Chapter 9

PROVISIONS OF FUTURE ENVIRONMENT AND MONITORING

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9.1 Introduction

Although the optimum alignment and design were studied, taking into account of the environmental conditions in the corridor, some unfavourable effects will not be avoidable. This Chapter will discuss the measures to minimize such residual effects and to provide better environmental conditions along the project corridor.

(1) To examine the environmental countermeasures for the proposed alignment, the PEIA Study was conducted for the three alternative route alignments as described in Chapter 6. In this Chapter, the major negative effects and their countermeasures for the selected route are summarized.

(2) To ensure the recommended procedures or actions for the environmental preservations and protection - The Environmental Management Programme (EMP) including design and construction guidelines as well as a monitoring programme was formulated to provide overall quality management for the proposed project.

(3) To improve future environmental condition in the developed areas including the provision of the preferable land use developments along the project corridor - A concept of road side area development was introduced. By restructuring road side area along the corridor, for example, from residential area to industrial or commercial area the environmental situation will improve.

9.2 Major Environmental Impact and Mitigation for the Preferred Route Alignment

9.2.1 Physical Environment

(1) Noise and Air Quality

(a) Northern Section : Housing Estate south of Batu Dam

The selected route passes through a new housing estate to the south of Batu Dam, where bridges and tunnels are planned. A part of the housing estate will be divided by the route. Detour of the alignment is fairly difficult due to its proximity to the reservoir of Batu Dam.

In the construction phase, the noise caused by earthworks, construction vehicles and piling for bridges will cause an adverse impact on the atmosphere of this estate. The blasting noise will not disturb the residential estate because of the distance from the tunnel construction site.

In the operational phase, noise and air pollution is foreseen, therefore, noise screens and appropriate buffer zones should be provided. They will be helpful in

preventing negative effects on the environment of residents.

(b) Eastern Section : Taman Melawati

The route passes through a tunnel under the quartz ridge and crosses Taman Melawati by viaduct. A part of residential area will be affected, which may result in relocation of some houses. In addition, the remaining residents may suffer from noise and air pollution. As the alignment is determined taking into consideration of the reservoir of Klang Gates Dam and the state wildlife reserve, it will be difficult to change the route drastically.

During the construction phase, the area may suffer from noise and air pollution caused by various construction works such as earthworks, piling and blasting for tunnel boring and the operation of construction vehicles. The blasting noise should be adequately mitigated by noise screen, considering the calm atmosphere of the residential area.

In the operational phase, the viaduct over the residential area may cause some public disturbances, therefore, various countermeasures might be required including structure modification of the KLORR or reformation of roadside land use.

(c) Kg. Rantau Panjang

The highway viaduct will cross over the local kampung at Hulu Langat. In the construction phase, some houses might be removed. The noise and air pollution, however, will not be significant if the appropriate counter measures are applied.

In the operational phase, the preparation of new town planning including the roadside development is important in order to conserve the atmosphere of Malay Reserve Land.

(2) Soil Erosion and Water Pollution

About 65% of highway length involves earthwork in mountainous and hilly areas, where "Cut and Fill" is a popular construction method. However, this construction method tend to cause soil erosion and water quality degradation.

(a) Northern Section

There are two large scale "Cut and Fill" areas, more than 1 km in length.

(b) Middle Section

The largest scale "Cut and Fill" area is located near the northern entrance of the longest tunnel which traverses Ampang Forest Reserve. The cutting height is about 30 m and its length reaches about 1 km.

Since it traverses the Hulu Gombak Forest Reserve, appropriate measures should be applied to control soil erosion, water pollution and solid waste disposal.

(c) Southern Section

Near the end point of the southern section, there are also two large scale "Cut and Fill" areas, over 1 km in length.

(3) Hydrology

The selected route is aligned to avoid the main reservoirs of Batu Dam and Klang Gates Dam, water intake points and main water catchment areas.

In the Ampang Water Catchment Area, construction of a tunnel is an important mitigation measure as it avoids trespassing the area.

The intake point of Sungai Gahal at Hulu Langat is not affected as the route passes through another valley nearby.

9.2.2 Biological Environment

(1) Flora and Fauna

The surrounding rich flora in the area sustains a diverse array of fauna, thus creating a balanced ecosystem.

(a) Northern Section : The area between Kanching and Bukit Lagong Forest Reserve

There is a virgin jungle forest at southern part of Bukit Lagong Forest Reserve. The information that endangered species, e.g. Tigers, Serows, Tapirs, Bears and some kinds of wildcats and monkeys are found in the Forest Reserve shows the high biological diversity of the area.

During the construction phase, site clearing, logging and earthworks may directly damage forest and grass land, which supply adequate food, shelter and breeding grounds for fauna. In general, road construction causes loss of wildlife and a split in its habitat. Endangered species are usually the most sensitive wildlife.

In the future operational phase, fauna is continuously affected by urban development opened up by the new highway.

(b) Eastern Section:

(i) Klang Gates Wildlife Sanctuary

Klang Gates State Wildlife Reserve was gazetted in 1936. This reserve which spreads over the area of 130 ha, covers most part of Quartz Ridge. The width is 200 - 250 m and the length is approximately 6.5 km.

Some sensitive quartzite vegetation is found here. This wildlife sanctuary is a significant natural component of the ecosystem, combined with the Klang Gates

Dam Reservoir and the Hulu Gombak Forest Reserve.

Both in the construction and the operation phases, it is recommended to conserve the wide area as a combined natural ecosystem.

(ii) The Southern Part of Hulu Langat Forest Reserve

As a consequence of the KLORR project, urban development may be stimulated at the Hulu Langat area. Uncontrolled development will seriously affect the forest on the hillside.

From this point of view, designation of amenity forest plan could be proposed. An amenity forest would function as an effective way of raising citizens' quality of life. The forest reserve located on the southern part of Hulu Langat is recommended location for such plan.

9.2.3 Sociological Environment

The selected route is designed not to affect the sensitive environment like Orang Asli and squatter settlements as much as possible. However, some unfavourable impacts to the residential areas will still remain as mentioned above.

(1) Public Nuisance

(a) Northern Section

The route runs through hills by two tunnels at the foot of Batu Dam toward Kuala Lumpur - Karak Highway. Between these tunnels, a 500 m bridge is planned. In this section, two housing estates are situated on the north and south sides of the Route.

(i) Housing Estate on the South of Batu Dam

The distance from the housing estate located on the south side is only about 100 m. Noise screens and buffer zones would be useful mitigation measures.
Another housing estate with about 200 houses is situated on the north side of the proposed bridge near the Batu Dam.

The distance between the estate and the route is approximately 100 m but, separation of the community will not happen as residents will be able to pass under the bridge proposed at this point.

The noise pollution will not be serious at the opening stage, but, it will gradually increase in accordance with the growth in traffic volume. Mitigation measures such as buffer zones, noise screens, etc. will be required.

(b) Eastern Section

(i) Taman Melawati

This area will have the same problems encountered at the housing estate of Batu Dam mentioned above. In order to reduce the affected area, some modification of the route alignment might be effective and will be required in the detailed design stage.

(ii) Sungai Telaga Malay Reserve

In the construction phase, the residents of the squatter at Kampung Kemesah behind the Zoo Negara will be affected by the construction vehicles passing towards the Sungai Telaga Malay Reserve since the existing trail is too narrow for heavy vehicles to pass. As the structure type planned is a bridge, the route will not affect the residents of Sungai Telega Malay Reserve in the operational phase, because the Malay Reserve is located at sufficient distance from the bridge, not causing public nuisance from the project.

(iii) Kampung Rantau Panjang

In this area conservation practice based on town planning will be required for roadside settlements as mentioned above.

(c) Southern Section :

(i) Bandar Baru Bangi

The route passes through Bangi New Town and links with the KL-Seremban Expressway. The traffic volume is expected to be very high in this area. However, the houses in the New Town are mostly of high grade, and a sufficient space for a buffer zone can be easily provided between the Route and the New Town. Thus, public disturbance of this area will be quite limited if appropriate control measures are applied.

9.3 Environmental Management Programme

The Environmental Management Programme (EMP) is formulated to provide an overall quality control for the proposed Project. It needs to be implemented to ensure the recommended procedures or actions in the EIA report are carried out accordingly. The programme covers the following :

(a) Design Guidelines
(b) Construction Guidelines
(c) Operation and Maintenance Guidelines
(d) Monitoring Programme

9.3.1 Design, Construction, Operation and Maintenance Guidelines

Design Guidelines

The Design Guidelines cover rules and regulations contained in the Environmental Quality Act. It takes into account the criteria outlined in Table 9-1 in order to achieve its objectives.

Tables 9-1 : Design Criteria in Formulating the Design Guidelines

Design Criteria	Regulations or Rules
Drainage design	Compliance with regulations set by JPS
Atmospheric emissions	Compliance with Malaysia Environmental Quality (Clean Air) Regulation 1978
Noise	Compliance with WHO Recommended Noise Exposure Limits
Wastewater discharge	Compliance with Standard A of the Sewage and Industrial Effluent Regulation (EQR 1979)

Construction Guidelines

The following principles and approaches as outlined in Table 9-2 should be adopted in formulating the construction guidelines for the Project.

Table 9-2 : Principles in Formulating the Construction Guidelines

Principles	Remark
Minimize damage and interference	Work shall be carried out to minimize any damage to or interference with : • Water courses or drainage systems ; • Structures, roads and property ; • Public or private vehicular or pedestrian accesses ; • Biological resources.
Traffic management plan	A traffic management plan must be submitted to the relevant authorities if performing work on public or private rights of way. The Project proponent should restrict the use of highways and public rights of way and seek for approval for temporary traffic arrangements.
Fire service access	24 hour access to adjoining properties and emergency services.
Restoration of existing facilities	Any disturbance and damage shall be restored to the original condition.
Cleaning up	All construction sites must be free from solid waste material, construction debris and rubbish.
Safety measures	Compliance with the instructions from the relevant authorities and law requirements.
Soil erosion control	Management of soil erosion and river siltation during site clearing and earthworks.
Pollution control	Pollution control includes mitigation measures for noise, air and water pollution as well as solid waste disposal.

Operation and Maintenance Guidelines

During operation and maintenance phases, emission of air and noise as well as sewage water discharge should comply with laws and regulations as stipulated in Table 9-1. A solid waste collection and disposal programme must be carried out to ensure that the waste collected is disposed at identified dump sites.

9.3.2 Environmental Monitoring Programme

The objective of environmental monitoring programme is that it can act as an early warning sign against pollution or undesirable impact to the environment. With early detection, appropriate remedial action can be expeditiously carried out to prevent further deterioration of the environment.

A regular monitoring programme for water, air and noise has to be drawn up as the success and efficiency of mitigation measures against these residual effects may vary, resulting in uncertainty to the degree of impact on the environment. Monitoring programmes should also extend to traffic flow, aquatic life (with assistance from the Department of Fisheries), forest activities and wildlife (with assistance from Perhilitan). The frequency of monitoring and the parameters to be measured are shown in Table 9-3 and the location of the monitoring are shown in Figure 9-1.

(1) Water Quality Monitoring

A water quality monitoring programme is recommended to ensure that the management of silt and sewage of the project is considered. If the water quality deteriorations should be found, appropriate immediate counter measures will be taken.

