2-lane (W=9.95 m) 30m-span	56	each	5.24	293.26
PC I-Girder : 4-lane (W=19.7 m) 30m-span	44	each	10.77	473.84
PC I-Girder : 4-lane (W=19.7 m) 40m-span	1	each	15.26	15.26
PC I-Girder : 5-lane (W=22.95 m) 30m-span	6	each	12.13	72.78
PC Box-Girder : 4-lane (W=12.2 m) 45m-span	2	each	31.00	62.00
PC Box-Girder : 4-lane (W=12.2 m) 60m-span	1	each	42.06	42.06
sub-total				**870.55**
(Substructure)				
Abut-2 Type 30m-span	1	each	2.85	2.85
Pier-10 Type 30m-span	12	each	4.66	55.93
Pier-11 Type 40m-span	2	each	7.52	15.05
Pier-14 Type 30m-span	24	each	3.38	81.20
Pier-15 Type 30m-span	6	each	6.30	37.78
Pier-18 Type 30m-span	24	each	5.02	120.51
Pier-19 Type 30m-span	4	each	5.53	22.11
Pier-20 Type 30m-span	2	each	6.48	12.95
Pier-21 Type 30m-span	3	each	7.13	21.40
Pier-22 Type 40m-span	2	each	7.62	15.24
Pier-23 Type 40m-span	2	each	6.72	13.44
sub-total				**398.46**
2) On & Off Ramp (from EDSA) L=0.92km				
(Superstructure)				
PC I-Girder : 1-lane (W=6.2 m) 30m-span	16	each	3.85	61.67
PC I-Girder : 1-lane (W=6.2 m) 40m-span	8	each	5.45	43.58
sub-total				**105.25**
(Substructure)				
Abut-3 Type 30m-span	2	each	1.42	2.84
Pier-5 Type 30m-span	11	each	3.04	33.49
Pier-5 Type 40m-span	11	each	4.11	45.20
sub-total				**81.53**
2. Expressway Miscellaneous				
1-lane	0.86	km	7.99	6.87
2-lane (without Center Media)	1.68	km	18.15	30.50
4-lane	1.45	km	22.59	32.76
5-lane	0.18	km	23.50	4.23
sub-total				**74.36**
3. Re-construction of At-grade Road	2.66	km	8.60	**22.86**
TOTAL				**1,553.02**

Cont'd…Table F.6 Direct Construction Cost of R10/C3/R9 Expressway

Route.: **R10 Extension (from 3+908 to 8+164)**

Item	Q'ty	Unit	Unit Cost (MP)	Total Cost (MP)
1. Elevated Road Structure				
1) Throughway L=4.26km				
(Superstructure)				
PC I-Girder : 1-lane (W=6.2 m) 30m-span	14	each	3.85	53.96
PC I-Girder : 1-lane (W=6.7 m) 30m-span	44	each	3.92	172.68
PC I-Girder : 4-lane (W=19.7 m) 30m-span	104	each	10.77	1,119.99
PC I-Girder : 5-lane (W=22.95 m) 30m-span	2	each	12.13	24.26
PC I-Girder : 6-lane (W=32.2 m) 30m-span	10	each	16.65	166.49
sub-total				**1,370.89**
(Substructure)				
Pier-3 Type 30m-span	92	each	6.54	601.75
Pier-5 Type 30m-span	7	each	10.68	74.73
Pier-6 Type 30m-span	8	each	9.30	74.41
Pier-8 Type 30m-span	0	each	19.40	0.00
Pier-9 Type 30m-span	11	each	8.83	97.14
Pier-24 Type 30m-span	17	each	15.86	269.66
Pier-25 Type 30m-span	4	each	15.86	63.45
Pier-26 Type 30m-span	7	each	11.16	78.10
sub-total				**1,259.23**
2) On & Off Ramp L=1.24km				
(Superstructure)				
PC I-Girder : 1-lane (W=6.2 m) 30m-span	2	each	3.85	7.71
PC I-Girder : 1-lane (W=6.2 m) 40m-span	8	each	5.45	43.58
PC I-Girder : 1-lane (W=6.7 m) 30m-span	18	each	3.92	70.64
PC I-Girder : 1-lane (W=6.7 m) 40m-span	2	each	5.76	11.53
sub-total				**133.46**
(Substructure)				
Abut-1 Type 30m-span	1	each	8.58	8.58
Abut-2 Type 30m-span	2	each	2.20	4.40
Pier-7 Type 30m-span	11	each	3.85	42.39
Pier-7 Type 40m-span	11	each	5.20	57.23
sub-total				**112.59**
2. Expressway Miscellaneous				
1-lane	2.74	km	7.99	21.90
2-lane (without Center Media)	0.72	km	18.15	13.07
4-lane	3.12	km	22.59	70.49
5-lane	0.06	km	23.50	1.41
6-lane	0.30	km	24.06	7.22
sub-total				**114.09**
3. Re-construction of At-grade Road	4.26	km	8.60	**36.62**
TOTAL				**3,026.87**

ANNEX G

Participatory Rapid Social Appraisal of the Case Study Areas (R-10/C-3/R-9)

ANNEX G: Participatory Rapid Social Appraisal of the Case Study Areas (R-10/C-3/R-9)

(1) Introduction

Objectives and Methodology

The social assessment of the case study areas (R-10/C-3/R-9) intends to draw out the potential social impacts of the proposed DPWH Road Expansion and the Skyway in the R-10/C-3/R-9 Expressways. The social issues that were addressed included the identification of the affected population, perception and social acceptability of the project, socio-economic trends, and resettlement. The methodology used to carry out the rapid social assessment consisted of (i) a review of secondary data (ii), rapid participatory appraisal with affected families through focus group discussions, (iii) consultation meetings with various stakeholders and ocular surveys in the study sites.

Although the study was carried out in all the case study areas, the social assessment was specifically focused in R-10 where the magnitude of affected families of informal dwellers is more significant. In an absence of a formal structured survey, an in-depth focus group discussions and a series of consultation with leaders of the four affected barangays were done. The Barangays selected for cluster focus group sampling were: Brgy 38, 44, 39 and 40. The attached names of the participants and list of barangay leaders consulted are attached as annexes.

Socio-economic Information

An assessment of the socioeconomic condition of R-10 (Navotas and Tondo) was obtained through the use of secondary data. This was further complemented with interviews with local officials of the LGU, and focus group discussions with selected barangays of R-10 Tondo, In R-10 Navotas, due to an on-going demolition at NBBS fish port, people were generally wary and indifferent to interviews, thus the information on R-10 Navotas made use of the socioeconomic profile provided by the LGU. Below are the highlights of the social findings.

Land, Shelter and utilities

The settlement on R-10 consists of mostly row dwelling shanties. The dwellings are made of various makeshift materials (wood, corrugated or plane sheet iron, paper box). There are a few of more permanent materials seen. Majority of dwellings size is approximately 20-30 sq. meters. Houses have basic services such as water and electricity. The most visible sight upon entrance to the community is the improper disposal of waste water and garbage.

The land belongs to the government. Many families that are living besides the proposed road widening have already obtained permanent residency awarded by the government though the community mortgaged program (CMP).

Economic activities

The most common forms of employment are laborers at the pier, drivers, construction workers, vendors and factory workers. Only drivers and stevedores have fixed income while the rest are seasonal or variable. Average family income ranges from P5, 000-P7, 000 a month. Majority said that this income could hardly sustain the daily needs of the families in addition to other household expenditures such as education, basic necessities and food. Table 3 presents the categories of work and income pattern of the families.

Table G.1 Income level by categories of work

Income Range/ Category	Below 1000	1,000 to 3,000	3001 to 5000	5001 to 7000	7001 to 9000	9001 to 11000
Vending		X				
Driving			X			
Stevedore					X	
Porter				X		
Laborer			X			
Const. Worker			X			
Professional					X	

Source: FGD JICA Study Team, August 2002

Views on current location

For R-10 informal dwellers, location is important in terms of accessibility to source of employment. Majority are working at the pier and the nearby factories of Divisoria, Malabon and Navotas of which these areas are viewed as places offering both numerous opportunities and variety of work. Some of the disadvantages identified include poor environment, dangerous to children and congestion of houses.