Table 9-3 : Environmental Monitoring Programme

Environ-mental Impact	Parameter	Frequency		Location	
		Construction Phase	Operational Phase	Sampling Site	Land use
Air Quality	TSP (Total Suspended Particles) NOx, SOx, CO and HydroCarbon Wind Direction and Speed Temperature and Relative humidity	3 months	6 months	A1 : Kajang Town A2 : Templer Park A3 : Hulu Langat	Commercial Area Residential Area Rural Area
Noise	24-Hour sound level meter reading	3 months (Earthwork Stage : monthly)	6 months	N1 : Kajang Town N2 : Templer Park N3 : Hulu Langat N5 : Karak Higway	Commercial Area Residential Area Rural Area Traffic Zone
Water Quality	pH, 5-day Biochemical Oxygen (BOD), Chemical Oxygen Demand (COD), Total Suspended Solids (TSS), Oil & Grease (O&G) and *E-col* count, Temperature and Dissolved Oxygen (DO)	3 months (Monthly for TSS during the Earthworks Stage:)	/	W3 : Sg. Batu W5 : Sg. Gombak W7 : Sg. Kelang W9 : Sg Ampang W12 : Sg Langat W13 : Sg Langat	Residential Area Near Settlements Residential Area Recreational park Rubber Plantations Residential Area

It is suggested that the water monitoring program may be carried out monthly during the construction phase and be reduced to three monthly during the operation. All the monitoring parameters measured must be assessed based on CLASS I or II A waters of the proposed "Interim National Water Quality Standards for Malaysia".

(2) Air Quality Monitoring

A regular air quality monitoring programme is needed to ensure that the ambient primary pollutant levels are below the allowable limit of Atmospheric Emission Limits according to Environmental Quality Regulation 1978. It is suggested that the air monitoring programme be carried out every three month during the construction phase, and be reduced to half yearly during the operational stages of the project.

(3) Noise Quality Monitoring

It is a legal requirement to keep the noise level at the boundary perimeter at 75 dBA (maximum), 50 L_{eq} at night and 60 L_{eq} and below during the daytime. A continuous noise monitoring programme is needed to ensure that the noise generated by the project activities would not effect the residents living along the KLORR.

During construction phase, noise monitoring should be carried out every three months and reduced to half yearly for the operational phase of the KLORR. As noise levels correlate with traffic volume and type of vehicles utilizing the road, monitoring during the operational phase can be carried out anytime when deemed necessary.

(4) Financial Allocation

It is necessary to allocate an adequate budget for the implementation of the Environment Management Programme to ensure that proper execution of the plan or any corrective measures be carried out expeditiously.

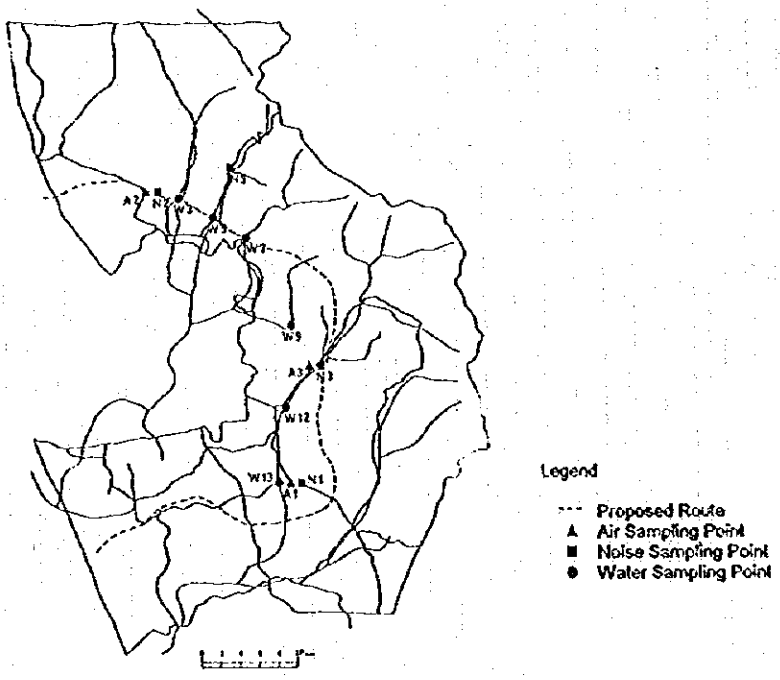

Figure 9-1 : Location of the Environmental Monitoring

9.4 Roadside Development for the Environmental Preservation

9.4.1 Provision of Favourable Land use for Expressway

Environmental countermeasures to expressways vehicular traffic are generally implemented inside of ROW, such as buffer zones, noise barriers and so on. The countermeasures should not be examined only from the standpoint of road construction. It is important to restructure and provide a favourable land use pattern along expressways for environmental considerations.

Basically, there are two strategies to promote favourable land use conditions along expressway corridors as summarized in Table 9-4. One is to control the construction of residential buildings, schools and hospitals which tend to be influenced by vehicular traffic nuisance. The other is to redevelop the corridors for commercial or industrial areas which are not so sensitive to the traffic pollution. The residential areas can be provided behind the commercial or industrial areas.

The construction of expressways may deteriorate natural and social environments, but at the same time will provide better accessibility and stimulate urbanization in the areas. The KLORR may provide adverse environmental effects to some existing developed areas. However, future urbanization pressure generated by the KLORR will change the existing land use. It is recommended that urban development plans should be prepared or reviewed to provide a preferred roadside land use pattern.

Table 9-4 : Strategies for the provision of Favourable Land use for Expressway

Countermeasure	Basic Ideas	Type of Approach
Land use control	To regulate constructions of the buildings which tend to be influenced such as residential houses, schools and hospitals.	• To designate the roadside areas as a non residential land use or open spaces. • In case, the areas are designated as a natural reserve. The designation should be maintained. • Non - residential public facilities such as urban utility facilities will be favourable.
Redevelopment to provide a favourable land use pattern	To prepare an integrated land use plan in line with the expressways construction and promote land use such as industry and commercial along the expressway. Some existing residential areas may be converted to industrial or commercial land use.	• To designate non - residential land use for the roadside areas.

This section will discuss road side land use and development as environmental preservation counter measures.

9.4.2 Urban Development Considerations Along Expressway

There are several types of urban road network patterns depending on the size of urban areas and configuration patterns. The latter is basically divided into four (4) types, namely Bypass, Ladder, Radial and Ring and Grid patters. The general features of urban development for respective urban road patterns are summarized in Figure 9-2.

The construction of urban trunk roads will stimulate the expansion of urban areas. Table 9-3 shows preferable land use patterns along urban trunk roads. Road side areas especially interchange areas will be suitable for industry and residential areas and should be cordoned by the buffer zone.

9.4.3 Case Study of Road Side Area Development for Environmental Preservation

1) Selection of the Study Zones

For a case study of road side area development, a zone in Bangi and Kajang area is selected as shown in Figure 9-4. This zone is a part of the environmental countermeasure application zone based on the following considerations :

- The zone is conceptually formatted as one of the future town area as road side area development along the proposed highway.
- The planned interchange of the North-South Expressway and the KLORR will weave the zone. This wil be increasing pressure to form the town area.
- For this zone, the existing towns are clearly recognized. Kajang is a regional center and Bangi is a new town. The area between Kajang and Bangi is in the process of forming up a strategic corridor development that will complete the urbanisation of Kajang and Bangi.

2) Condition to make Layout Plan

- Accurate clarification of the alignment of the KLORR.
- Based on the prevailing land use along the KLORR, the potential constraints on the construction of proposed road including the application of laws or policies in controlling the project will be explained clearly.
- Land readjustment area and the scale of the buffer zone have to be identified as detail as possible so that the design of the road side block and the land use plan can be determined.
- When blocks of road side area is planned, the block should function as a buffer zone for areas back side of the block. Land use of such road side block will prefarablly be commercial or industrial.

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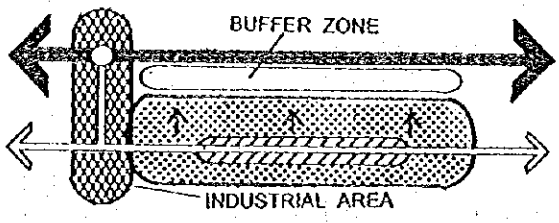
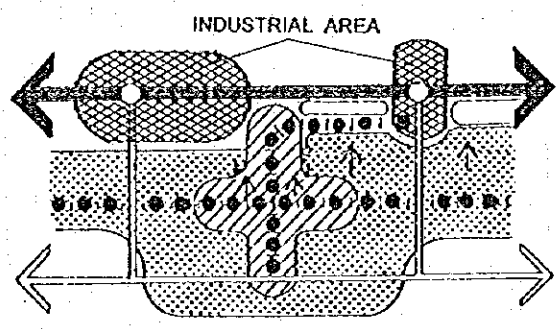
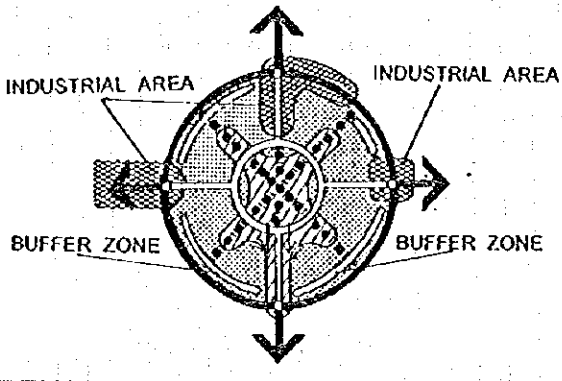
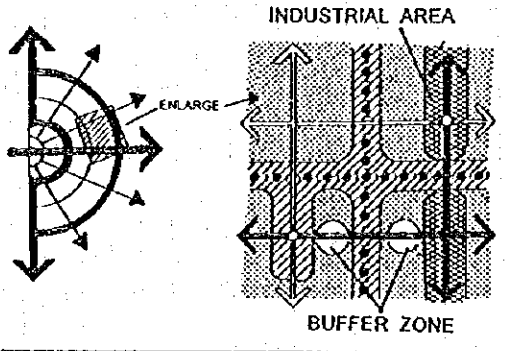
1. Bypass Pattern The area near the interchange is normally developed as an industrial zone. If the town area is expanded to the highway, the formation of a residential area can be constrained with the provision of a buffer zone.	
2. Ladder Pattern The interchange area is normally cordoned by the industrial zone. If the town area is expanded to the highway, the land use for commercial purposes is allowable. However, the expansion of residential areas to the road side should be constrained with the provision of the buffer zone.	
3. Radial and Ring Pattern The area near the interchange is normally developed into a mixed industrial and commercial zone. Residential areas are cordoned by the buffer zones	
4. Grid Pattern The area near the interchange is normally developed for residential purposes. Residential areas are cordoned by the buffer zones	