Perception of Government's project

The road widening and the proposed skyway project are viewed as generally good project. in terms of overall benefits. Some of the benefits identified were:

Project Benefits	Adverse Impact
- Improvement of traffic condition - greater accessibility and mobility - increase opportunity for work	- Loss of homes due to resettlement dwellers - Possible loss of jobs - Increase expenditures due to distance when relocation is off city - Disruption of schooling

Key Issues and Recommendations

Problems raised mostly relate to housing and employment if relocation occurs. The experience related by those who were resettled in Bitongol, Bulacan, DPWH's site for resettlement of those displaced in R-10 before, revealed an alarming and wary disposition among the residents. There was no employment opportunities provided with resettlement. The cost of landplots was viewed as unaffordable and people therefore decided on selling their rights and going back to squatting at R10 or in other parts of Metro Manila. As a result, middle income families benefited the resettlement sites rather than the poorest.

To a certain extent, the residents have accepted the project and have resigned to the fact that they would have to relocate, but were concerned about the relocation , largely in terms of whether it would be close to sources of employment. Some of the recommendations of the residents on actions to be incorporated into the relocation strategy were:

1) Relocation should be carried out in conjunction with opportunities for income generation and employment
2) Relocation site should have a health care facility
3) Basic facilities and schools should be made available
4) Cost of plots or houses must be affordable.

ANNEX H

Recommended Appraisal Valuation

ANNEX H: Recommended Appraisal Valuation

Based on 3rd BIR Revenue Zonal Valuation (March 24, 1997) Land & Imp. Based on SV 1995							
No.	Lot No.		Area	Location per TD	Appraisal Valuation (per sq.m)	Total Recommended Valuation	
1	L-13-A-1	B-40	75.81	5th Avenue	P 13,000	Land: 985,530.00	1,087,466.00
						Res.: 101,936.00	
2	L-13-A-2	B-40	75.81	5th Avenue	P 13,000	Land: 985,530.00	1,036,022.00
						Imp.: 50,492.00	
3	L-13-A-3	B-40	75.81	D. Aquino St.	P 9,100	Land: 689,871.00	742,745.00
						Imp.: 52,874.00	
4	L-13-B	B-40	227.43	5th Avenue	P 13,000	Land: 2,956,590.00	3,764,595.00
						Imp.: 409,240.00	
						Imp.: 398,765.00	
5	L-13-C	B-40	227.64	5th Avenue	P 13,000	Land: 2,959,320.00	3,303,079.00
						Imp.: 96,079.00	
						Imp.: 247,680.00	
6	L-14-B	B-40	384.00	5th Avenue	P 13,000	Land: 4,992,000.00	5,421,072.00
						Imp.: 115,315.00	
						Imp.: 313,757.00	
7	L-14-A	B-40	298.50	5th Avenue	P 13,000	Land: 3,880,500.00	4,356,002.00
						Imp.: 475,502.00	
8	L-13-A-1-B	B-39	89.40	5th Avenue	P 18,200	Land: 1,627,080.00	1,847,880.00
						Imp.: 220,800.00	
9	L-13-A-1-A	B-39	61.00	5th Avenue	P 18,200	Land: 1,110,200.00	
10	L-13-A-2	B-39	112.10	P. Sevilla St.	P 12,350	Land: 1,384,435.00	1,549,075.00
						Imp.: 164,640.00	
11	L-13-B-1	B-39	210.00	5th Avenue	P 18,200	Land: 3,822,000.00	4,002,002.00
						Imp.: 200,002.00	
12	L-13-B-2	B-39	210.00	5th Avenue	P 18,200	Land: 3,822,000.00	3,934,320.00
						Imp.: 112,320.00	

Based on 3rd BIR Revenue Zonal Valuation (March 24, 1997) Land & Imp. Based on SV 1995							
No.	Lot No.		Area	Location per TD	Appraisal Valuation (per sq.m)	Total Recommended Valuation	
	L-14-A	B-39	227.50	5th Avenue	P 18,200	Land: 4,140,500.00	4,308,500.00
						Imp.: 574,560.00	
	L-14-B	B-39	227.50	5th Avenue	P 18,200	Land: 4,140,500.00	4,715,060.00
						Imp.: 857,088.00	
	L-14-C	B-39	227.50	5th Avenue	P 18,200	Land: 5,614,700.00	4,997,588.00
						Imp.: 1,538,682.00	
	L-13-A	B-39	308.50	5th Avenue	P 18,200	Land: 5,614,700.00	7,153,382.00
						Imp.: 1,538,682.00	
	L-13-B	B-38	374.00	C. Cordero St.	P 14,430	Land: 5,396,820.00	
	L-14-A	B-38	677.50	F.Roxas St.	P 15,470	Land: 10,480,925.00	
	L-13	B-37	682.50	5th Avenue	P 18,200	Land: 12,421,500.00	
	L-14	B-37	682.50	5th Avenue	P 18,200	Land: 12,421,500.00	
	L-13	B-36	682.50	5th Avenue	P 18,200	Land: 12,421,500.00	
	L-14	B-36	682.50	5th Avenue	P 18,200	Land: 12,421,500.00	
	L-12	B-36	650.00	J. Teodoro St.	P 18,200	Land: 11,830,000.00	
	L-11	B-36	650.00	A. del Mundo St.	P 16,900	Land: 10,985,000.00	
	L-13	B-35	682.50	5th Avenue	P 18,200	Land: 12,421,500.00	15,563,875.00
						Imp.: 3,142,375.00	
	L-14	B-35	682.50	Rizal Ave. Ext.	P 28,600	Land: 19,519,500.00	
	L-12-A	B-35	180.00	Rizal Ave. Ext.	P 28,600	Land: 5,148,000.00	
	L-11	B-35	650.00	J. Teodoro St.	P 28,600	Land: 18,590,000.00	
	L-1	B-47	682.50	C. Cordero St.	P 14,300	Land: 9,759,750.00	11,161,942.00
						Imp.: 830,800.00	
						Imp.: 571,392.00	
	L-2	B-47	682.50	5th Avenue	P 7,800	Land: 5,323,500.00	6,128,460.00
						Imp.: 804,960.00	
	L-1-B-2		112.50	5th Avenue	P 7,800	Land: 877,500.00	982,000.00
						Imp.: 104,500.00	
	L-1-A	B-48-A	170.00	5th Avenue	P 7,800	Land: 1,326,000.00	1,501,680.00
						Imp.: 175,680.00	

Based on 3rd BIR Revenue Zonal Valuation (March 24, 1997) Land & Imp. Based on SV 1995							
No.	Lot No.		Area	Location per TD	Appraisal Valuation (per sq.m)	Total Recommended Valuation	
						Imp.: 102,010.00	
						Imp.: 36,101.00	
						Imp.: 1,844,107.00	
	L-2-B-2		170.68	A. del Mundo St.	P 16,380	Land: 2,795,738.40	3,237,890.40
						Imp.: 442,152.00	
	L-1-B-1-A-1		150.00	F. Roxas St.	P 16,380	Land: 2,457,000.00	2,694,300.00
						Imp.: 237,300.00	
	L-B-1-A-2-B		50.00	A. del Mundo St.	P 16,380	Land: 819,000.00	937,048.00
						Imp.: 118,048.00	
	L-1-B-1-A-2-A		100.00	A. del Mundo St.	P 16,380	Land: 1,638,000.00	1,839,600.00
						Imp.: 201,600.00	
	L-1	B-48-B	650.00	5th Avenue	P 7,800	Land: 5,073,900.00	5,908,093.00
						Imp.: 834,193.00	
	L-2	B-48-B	682.50	5th Avenue	P 7,800	Land: 5,323,500.00	8,562,222.00
						Imp.: 3,238,722.00	
	L-5	B-43	119.00	Nadurata St.	P 7,800	Land: 928,200.00	1,076,541.00
						Imp.: 148,341.00	
	L-4	B-43	74.00	Nadurata St.	P 7,800	Land: 577,200.00	687,103.00
						Imp.: 109,903.00	
	L-3	B-43	40.00	Nadurata St.	P 7,800	Land: 312,000.00	326,974.00
						Imp.: 14,974.00	
	L-2	B-43	76.00	5th Avenue	P 16,380	Land: 1,244,880.00	1,269,847.00
						Imp.: 18,919.00	
						Imp.: 6,048.00	
	L-1	B-43	52.50	Nadurata St.	P 7,800	Land: 409,500.00	432,700.00
						Imp.: 23,200.00	
	L-2-A	B-43	321.50	Baltazar St.	P 7,150	Land: 2,298,725.000	
	L-1	B-43	673.50	Baltazar St.	P 7,150	Land: 4,815,525.00	
	L-1	B-44	650.00	Nadurata St.	P 7,800	Land: 5,070,000.00	