Figure 9-3 : Basic Consideration for the Road Side Development

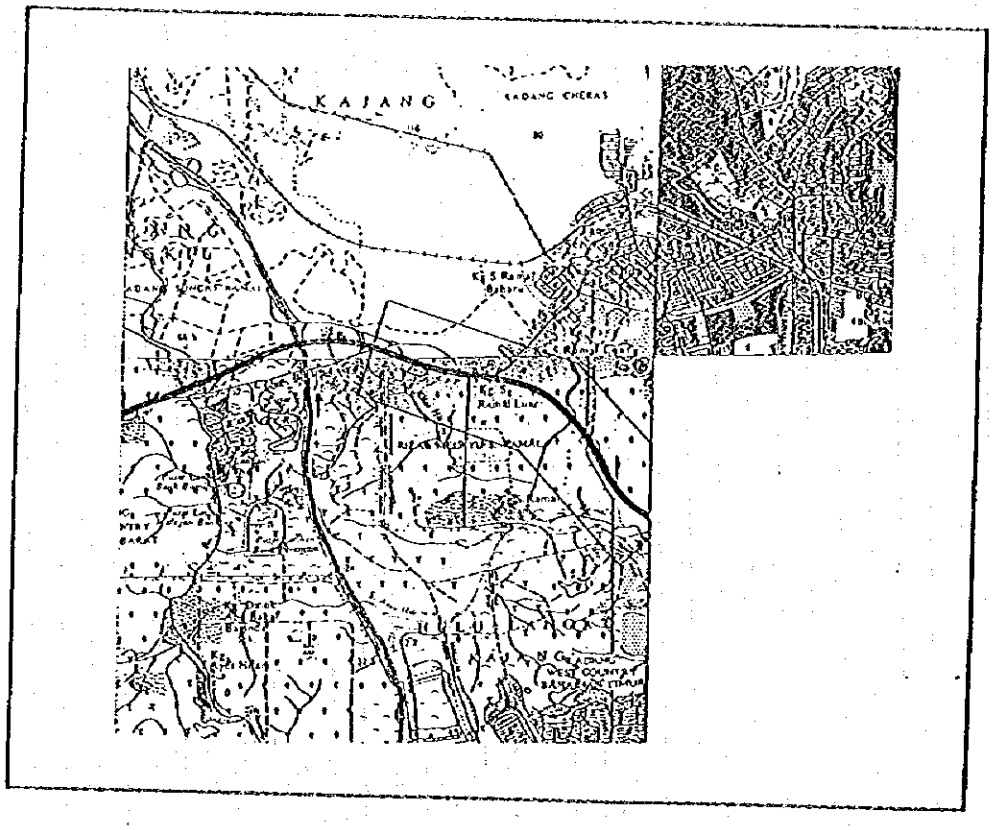


Figure 9-4 Case Study Area for the Road Side Area Development

If the road side block is planned as a residential area, the house should be a type of link terrace house or condominium of medium height. The buildings can function as a noise barrier.

- Based on the above consideration, buffer zone and block formation are designed for the zone as shown in Figure 9-5. Figure 9-6 shows artist's impression of the road side area development.

Table 9-5 : Application of the ROW Width including Buffer Zone

Road Side Land Use		Type	ROW Width,(m) (B.Z)
Residential Area (Dwelling Unit of a Major Area)	Generally	B	100 (21.05)
	Specially where the place is a quiet environment (hospital, school etc)	C	120 (31.05)
Industrial Area		E	80 (11.05)
Open Space Area		D	60 (13.05)

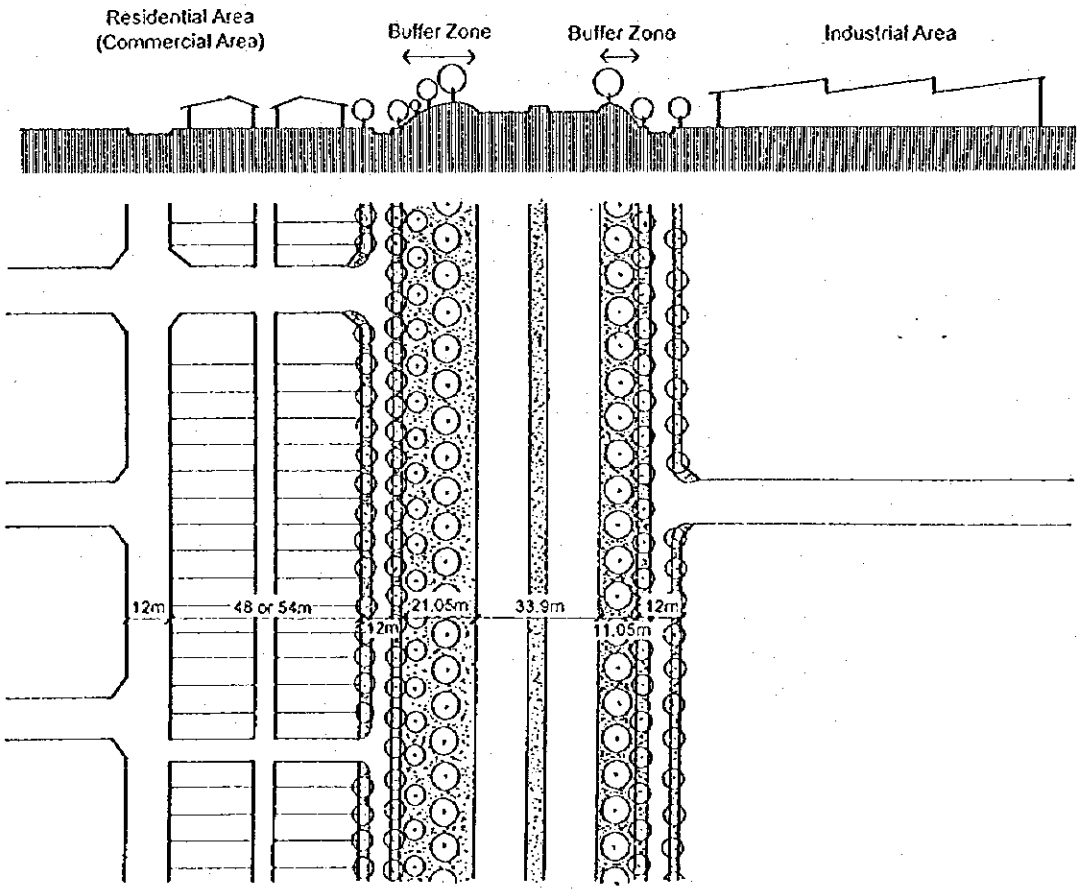


Figure 9-5 : An Example of the Provision of the Buffer Zone and Block Formation

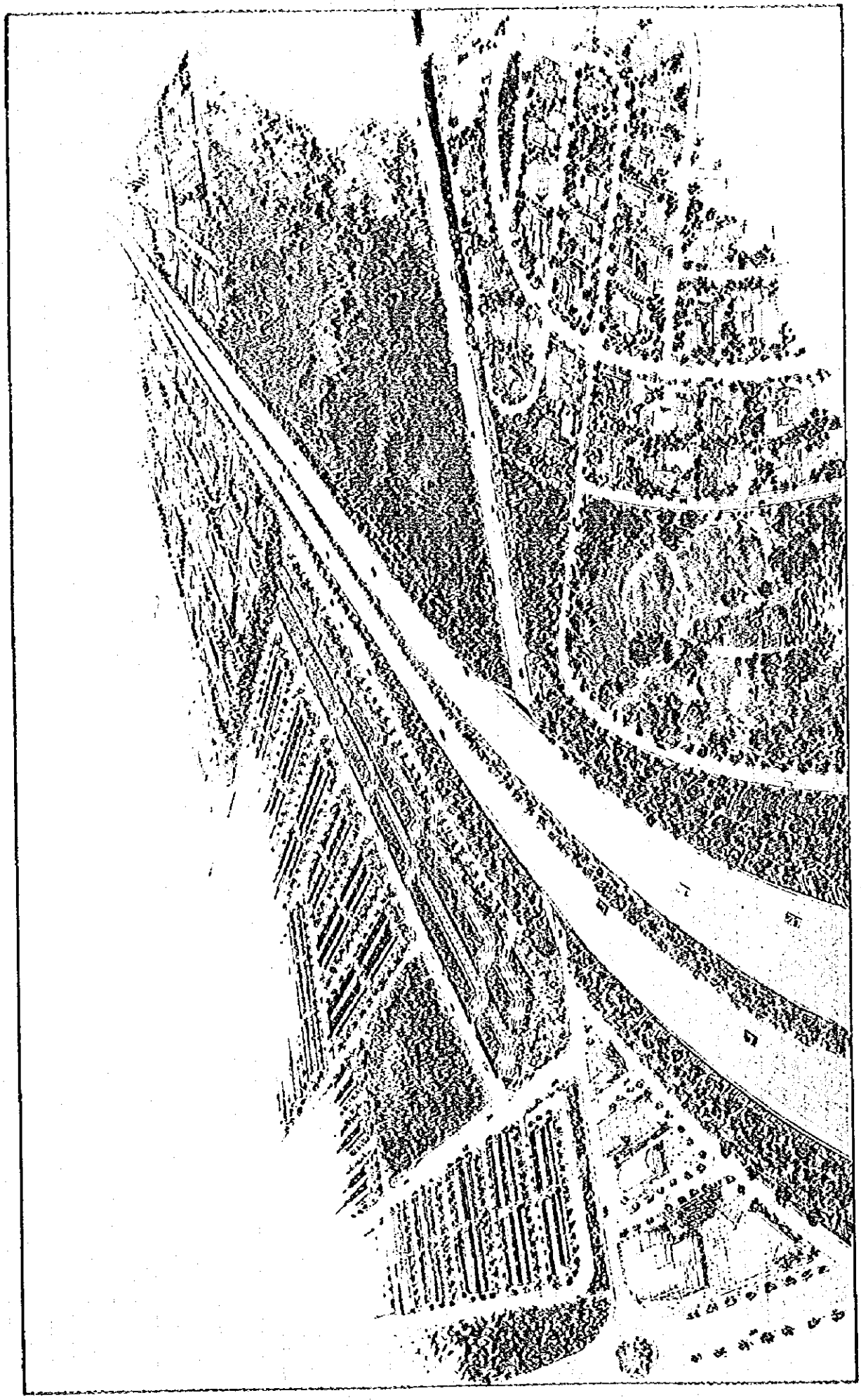


Figure 9-6 : Artist's Impression of the Road Side Area Development

Chapter 10

MAINTENANCE AND OPERATION

CHAPTER 10 MAINTENANCE AND OPERATION

10.1 Operation Plan of the KLORR

The KLORR will be a ring road surrounding the built-up area of Kuala Lumpur. Considering the important function of the KLORR as mentioned in Chapter 5, the KLORR should be kept in good condition in order to maintain smooth traffic flow, safety and users' comfort after its opening to traffic.

Maintenance and management of the expressway can be divided into two aspects:
(1) Maintenance of road and related facilities in normal conditions, and
(2) Management of traffic in safe and comfortable conditions.

As the KLORR will be operated as a toll highway, the toll collection system will be another matter of concern for the operation. This includes maintenance of toll booths, management of toll collectors and record of traffic and toll collections.

The plans for maintenance and operation for the KLORR have to be made after taking into consideration their standards as well as the past experience of the existing expressways and highways. The issues of road maintenance and traffic operation were identified in the report entitled "Study on Traffic Control and Management System of Malaysian Expressways and Toll Highways" by JICA in December 1989. These are:

(1) Insufficient traffic control and management measures
(2) Inadequate provision of safety facilities
(3) Poor road conditions in certain sections
(4) High traffic accident rate and vehicle breakdown incidents, lack of traffic accident data and analysis, and insufficient first-aid measures
(5) Insufficient maintenance that has resulted in less satisfactory condition of expressways, highways and tunnels
(6) Undesirable driving habits of expressway users and their lack of knowledge on safe driving and behavior
(7) Inadequate data collection and analysis on adverse weather conditions and incidents caused by such phenomena

10.2 Maintenance of Road

Maintenance and repair are essential to keep the roads and associated facilities in an initially-constructed or later-improved condition. This will ensure traffic safety, smooth traffic flow and comfort on the expressway.

1) Maintenance Work

The maintenance work can be classified as follows:

(1) Inspection
Inspections are performed to observe expressway, its related facilities

and devices where repair and maintenance deemed necessary so that no hindrance to traffic will occur.

(2) Road Cleaning

Road cleaning involves removing dirt and trash from the road surface and various facilities to keep the surface clean and avoid traffic obstruction.

(3) Vegetation Control

Vegetation control consists of cultivating new growth, maintaining fully-grown vegetation and renewing old and falling vegetation. Grass, plants and trees can then fulfill their intended purpose of providing mental refreshment for drivers, creation of scenic beauty and conservation of the environment.

(4) Repairs

Repair of pavements, earth works, traffic control and safety facilities, bridges, tunnels, etc.

(5) Maintenance of Road Fixtures, Fittings and Equipment

This includes the inspection, maintenance and repair of buildings, machinery, electrical equipment and communication facilities.

2) Maintenance Works and Scheduling

The maintenance work on the KLORR will be divided into three components like other expressways or highways, namely:

(1) Routine Maintenance

Routine maintenance tasks include daily inspection of roads, structures and other related facilities. Objects of inspection cover pavements, embankments, bridges, tunnels, landslides, fences, guardrail, signboards, etc. This daily inspection is aimed at early detection of any defects, damage, wear and tear of structures and facilities on the expressway. The results of the inspection are reported back for follow-up maintenance work, if necessary.

(2) Periodical Maintenance

Periodical maintenance involves a detailed inspection and checking and testing the condition of various facilities at certain fixed time intervals. As the name suggests, maintenance is performed by fixed time cycles, such as yearly or half-yearly, monthly or weekly, depending on the type of facility and maintenance items. Defects or

damage is promptly reported for repairs or remedies. Periodical maintenance also covers the task of cleaning the pavements, signboards, guardrail and other facilities, such as the upkeep of vegetation along the expressway, cleaning tunnel walls and painting.

(3) Incidental Maintenance

Incidental maintenance is work carried out to restore the expressway and related facilities to their normal functioning conditions after they have been damaged during road accidents or natural disasters (such as landslides, avalanches, etc). Figure 10-1 shows the types of maintenance works.

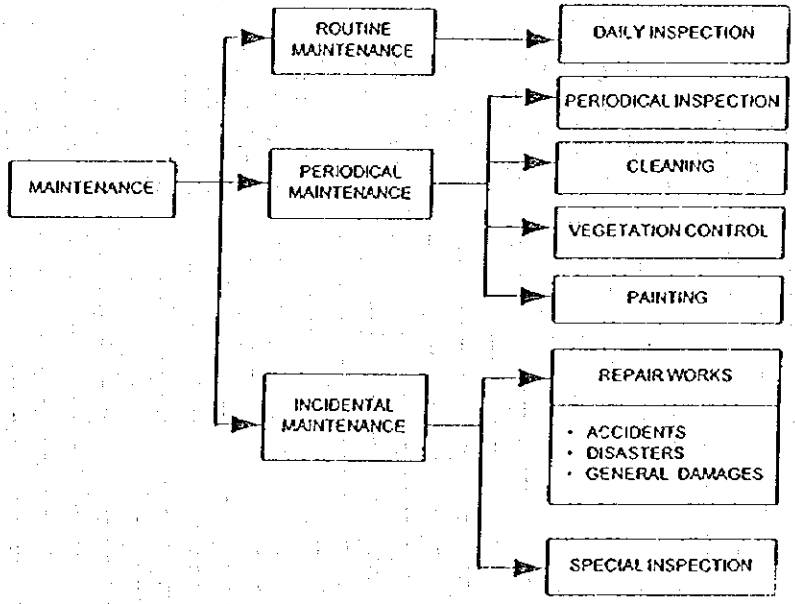


Figure 10-1 : The types of Maintenance Works

3) Traffic Control for Road Maintenance

A certain road maintenance activities require closing of a part of the expressway. This creates a disturbance to traffic flow. To minimize the possibility of accidents, traffic congestion, inconvenience to road users, and also prevent workers from danger, road maintenance planning and appropriate traffic control are essential.

Road maintenance work has to be carried out with traffic control and regulation depending on work content, to minimize disturbance to traffic flow and accidents. The types of traffic control for maintenance and restoration work after an accident are:

- closure of road shoulder
- closure of lane
- closure of one direction carriageway

- temporary reduction of speed limit

During the application of these controls, it is important to inform road users of the traffic control conditions undertaken and to warn on-coming vehicles of danger ahead.

10.3 Traffic Control and Surveillance

The KLORR will be an expressway to be operated with full access control. The traffic will be high speed and high volume. To operate this kind of road properly, a suitable traffic control and surveillance system should be introduced in order to maintain traffic well, to rescue those who are involved in accidents and to restore immediately to a normal condition.

As traffic volume increases, the occurrence of incidents or accidents on the expressway will affect traffic not only on the expressway itself but also on its connecting roads. The traffic control and surveillance system aims to detect these occurrences and minimize the influence of the incidents by presenting adequate information to drivers and controlling traffic flow.

1) Basic concept

According to the 1989 Report "Study on Traffic Control and Management System of Malaysian Expressways and Toll Highways" by JICA, traffic control and management systems of the KLORR should be classified as level 3, which is the highest grade, based on the estimated traffic volume of more than 50,000 pcu/day.

With further growth in traffic demand, increased dependence on the expressway and highway system, and social demands or awareness for higher level of traffic safety, convenience and comfort, additional and new types of traffic surveillance and information dissemination facilities have to be installed to meet such needs. Service levels will be upgraded to Traffic Management Level 3. Response times to an incident will be improved and various means of conveying information will be provided to cope with the many requirements of road users.

This level will be necessary for all sections facing daily traffic congestion where the danger of secondary incidents is high. Even for minor incidents, quick countermeasures are necessary, as even minor incidents would cause severe congestion and other adverse effects.

Besides, the KLORR will pass through mountainous regions containing tunnels and bridge sections. This needs a high level management service which will include such functions as detection of incidents by CCTV and vehicle detectors, detection of land-slide by automatic measurement devices, and also, information conveyance to road users before the entrance of tunnels by changeable message signs. Furthermore, it may be necessary to establish additional traffic management systems for long tunnels.

2) Traffic Operation Functions

It is essential to introduce traffic control and surveillance systems to the KLORR in order to achieve three goals, namely: (i) ensuring smooth traffic flow, (ii) traffic safety and (iii) users' comfort on this expressway.

This system has three functions: (1) traffic control, (2) road and traffic surveillance and (3) toll operation.

(1) Traffic control

Traffic control includes not only the general traffic control on the expressway under normal conditions, as carried out by the expressway or police patrol units along the expressways daily, but also emergency measures for controlling traffic under unusual conditions. Such unusual conditions may include in case of traffic accidents, adverse weather phenomena (torrential rain, heavy thunderstorms concentrated in a small area, strong winds, fog, etc.) and traffic regulations for improvement works such as widening of carriageway, construction of additional ramps, pavement repairs, etc.

During such emergencies and accidents, disasters, and during maintenance work, the various traffic control measures will be undertaken following the provisions of traffic laws and regulations. These include such measures as temporary closure of a lane or even a section of the expressway and the temporary reduction of the speed limit .

(2) Road and traffic surveillance

Traffic surveillance is aimed at collecting information on traffic conditions using such equipment as vehicle detectors, closed-circuit television cameras, helicopters, emergency telephones, and other means, eg: cooperative / helpful motorists, mobile telephones, patrol vehicles, etc. Information on weather conditions using such weather observatory equipment as rain gauges and anemometers will also be useful. Some of these methods will yield quantitative data while others will provide incidental information. Traffic information collected and processed is interpreted by traffic engineers and passed on to the police or patrol personnel for traffic control.

(3) Toll collection operations

The main tasks of toll collection include issuing tickets to drivers using the expressway at entrance toll gates and collecting of toll fee at exit points. The other tasks are maintenance of toll booths, management of toll collectors and record of traffic and toll collections.

3) Necessary Equipment

To ensure the necessary standard of performance of level 3, the equipment mentioned below should be installed:

(1) Vehicle Detector

Vehicle detectors should be installed to obtain information of each section between interchanges and every entrance and exit rampway.

(2) Weather Observation Equipment

Weather observation equipments, such as rain gauges and anemometers, should be installed at appropriate locations.

(3) CCTV Camera

Close Circuit Television Cameras should be installed at strategic and important locations, and in the tunnels, to observe traffic conditions.

(4) Emergency Telephones

Emergency telephone sets should be installed at 1 km intervals throughout the entire length of the KLORR.

(5) Changeable Speed Limit Signs

Changeable speed limit signs should be installed in the mountainous regions and stretches with high traffic volume.

(6) Changeable Message Signs

Changeable message signs should be installed to give information on road accidents, etc, at strategic and important points such as:

a) Upstream of interchange diverging points
b) Upstream of tunnel entrances
c) Entrance gate or plazas
d) Access roads

(7) Highway Radio

Radio broadcasting antennas should be installed at important sections along the road to provide information that cannot be given by changeable message signs, through the road users' car radios .

(8) Radio Broadcasting

A radio broadcasting system should be operated from the Control Center to disseminate information on incidents and traffic conditions.

(9) Communication Network

A communication network should be installed to cover the entire length of the KLORR.

(10) Information Counters

An Information Counter should be established at the rest and service area.

4) Management Office

To undertake the aforementioned activities, the following offices should be established along the KLORR:

(1) Maintenance Office

Maintenance Office(s) should be established at appropriate locations to maintain the whole of the KLORR. It should be at or near the interchanges, which will be a convenient place to commute for personnel and the workers carrying out the maintenance activities.

(2) Tunnel Maintenance Office

Tunnel Maintenance Offices should be established at long tunnels, to survey the operating conditions of tunnels, such as lighting and ventilation, and rescue disabled vehicles and people involved in accidents.

(3) Toll Operation Office

Toll Operation Offices should be established at important interchanges to gather toll collections and to store trip records.