						Imp.: 3,059,712.00	
	L-2	B-44	682.50	D. Aquino St.	P 9,750	Land: 6,654,375.00	
						Imp.: 1,874,339.00	
	L-2-B-1	B-45	170.63	P. Sevilla St.	P 13,000	Land: 2,218,190.00	
	L-2-B-2	B-45	170.62	5th Avenue	P 7,800	Land: 1,330,836.00	
						Imp.: 51,610.00	
	L-2-A	B-45	160.00	5th Avenue	P 7,800	Land: 1,252,680.00	
						Imp.: 215,040.00	
						Imp.: 342,835.00	
	L-2-A-2	B-45	170.62	5th Avenue	P 7,800	Land: 1,330,836.00	
						Imp.: 320,000.00	
						Imp.: 280,000.00	
	L-1-B	B-45	341.25	5th Avenue	P 7,800	Land: 2,661,750.00	
	L-1-A	B-45	341.25	5th Avenue	P 7,800	Land: 2,661,750.00	
						Imp.: 297,510.00	
	L-2-B	B-46	81.50	5th Avenue	P 7,800	Land: 635,700.00	
						Imp.: 823,296.00	
						Imp.: 329,166.00	
	L-2-A-2-D	B-46	42.66	C. Cordero St.	P 7,800	Land: 610,038.00	
						Imp.: 187,822.00	
	L-2-A-2-C	B-46	42.66	5th Avenue	P 7,800	Land: 332,748.00	
						Imp.: 150,437.00	
	L-2-A-2-B	B-46	42.65	5th Avenue	P 7,800	Land: 332,670.00	
	L-2-A-2-A	B-46	42.65	5th Avenue	P 7,800	Land: 332,670.00	
						Imp.: 400,680.00	
	L-2-A-1	B-46	170.63	5th Avenue	P 7,800	Land: 1,330,914.00	
						Imp.: 211,416.00	
	L-1-C	B-46	227.64	5th Avenue	P 7,800	Land: 1,775,592.00	
						Imp.: 566,146.00	
	L-1-A	B-46	227.43	5th Avenue	P 7,800	Land: 1,773,954.00	

Total Land Area
18,908.59 sq. m.

Total Recommended Valuation For:
Land: 270,388,378 Imp. 28,213,066

ANNEX I

Example of Actual Replacement Cost

ANNEX I: Example of Actual Replacement Cost

OWNER: JERRY PADILLA
DESCRIPTION: ONE-STOREY SEMI-CONCRETE
FLOOR AREA: 53.82 sq.m.
TAG NO. : 067 P5 BARANGAY WESTERN BICUTAN, TAGUIG, METRO MANILA