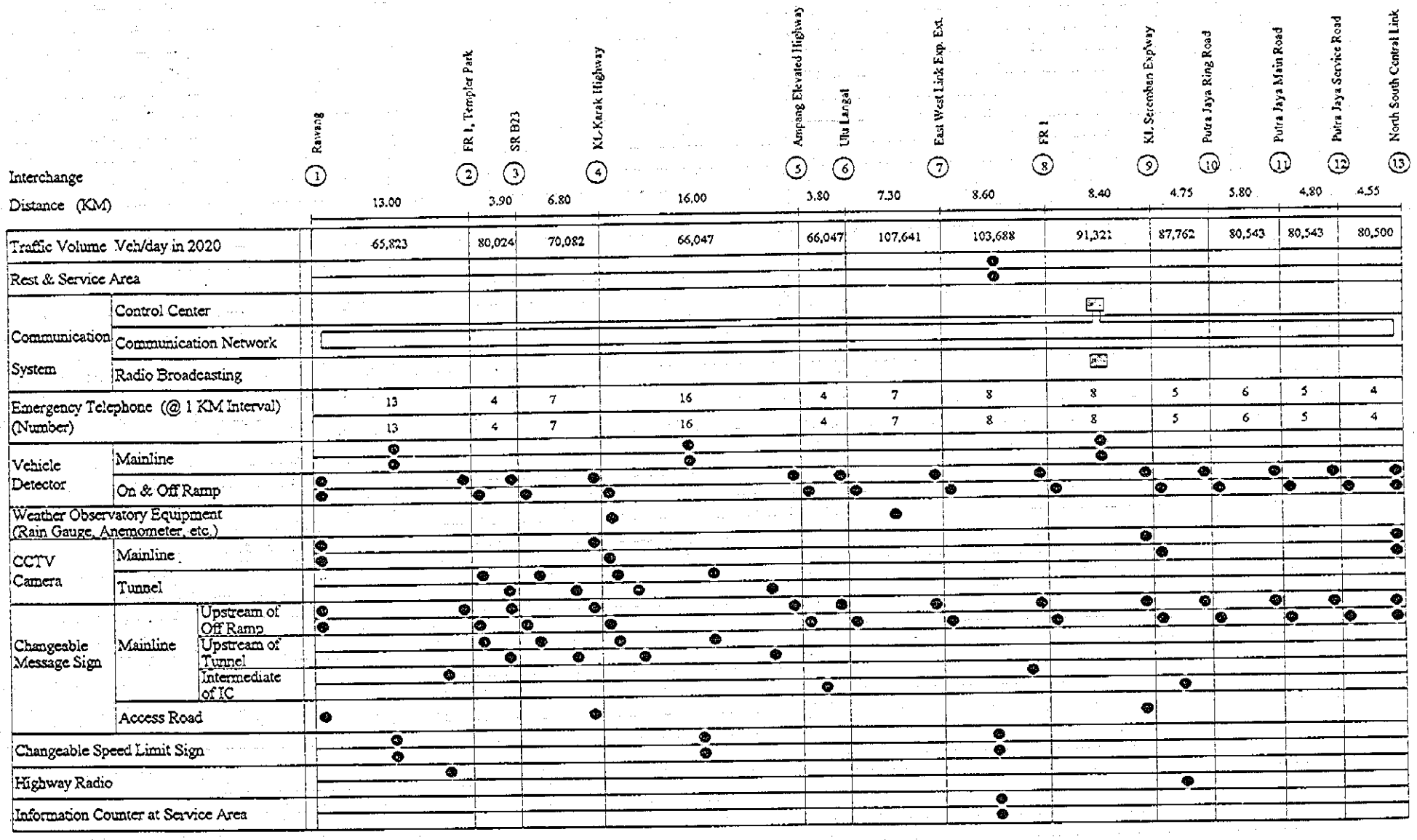
(4) Traffic Control Center

A Traffic Control Center will carry out the functions of traffic control and surveillance. It will be equipped with control panels, control consoles, a radio transmission system, data processing facilities and so on. It is recommended that it should be located in the same office as the Maintenance Office.

5) Traffic Control and Surveillance Plan for the KLORR

It is preferred that a Traffic Control and Surveillance system be introduced for the KLORR. Initially, the system would be in the low level, but depending on the demand, it would be leveled up step by step. An example of this plan, based on the aforementioned guidelines, is given in Figure 10-2.

Figure 10-2 : An Example of Traffic Control and Surveillance Plan for Site Equipment on the KLORR



10.4 Operation of the KLORR as a Toll Road

The KLORR will be operated as a toll highway under a privatization scheme. It is proposed that the toll system of the KLORR be a "closed-system". This means toll booth will be installed at entrances and exits to the KLORR

The main tasks of the tollway operations are:

a) Issuance of tickets to road users at the entrance booths.
b) Collection of toll fees at the exit booths of the KLORR.
c) Maintenance and repair of toll operation facilities and equipment.
d) Record of road users' trips.
e) Distribution of revenue to concession companies.
f) Agreement among concession companies.
g) Management of the whole tollway operations.

The details of special and important tasks are as follows:

(1) Record of trips

Daily records of every vehicle trip should be stored at the exit toll booths. The collected toll revenue for the day will be tallied against the trip records. If the difference between them is considerable, an investigation would follow.

Trip records of length and toll fees should be stored separately by the concession companies which manage the KLORR and the other connected toll expressways.

(2) Agreement among concession companies

An agreement should be made among concession companies which manage connected toll expressways regarding the distribution of collected toll revenue based on trip records.

10.5 Improvement of Traffic Safety Environment

The purpose of this section is to reconsider and establish the countermeasures of traffic environment (especially in the mountain areas and urban by-passes) from the standpoint of service levels and traffic safety not only on the existing highways and expressways but also on the proposed KLORR.

This discussion will focus on road environment and traffic safety, based on the drivers' behaviour and data on past experiences. The driver interview survey conducted in the mountain areas was the first case in Malaysia where opinions and observations regarding road and traffic safety were obtained from the road users. It is important and necessary to consider the amelioration of the traffic environment from the engineering as well as the road users' standpoints.

10.5.1 Improvement of Traffic Safety in Mountain Side Section

The improvement plan is proposed in the traffic management aspect for the mountain section of the KLORR, based on the results of the driver interview survey.

1) Installation of Equipment for Hazard Control

Anxiety about road side landslides, especially in a rainstorm, is the biggest concern of drivers during their travel in the mountainous area. It is important to be able to predict a hazardous situation before it happens, based on data obtained by automatic measuring equipments.

In order to keep a high level of traffic safety and also prevent the occurrence of further accidents, the following equipments should be installed in the section of the mountain area:

(1) Automatic Observation Equipment for Land Slope

The equipment has several functions, such as measuring the expansion and contraction of land, pit inclination, slope inclination, and the processing and recording of such data. This system is shown in Figure 10-3.

(2) Rain Gauge

In the mountain area, it frequently downpours with large amounts of rain water. Therefore, it is required to provide this area with rain gauge equipment. At present, as there is no such equipment, drivers have to make decision whether to continue driving or stop under heavy rain conditions.

(3) Anemometer or Streamer

Wind is one of weather characteristics in the mountain area, especially hazardous on embankments or long bridge sections. From a safety point, strong side direction winds have to be observed and monitored.

The streamer shown in Figure 10-4 is a simple equipment, but is very useful in showing the wind intensity and direction to drivers.

Most drivers on the expressway request information on weather conditions and traffic regulations before they arrive at the location. Therefore, it is necessary to provide an information system such as changeable message signs, radio systems and so on, to convey up-to-date information to drivers.

2) Safety Improvement in Tunnels

The survey results in the Karak highway revealed several items about tunnel safety. A new tunnel is under construction for widening to dual carriageway

and safety measures will be upgraded.

The poll on drivers' opinions and observation of tunnel safety on the N-S Expressway showed higher and better results than the Karak Highway. In fact, there is a difference in the concerns of users of the Genting and Ipoh Tunnels. For the Genting Tunnel users, accidents were the greatest worry, whilst for the Ipoh Tunnel users, an escape route in the event of an accident is their foremost concern.

Safety measures for the KLORR tunnels are expected to be provided on the same or higher level to those provided in the Ipoh Tunnel.

(1) Inside Tunnel

To maintain the service level of the KLORR, same improvements as in the Ipoh Tunnel should be considered as follows:

- Provide guide signs to indicate escape route(s) to tunnel users.
- The condition of the existing guide signs is not good because it is difficult to locate them inside the tunnel.
- Larger and higher-visibility signs are to be set up.

(2) Outside Tunnel

Same as for both the Genting and Ipoh tunnels, it is strongly advised to have guidance and warning signs as shown in Figure 10-5, which should be installed in front of the tunnel entrance.

When an accident, fire or vehicle breakdown occurs inside the tunnel; it is very important to make other drivers aware of it in order to prevent any further accident and therefore to minimize damage.

It is very important to prohibit further drivers from entering the tunnel when an accident has occurred.

3) Safety Measurement in Hazard Sections

(1) Steep Slopes and Sharp Curves

The survey results show that steep slopes and sharp curves are hazardous sections on highways and expressways. In fact, drivers are of the opinion that the most hazardous points are on sharp curves and down slope sections.

It is highly advisable that safety measures be set up on sharp curves and downward slope sections on the KLORR. For example, it is necessary to install delineators and side guiders.

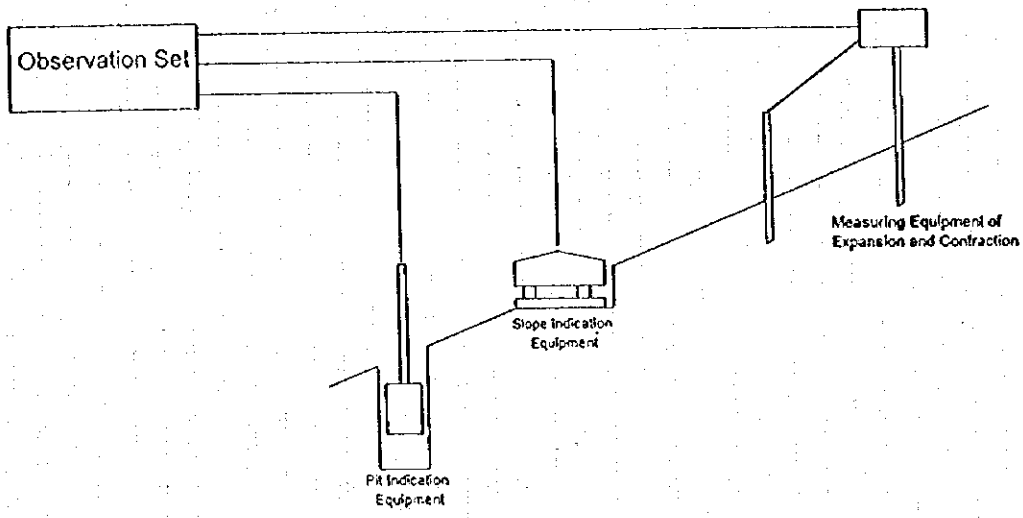


Figure 10-3 : Land Slope Observation Equipment

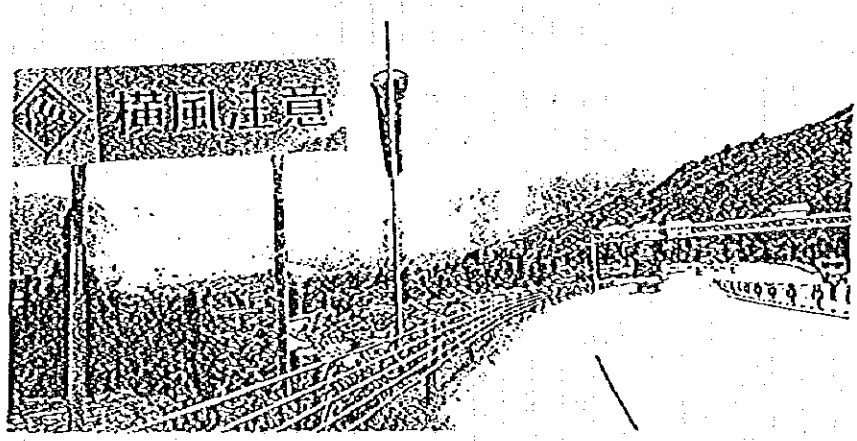


Figure 10-4 : Streamer

(2) Long and Straight Sections

It is known that the long and straight sections of an expressway / highway are inclined to be the "black spots". The monotonous driving environment in these long and straight sections can lead to "unconscious driving" and sometimes even hypnosis. "Unconscious driving" on these sections can result in short headway which is the main cause of rear-end collisions.

10.5.2 Improvement of Traffic Information Dissemination to Road Users

It is useful and important to give traffic information to drivers to keep smooth traffic flow, to provide a good service on the KLORR. The traffic information guide for the KLORR is useful for traffic management especially in the urban areas.

Three levels of traffic information guides are defined to meet the requirements. These levels are recommended to be improved step by step in the future.

1) Traffic Information Service Level 1

Level 1 forms the basic requirement of road users for a traffic information system. Fundamental information has to be given to drivers. Road guidance signs are essential on the main road of the KLORR as well as the linked roads and streets.

Sometimes, existing guidance signs are not clear and thus be easily misunderstood causing drivers to be confused which may lead to dangerous behaviour on the highway/expressway. Therefore, easy to understand signs must be installed at adequate locations on the KLORR.

2) Traffic Information Service Level 2

Level 2 aims to give real time information on traffic, roads, weather, etc. to drivers by means of changeable message signs, radio broadcasting, etc. However road users usually do not know the cause of a congestion - whether it is caused by a natural disasters or an accident. To inform road users of the cause means a higher level of service.

Changeable message signs should be installed to convey the cause, the length of the traffic queue and the location of the congestion. An example of this equipment is shown in Figure 10-7.

Traffic information via radio broadcasting has already been introduced in Malaysia, though it is mainly restricted within the Kuala Lumpur boundary at present. The frequency of broadcasting is 3 to 4 times per hour but information in detail is required as level 2.

3) Traffic Information Service Level 3

Level 3 has a high level function, giving more detailed information to drivers so that they can choose the best route from alternative routes. This function is also useful not only to distribute traffic from congested routes and to solve the congestion, but also to mitigate the driver's anxiety.

Changeable diagrammatic signs using LED can give the detailed information such as travel time in minutes, congestion level by color and traffic conditions on two or more parallel roads.

Figure 10-8 shows an advanced message sign board to give detailed information to drivers.

4) Road users always require detailed and accurate information such as road, traffic, weather, occurrence of incidents or accidents to enable them to drive safely, smoothly and comfortably. Thus, it is necessary to improve the traffic information system of the KLORR depending on the users' opinions and requests.

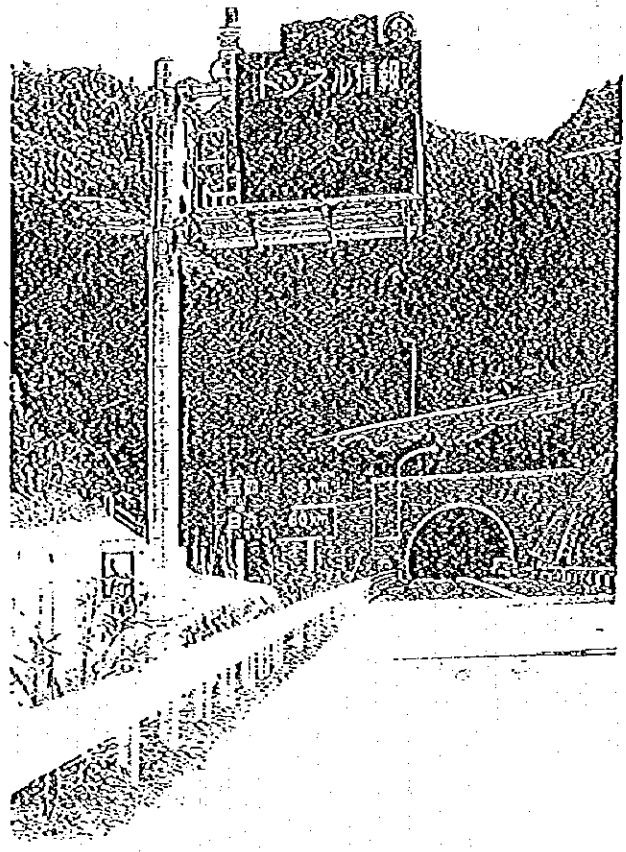


Figure 10-5 : Tunnel Guide and Warning Sign

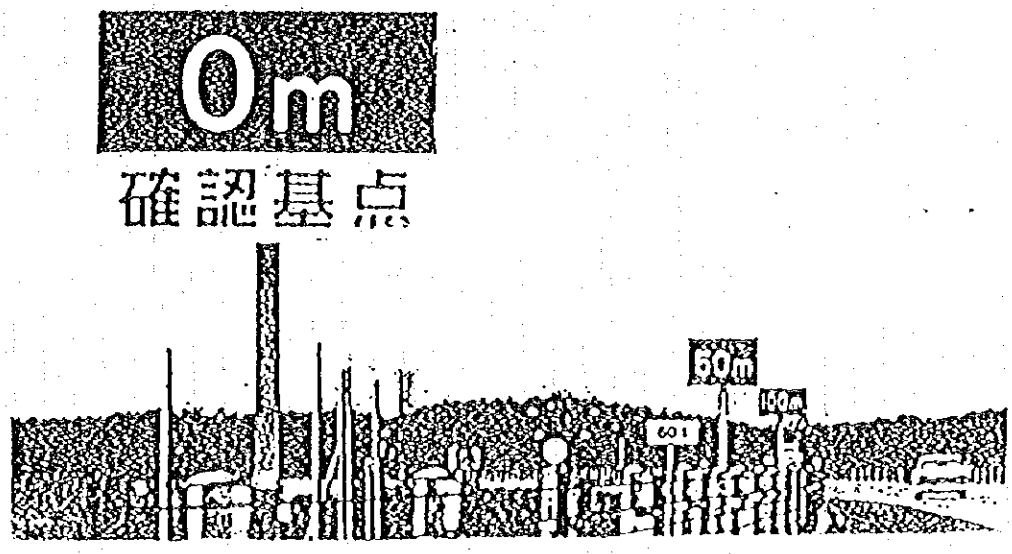


Figure 10-6 : Safety Gap Sign

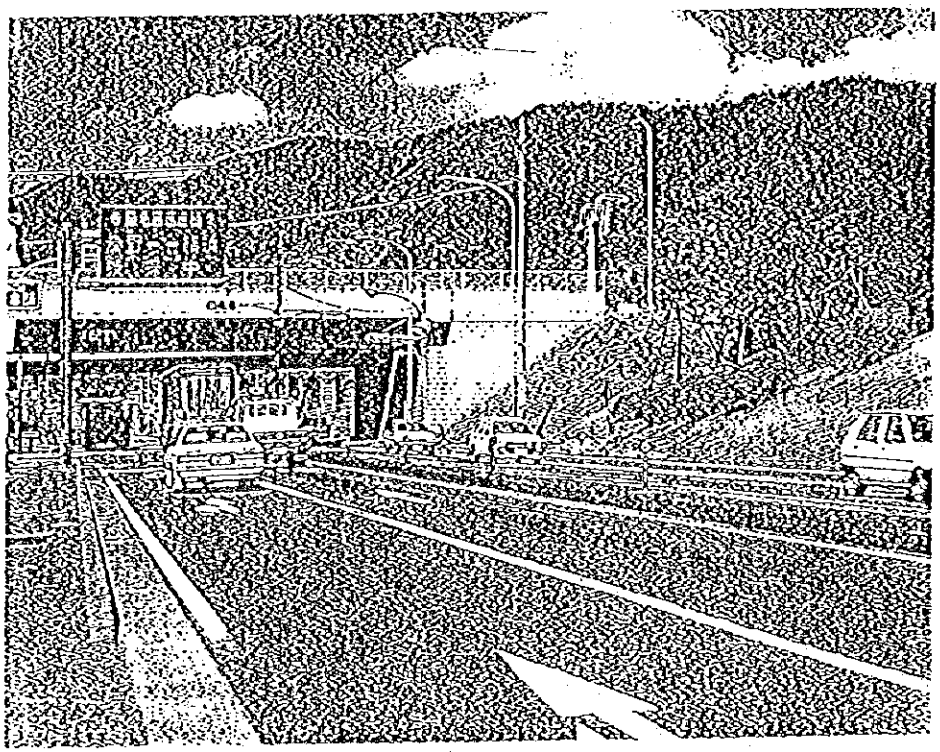
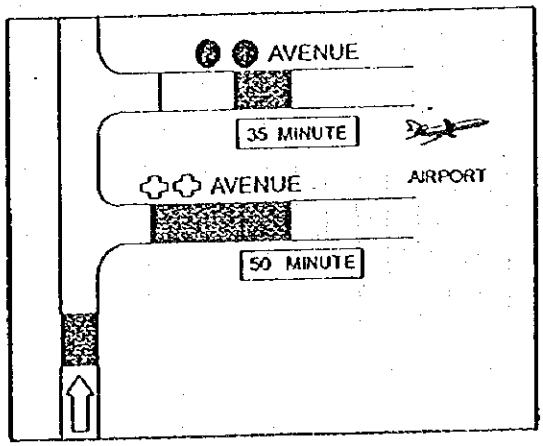


Figure 10-7 : Changeable Words Message Sign



LEGEND:

CONGESTION

VERY CONGESTION

NO CONGESTION

Figure 10-8 : Changeable Diametric Message Sign

Chapter 11

PROJECT COST ESTIMATES

CHAPTER 11 PROJECT COST ESTIMATES

11.1 Basis for Cost Estimates

The cost for the project road consists of two elements as follows:

(1) Construction cost including land acquisition and compensation cost,
(2) Road maintenance and operation costs including environmental monitoring.

The construction cost of each road section is estimated on the following basis :

1) The direct construction cost is estimated by the quantity take-off of construction work items based on the preliminary engineering plans.

2) The unit price of each work item is determined based on the economic conditions prevailing in 1995.

3) The cost of each work items is obtained by multiplying quantity and unit price in Malaysian Ringgit (RM).

4) Land acquisition includes land costs and compensation cost for the demolished properties and the relocation of public utilities.

5) The cost of facilities for road maintenance, traffic management and environmental monitoring is estimated at 1% of the direct construction cost

6) Service fees for consulting, supervising and final engineering is estimated to be 5% of the total direct construction cost.

11.2 Estimated Construction Cost

1) Total Construction Cost

The total construction cost of the final plan in 1995 prices is estimated as follows :

Table 11-1 : Total Construction Cost

Description	Amount	
Direct Construction	RM	3,944.6 million
Land Acquisition	RM	464.5 million
Engineering Cost	RM	197.3 million
Environmental Protection Cost	RM	39.5 million
Total	RM	4,645.9 million

2) Total Construction Cost of each Section

The implementation of the project will be carried out under the staged construction scheme and the cost of each road section in 1995 prices is estimated as follows :

Table 11-2 : Construction Cost of each Sections

Section	Length (m)	Construction Cost	Land Cost*	Engineering Cost	Environmental Protection Cost	Total of Cost
Section 1-1	10,490	520.2	29.5	26.0	5.2	580.9
Section 1-2	12,340	687.2	69.7	34.4	6.9	798.2
Section 2-1	23,000	1,042.7	183.9	52.1	10.4	1,289.1
Section 2-2	14,580	605.2	42.7	30.3	6.1	684.3
Section 3-1	10,200	352.1	55.3	17.6	3.5	428.5
section 3-2	18,300	737.2	83.4	36.9	7.4	864 .9
Total	88,910	3,944.6	464.5	197.3	39.5	4,645.9

Note : * : Land Acquisition and Compensation

3) Direct Construction Cost for Structures

The direct costs of construction of structures are estimated as shown in Table 11-2. The amounts are slightly higher than the costs estimated in alternative route study shown in Table 7-2. Structures such as tunnels and bridges are required in view points of environmental protection as follows:

1) Tunnel

Although the length was reduced, number of tunnel increases so as not to make the cutting slope too high.

2) Bridge

As bridges were designed to cross streams on 1:5,000 map which could not see by mosaic photograph at alternative route study, the number of the bridges increased so as not to make embankment too high.

The direct cost of construction of each structure is estimated as follows:

Table 11-3 : Direct Construction Cost for Structures

(Unit : Million RM)

Description	Quantity	Foreign	Local	Amount
General	L.S.	67.3	127.2	194.5
Road Work	58,190m	270.2	322.4	592.6
Bridge	21,430m	712.6	684.6	1,397.2
Tunnel	9,290m	638.3	318.6	956.9
Interchange	13 locations	252.4	505.5	757.9
Miscellaneous		3.1	2.4	45.5
Total		1943.9	1960.7	3,944.6

11.3 Road Maintenance and Operation Cost

1) Road Maintenance

Road Maintenance is essential to preserve and keep roadways, roadside structures, vegetation and related facilities such as traffic control devices in their original condition.