REPLACEMENT COST SUMMARY

I.	REMOVAL/ DEMOLITION OF EXISTING STRUCTURE			P	8, 073.00
II.	EXCAVATION FOR STRUCTURE				4, 015.06
III.	CONCRETE WORKS				17, 320.83
IV.	FORMWORKS				21, 872.00
V.	MASINRY WORKS				32, 150.78
VI.	CEMENT FLOOR FINISH				11, 374.76
VII.	ROOF & ROOF FRAMING				20, 223.00
VIII.	CEILING & CEILING FRAME				14, 145.45
IX.	TILEWORKS				15, 000.00
X.	STAIRS (WOODEN)				---
XI.	PLUMBING WORKS				27, 600.00
XII.	ELECTRICAL WORKS				24, 500.00
XIII.	SECOND FLOOR PARTITION & SIDINGS, FLOORING				13, 925.00
	A. FLOORING	P	5, 425.00		
	B. SIDINGS		8, 500.00		
XIV.	PAINTING				25, 000.00
	ESTIMATED DIRECT COST				235, 199.88
	SOFT COST (MARK-UP 20%)				47, 039.98
	REPLACEMENT				282, 239.86

NOTE: The cost estimate was based on the DPWH Prices & Indices as of September 2001

PREPARED:	CHECKED & VERIFIED CORRECT:	RECOMMENDING APPROVAL
ROBERTO C. ALBESA, JR. Eng'g Assistant	MANUEL B. FERRER Chief RROD, Engineer IV	ROSAURO T. ORACION, JR. Asst. Project Manager, Engineer IV
ALEXANDER M. MASIKIP, JR. Eng'g Assistant		PATRICK B. GATAN, CESO IV Project Manager IV

OWNER	:	JERRY PADILLA
DESCRIPTION	:	ONE-STOREY SEMI-CONCRETE
FLOOR AREA	:	7.80 X 6.90 = 53.82 sq.m.
TAG NO.	:	067 P5 BARANGAY WESTERN BICUTAN, TAGUIG, METRO MANILA

I. REMOVAL AND DEMOLITION OF EXISTING STRUCTURE — p 8, 073.00

A	:	53.82	=	53.82 sq.m.	@	150.00	350.00

II. EXCAVATION FOR STRUCTURE — P 4, 015.06

V_{fc}	=	0.60 x	0.60 x 0.80	x	8.00	=	2.30	cu.m.	@	241.00 =	555.26
V_f	=	0.30 x	0.40 x 36.30	x		=	4.36	cu.m.	@	241.00 =	1, 049.80
V_{st}	=	2.00 x	2.00 x 2.50	x		=	10.00	cu.m.	@	241.00 =	2, 410.00

III. CONCRETE WORKS — P 17, 320.83

V_c	=	0.25 x	0.25 x 2.85	x	8.00	=	1.43	cu.m.
V_f	=	0.50 x	0.60 x 0.60	x	8.00	=	1.44	cu.m.
V_{wf}	=	0.30 x	0.25 x 36.30	x	2.72	cu.m.		
V	=	5.59 cu.m						

Cement:	5.59 x	9.50 =	53.08	@	140.00	=	7, 431.38	
Sand:	5.59 x	0.42 =	2.35	@	600.00	=	1, 408.05	
Gravel:	5.59 x	0.84 =	4.69	@	400.00	=	1, 877.40	
	54.00 pcs.		12 mm dia RSB	@	75.00	=		4, 050.00
	38.00 pcs.		10 mm dia RSB	@	58.00	=		2, 204.00
	10.00 kgs.		# 16 Tie Wire	@	35.00	=		350.00

IV. FORMWORKS — P 21, 872.00

Column & Beam

A_c		0.25 +	0.20 x 2.00 x 3.50	x	8.00	=	25.20 sq.m.
A_B		0.25 +	0.25 x 0.20 + 36.30	x		=	25.41 sq.m.
A	=	50.61 sq.m.					

Plywood:	50.61	/	2.88	=	17.57		
Coco Lumber:	50.61	x	34.00	=	1720.74		
Assorted CWN:	1720.74	/	2500.00	=	0.69 x 45.00	30.9733	

18.00	pcs.	¼ thk. Plywood	@	265.00	=	4, 770.00
1686.00	bd.ft.	2x2 Form Lumber	@	9.50	=	16, 017.00
31.00	kgs.	Assorted CWN	@	35.00	=	1, 085.00

V. MASONRY WORKS P 32, 150.78

A = 3.00 x 36.60 = 108.90 sq.m.