Road maintenance work is categorized into 3 ; (i) inspection tasks, (ii) periodical maintenance tasks and (iii) heavy repair tasks (which are carried out in 5-year intervals).

The cost estimate for the above 3 categories are as follows :

Inspection costs (per year)	-	Inspection and patrolling costs
Maintenance costs (per year)	-	Cleaning costs
	-	Repair costs
	-	Electricity costs
Heavy repair costs (every five year)	-	Pavement overlay costs

2) Toll Operation

The toll operation work consists mainly of toll management and toll collection. The cost estimates are made for the following items :

- Supervision of tollway operations
- Maintenance and repair of tollway facilities and equipment
- Traffic control and provision of information during the occurrence of incidents on the road
- Administration

As for the toll collection aspect, manpower is required in everyday operation.

3) Environmental Monitoring

The environmental quality monitoring programme for the KLORR consists of the following items :

- Air quality monitoring programme
- Noise quality monitoring programme
- Water quality monitoring programme

The estimate includes the cost of data collection and analysis for each programme and also the cost of an additional laboratory test, site inspection and audit survey.

4) Cost of Maintenance, Operation and Monitoring

The summary of maintenance costs for every year and for every five years, the toll operation costs and the environmental monitoring costs are as follows:

Table 11-4 : Total Cost of Maintenance, Operation and Monitoring

(RM in Thousand)

Road Maintenance (per year) Toll Operation (per year) Environment Monitoring (per year)	RM RM RM	10,800 7,556 213
Total for each year	RM	18,569
Heavy Repair (every five years)	RM	11,730

5) Cost of Maintenance and Operation Cost of Each Section

Table 11-5 shows the maintenance and operation cost of each section of the KLORR.

Table 11-5 : Maintenance and Operation Cost of Each Section

(Unit : RM in Thousand)

Section	Length (m)	Annual Cost		Total of Annual Cost	Per 5 year Cost Maintenance
		Maintenance	Operation & Monitoring		
Section 1-1	10,490	1,076	1,037	2,113	1,694
Section 1-2	12,340	1,266	1,215	2,481	1,588
Section 2-1	23,000	3,370	1,538	4,908	1,798
Section 2-2	14,580	2,133	973	3,106	1,991
Section 3-1	10,200	1,046	1,064	2,110	3,372
section 3-2	18,300	1,909	1,942	3,851	1,287
Total	88,910	10,800	7,769	18,569	11,730

Chapter 12

PROJECT EVALUATION

CHAPTER 12 PROJECT EVALUATION

12.1 General

The scheme of the KLORR has been formulated through the preliminary design as described in the previous chapters. There is no alternative plan regarding the main features such as alignment, cross section etc., thus the objective of the project evaluation in this chapter is to examine the economic and financial viability of the formulated scheme.

The evaluation procedure is shown in Figure 12-1. Firstly, the project to be evaluated is identified. Assuming a tentative schedule, where the project is implemented within the shortest period, a preliminary economic evaluation is carried out to find the high priority section. Based on this result, alternative implementation schedules are prepared. Then a financial analysis is under taken to find the various financial conditions to make the project feasible. Through this process, the most favorable implementation schedule is also identified. Finally, based on this schedule, the evaluation is made again from both the economic and financial viewpoints including a sensitivity analysis.

The sensitivity analysis for financial evaluation is made for the changes in various financial conditions including the GRDP growth rate of the Selangor State.

12.2 Economic Evaluation

Economic evaluation generally aims to find the economic feasibility by examining whether the project will bring about sufficient contribution to the national or regional economy based on the comparison of the cost and benefit. As mentioned above, the evaluation will be made three times for the following project cases.

(a) The proposed scheme as a whole based on the condition that the project is implemented during the years from 1997 to 2001 as shown below.

(b) The proposed scheme by section based on the same schedule assumed above. The section 2 is subdivided into two segments, since the section length is relatively long and requires large amount of construction cost.

Section 1 : The section from the North-South Expressway at the North to the KL-Karak Highway

Section 2 ; Segment 1 : The section from KL-Karak Highway to the Hulu Langat Road

Segment 2 : The section from the Hulu Langat Road to the Federal Route No.1 in the South

Section 3 : The section from the Federal Route No.1 to N-S Central Link

(c) The proposed scheme as a whole according to the implementation schedule was finally proposed in this study.

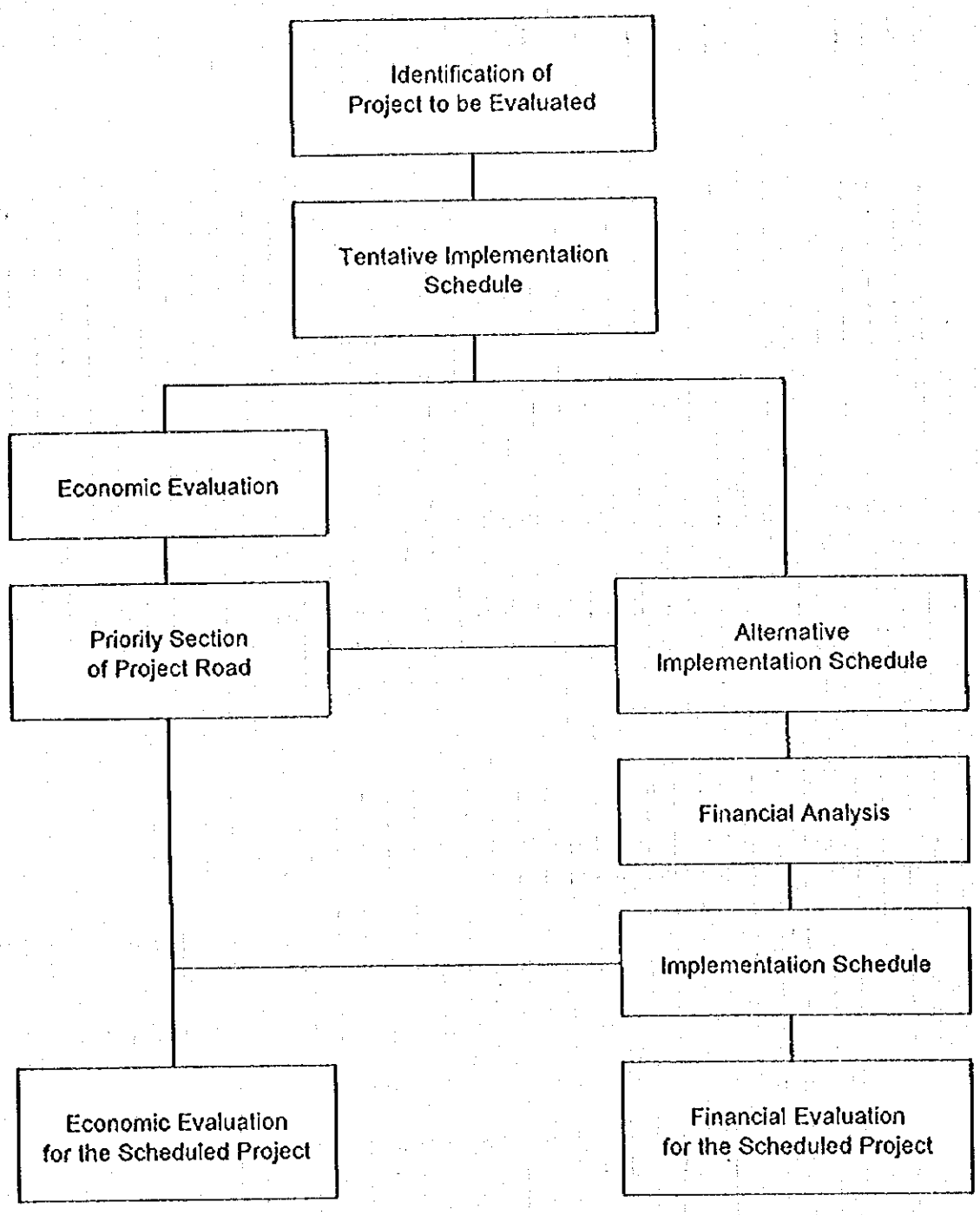


Figure 12-1 : Evaluation Procedure

For the evaluation, the following conditions are assumed.

(a) The life of the project is assumed to be thirty (30) years
(b) The discount rate is 12 % per annum.
(c) The implementation schedule is tentatively assumed as follows :

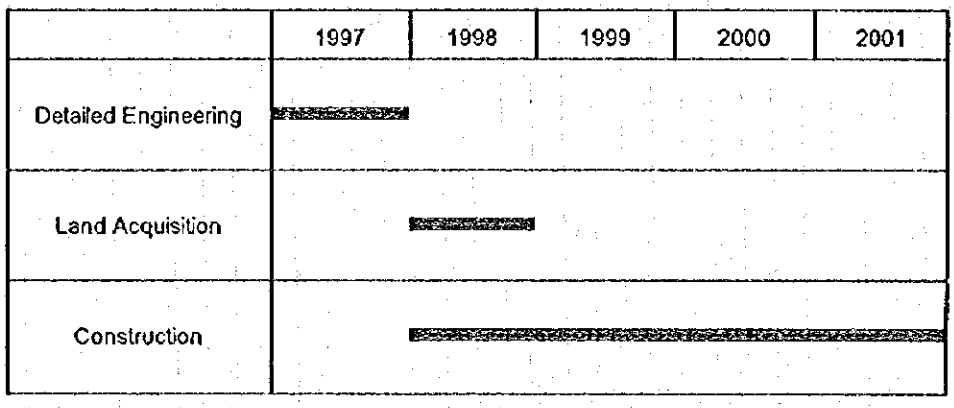


Figure 12-2 : Tentative Construction Schedule

As a result, the project road is assumed to be open to traffic in the year 2002.

12.2.1 Economic Cost

1) Economic Price

The economic evaluation uses the economic cost converted from the financial cost, which is calculated in market price. Market prices usually do not represent adequately scarcities of certain resources or surpluses of other resources and in addition, they are including indirect taxes or hidden subsidies which are transfer payments and not resources costs.

In order to convert the market price to economic price or shadow price, the national parameters, i.e, a set of conversation factors have been prepared by EPU.

The national parameters cover a comprehensive range of tradeable and non-tradeable goods. Accordingly, the national parameters are effectively utilized for estimating the economic cost after scrutinizing the appropriateness for their application.

(a) Skilled Labour

According to the Mid -Term Review of SMP, the unemployment rate dropped from 5.0 percent in 1990 to 3.0 percent in 1993. It is anticipated to further drop to 2.8 percent in 1995. This indicates that the Malaysian economy has reached a full employment level. This situation will be maintained as long as the recent economic growth is continued.

Hence, the market for skilled labour in Malaysia shows a scarcity, therefore, the opportunity cost may be adequately reflected in the market wage. As a result, the market wage is applied as the economic price.

(b) Unskilled Labour

The conversion factor from the national parameter is 0.78, which has been estimated under relatively higher unemployment rate. Based on the current unemployment rate, 2.8 %, the shadow wage rate is estimated to be 1.0, namely the market wage which can be applied for unskilled labour as well.

(c) Land

The area along the KLORR is presently used as a forest, agriculture and partly residential.

Land is freely traded except for the reserve land. Since the project corridor is located adjacent to the urbanized area, the development potential might be reflected in the market price. Accordingly, the market price will be applied as the economic price of land.