4"CHB:	108.90	x	12.50	=	1361.25 sq.m.		@	6.50	P	8, 848.13
Cement:	108.90	x	0.27	=	29.40 sq.m.		@	140.00		4, 116.42
Sand:	108.90	x	0.02	=	2.40 sq.m.		@	400.00		958.32
Rebars:	108.90	x	1.64	=	178.60 sq.m.		@	14.88		2, 657.51
Tie Wire:	5.00						@	35.00		175.00
PLASTER:	108.90	x	2.00	=	217.8	x		0.0315 m.		6.86 cu.m.
Cement:	6.86	x	13.00	=	89.19	x		140.00		12, 486.47
Sand:	6.86	x	1.06	=	7.27	x		400.00		2, 908.94

VI. CEMENT FLOOR FINISH (1ST FLOOR) p 11, 374.76

A =	53.82	x	0.10	=	5.38 cu.m.	@	140.00	=	7, 158.06
Cement:	5.38	x	9.5	=	51.13 cu.m	@	600.00	=	2, 712.53
Gravel:	5.38	x	0.84	=	4.52 cu.m.	@	400.00	=	904.18
Sand:	5.38	x	0.42	=	2.26 cu.m.	@	75.00	=	600.00
10 mm dia RSB	8.00								

VII. ROOF & ROOF FRAMING P 20, 223.00

A = 87.22 sq.m.

6.00	pcs.	2x5x14 Bottom Chord	70.00	BF @	24.00	=	1, 680.00
6.00	pcs.	2x5x14 Top Chord	70.00	BF @	24.00	=	1, 680.00
4.00	pcs.	2x5x14 Web Memner	46.67	BF @	24.00	=	1, 120.00
22.00	pcs.	2x3x14 Purlins	154.00	BF @	24.00	=	3, 696.00
5.00	pcs.	2x5x14 Wd. Girl	58.33	BF @	24.00	=	1, 400.00

6.00	pcs.	1x12x14 Fascia Board	84.00	BF	@	35.00	=	2, 940.00
10.00	kgs.	Assorted CWN			@	35.00	=	350.00
23.00	pcs.	# 26 x 12 Corr. Gl. Sht.			@	264.00	=	6, 072.00
3.00	kgs.	Roofing Nails			@	65.00	=	195.00
2.00	qt.	Vulcaseal			@	45.00	=	90.00
8.00	pcs.	Rigderoll			@	125.00	=	1,000.00

VIII. CEILING & CEILING FRAME P 14, 145.45

A = 87.22 sq.m.

1/4x4x8 Plywood:	87.22	/	2.88	=	30.28	@	265.00	=	8, 025.45
2x2 Nailers:	150.00	pcs.				@	35.00	=	5, 250.00
Finishing Nail:	5.00	kgs.				@	40.00	=	200.00
Assorted CWN:	10.00	kgs.				@	35.00	=	350.00
Wood Glue	4.00	qt.				@	80.00	=	320.00

IX. TILEWORKS P 15, 000.00

X. STAIRS p -----

XI. PLUMBING WORKS P 27, 600.00

1.00	unit	Septic Tank	@	6, 000.00
1.00		Pail Flush	@	600.00
1.0		Pipes, Fittings, Accessories	@	21, 000.00

XII. ELECTRICAL WORKS P 24, 500.00

XIII. FIRST FLOOR PARTITION & SIDINGS & FLOORING P 13, 925.00

A. PARTITION

8.00	pcs.	½ thk. Plywood	@	265.00	=	2, 120.00
55.00	pcs.	2x4x20 joist	@	55.00	=	3, 025.00
8.00	kgs.	Assorted CWN	@	35.00	=	280.00

B.	Sidings	P	8, 500.00
XIV.	PAINTING	P	25, 000.00

OWNER: JERRY PADILLA