The reserve land, which is mainly government land, are not counted as the land acquisition cost in case of financial cost. However, these costs are to be included in the economic cost by estimating the unit price from the adjacent land cost.

(d) Other Cost Items

Project cost is desegregated into various costs of tradeable/non-tradeable goods such as construction materials, equipments and labour etc. Construction materials are further broken down into detail cost items such as cement, steel, asphalt etc. As for these materials and equipment costs, the conversion factors from the national parameters will be applied. The conversion factors for major items are as follows.

-	Cement	:	0.92
-	Steel	:	0.99
-	Asphalt	:	0.92
-	Plywood	:	1.00
-	Diesel Fuel	:	0.88
-	Construction Equipment	:	0.94

(e) Construction Cost

In order to estimate the economic construction cost, the financial cost estimated in the previous Chapter is broken down into basic cost items as mentioned above. By using conversion factors, the economic cost is obtained as shown in Table 12-1.

The total project cost in economic cost is estimated as RM4,371 million, which is about 6% less than the financial cost.

Table 12-1 : Project Cost

(RM '000)

	Section 1 N-S Expressway - Karak Highway	Section 2		Section 3 Federal Route 1 - N-S Central Link	Total
		Segment 1 Karak Highway - Hulu Langat Road	Segment 2 Hulu Langat - Federal Route 1		
Financial Cost					
• Design	60,397	52,136	30,358	54,446	197,337
• Land Acquisition	99,218	183,900	42,680	138,710	464,508
• Construction	1,207,447	1,042,717	605,162	1,089,318	3,944,644
• Environmental Protection	12,074	10,427	6,051	10,893	39,445
Total	1,379,136	1,289,180	684,251	1,293,367	4,645,934
Economic Cost					
• Design	55,656	48,043	27,883	50,190	181,772
• Land Acquisition	108,254	191,700	52,040	147,830	499,824
• Construction	1,119,118	961,558	557,971	1,014,693	3,653,340
• Environmental Protection	11,127	9,608	5,576	10,038	36,349
Total	1,294,155	1,210,909	643,470	1,222,751	4,371,285

2) Maintenance Cost

Maintenance cost is also converted to the economic cost by employing combined conversion factor for road maintenance work. The result is shown in Table 12-2.

Table 12-2 : Maintenance Cost

	Section 1 N-S Expressway - Karak Highway	Section 2		Section 3 Federal Route 1 - N-S Central Link	Total
		Segment 1 Karak Highway - Hulu Langat Rd.	Segment 2 Hulu Langat - Federal Route 1		
Financial Cost					
Annual Maintenance (RM '000/yr)	2,342	3,370	2,133	2,955	10,800
Periodical Maintenance (RM '000/5 yrs)	3,282	1,991	1,798	4,569	11,730
Economic Cost					
Annual Maintenance (RM '000/yr)	2,158	3,106	1,966	2,723	9,953
Periodical Maintenance (RM '000)/5 yrs)	3,025	1,835	1,657	4,293	10,810

12.2.2 Economic Benefit

Among the various benefits derived from the implementation of the road network plan, the following factors are counted as the economic benefits.

a) Saving in vehicle operating cost
b) Saving in travel time cost
c) Reduction of traffic accident

In addition to these direct benefits, several other direct and indirect benefits can be identified, e.g., increased comfort in vehicle operation, the promotion effect of regional development, increase in land price etc.. These benefits, however, are not counted in this study since they are difficult to be measured in monetary terms. Even though they could be quantified, the estimates are unreliable and sometimes may cause double counting of the benefits.

1) Vehicle Operating Cost

The vehicle operating cost is estimated for representative vehicles in Kuala Lumpur region by updating the VOC data prepared in the HNDP by JICA in 1992. The cost is represented in terms of economic cost by deducting the tax and duty portion from the sales price.

Vehicle operating cost consists of distance related cost and time related cost.

(1) Vehicle Price

As the representative vehicles, those commonly used in Kuala Lumpur are selected taking into account the recent tendency in car market. The vehicle price and characteristics are shown in Table 12-3.

Table 12-3 : Vehicle Price and Characteristics

(RM in 1995 price)

	Passenger[1] Car	Van[2]	Medium[3] Lorry	Heavy[4] Lorry	Bus[5]
Fuel Type	Gasoline	Diesel	Diesel	Diesel	Diesel
Sales Price	$46,146.46	$51,097.32	$67,645.08	$115,000.00	$149,091.35
Excise Duty	$4,666.83	$8,744.89	-	-	-
Sales Tax	$2,812.32	$3,744.89	$5,060.49	$9,661.00	$7,569.56
Net Price	$38,667.31	$38,607.54	$62,584.59	$105,339.00	$141,521.79
Annual Mileage (km/yr)	20,000	34,000	71,000	71,000	71,000
Annual Usage Hour (hr/yr)	1,200	1,474	2,890	2,890	2,890

Note: 1) : Average price of Proton Saga Iswara 1.3S and Proton Wira 1.5
2) : Ford Econovan (ST63 FM1 - 2184CC)
3) : Mercedes Benz 709/42
4) : Hino FF3H3KD
5) : Average price of Hino AK3H and Mercedez Benz OF 1415/51

Source : HNDP JICA '92, Axle Load Study

(2) Vehicle Running Cost (Distance Related Cost)

(a) Fuel and Lubricant Oil

The market fuel price per litre as of September, 1995 was RM1.10 for premium, RM1.06 for regular and RM0.65 for diesel. Those prices are remaining almost unchanged compared with the HNDP Study. The economic fuel cost which is calculated by subtracting the tax portion from the market price, is also almost unchanged.

Table 12-4 : Fuel and Lubricant Cost

(RM/ltr, 1995 Price)

Fuel & Lubricant	Sales Price	Economic Cost
Premium	1.10	0.62
Regular	1.06	0.60
Diesel	0.65	0.48
Gasoline Engine Oil	6.40	6.08
Diesel Engine Oil	3.86 ~ 5.65	3.67 ~ 5.37

Source : Petronas

(b) Tyre Cost

The sales price of tyre is obtained through market price survey in Kuala Lumpur as shown in Table 12-5.

Table 12-5 : Tyre Cost

Vehicle Tyre	Size	Sales Price (RM)	Excise Duty / Tax (RM)	No. of Tyre/ 10,000 km
Passenger Car	155 SR13	111.21	7.06	0.8
Van	600 x 14 x 8PR	157.33	11.03	0.9
Medium Lorry	900 x 20 x 14PR	680.30	46.63	1.26
Heavy Lorry	1000 x 20 x 14PR	750.16	51.77	2.08
Bus	900 x 20 x 14 PR	680.30	46.63	1.26

Source : 1) Market Price Survey
2) HNDP
3) Axle Load Study

(c) Maintenance Cost

Maintenance cost consists of parts cost and labour cost. Parts cost is calculated by setting the parts cost ratio to vehicle price.

Labour cost is calculated by using labour hour and updated unit labour cost. Table

12-6 shows the maintenance cost.

Table 12-6 : Parts Cost and Maintenance Labour Cost

	Passenger Car	Van	Medium Lorry	Heavy Lorry	Bus
Parts Cost Ratio to Vehicle Price	3 %	5 %	8.5%	10%	10%
Maintenance Labour Hours / 1000km	1	1.2	20	24.5	30
Financial Unit Labour Cost RM/hr	7.39	7.39	7.39	7.39	7.39

Source : Market price Survey, HNDP and Axle Load Study

(d) Vehicle Depreciation Cost

Vehicle depreciation cost is usually divided into time related cost and distance related cost. The cost is calculated by updating the vehicle price.

(e) Unit Running Cost

As a result, the running cost is obtained as shown in Table 12-7.

Table 12-7 : Unit Running Cost

(RM / km in 1995 price)

Financial Cost		Car	Van	Medium Lorry	Heavy Lorry	Bus
1.	Fuel Cost	0.106	0.138	0.143	0.189	0.189
2.	Lubricant Oil	0.009	0.013	0.026	0.028	0.028
3.	Tyre Cost	0.009	0.014	0.086	0.157	0.086
4.	Maintenance	0.081	0.083	0.223	0.331	0.425
5.	Depreciation	0.098	0.083	0.053	0.089	0.121
6.	Total	0.303	0.331	0.530	0.794	0.848
Economic Cost		Car	Van	Medium Lorry	Heavy Lorry	Bus
1.	Fuel Cost	0.060	0.078	0.106	0.139	0.139
2.	Lubricant Oil	0.009	0.013	0.024	0.026	0.026
3.	Tyre Cost	0.008	0.013	0.080	0.146	0.080
4.	Maintenance	0.068	0.064	0.213	0.312	0.408
5.	Depreciation	0.082	0.062	0.048	0.081	0.115
6.	Total	0.227	0.230	0.471	0.704	0.768

(3) Fixed Cost (Time Related Cost)

(a) Depreciation Cost

The time related depreciation cost is obtained by subtracting the distance related portion from the total.

(b) Capital Opportunity Cost

The interest rate is assumed to be 10% per year taking into account the economic growth rate in future and the uncertain factor. The capital opportunity cost is calculated from the vehicle price and the interest rate as well as the residual value of vehicles.

(c) Crew Cost

Crew cost is also estimated by updating the crew wage.

(d) Overhead and Insurance Cost

The cost includes insurance, licencing fees and overhead cost for retaining the vehicle and crew.

(e) Unit Fixed Cost

The unit fixed cost is calculated as shown in Table 12-8.

Table 12-8 : Unit Fixed Cost

(RM / hour)

Financial Cost		Car	Van	Medium Lorry	Heavy Lorry	Bus
1.	Depreciation	1.658	0.832	0.597	1.015	1.316
2.	Interest	2.910	2.433	1.599	2.719	3.525
3.	Crew Cost	-	6.500	12.000	16.000	10.625
4.	Overhead	0.887	3.779	4.549	6.322	6.322
5.	Total	5.454	13.544	18.745	26.056	21.787
Economic Cost		Car	Van	Medium Lorry	Heavy Lorry	Bus
1.	Depreciation	1.363	0.616	0.510	0.856	1.207
2.	Interest	2.391	1.801	1.367	2.294	3.234
3.	Crew Cost	-	5.590	10.320	13.760	9.138
4.	Overhead	0.638	2.721	3.502	4.552	4.552
5.	Total	4.392	10.728	15.700	21.462	18.129

(2) Travel Time Cost

Time value is assessed in terms of hourly productivity of the vehicle passengers. The gross regional domestic products (GRDP) of Kuala Lumpur Metropolitan Region (Kuala Lumpur and Selangor) in 1995 is estimated to be RM39,870 million at 1978 price or RM69,892 million at 1995 price as shown in Chapter 3.

The number of employment in 1995 is estimated as 1,613,300, therefore, the annual value added productivity is calculated to be RM43,322 at 1995 price, which is equivalent to RM20.6 per hour by assuming the annual working time be 21:00 hours.

For estimating travel time cost, the above time value is applied to production related trips only i.e. business trips, which makes up about 16 % of the total.

Consequently, the time cost by vehicle type is obtained as shown in Table 12-9.

Table 12-9 : Time Cost

Vehicle Type	Average Occupancy (person/vehicle)	Time Cost (RM/hr/veh)
Car	1.7	5.4
Bus	21.5	68.5

Source : Roadside Interview Survey in 1995

(3) Accident Cost

According to the transport statistics, the total damage to properties and vehicles in 1990 is RM121,130,000 at 1990 price, which is equivalent to RM147,536,000 at 1995 price.

The statistics of casualties in 1989 and 1990 are shown as Table 12-10. The GRDP of KL Metropolitan Region in 1995 is RM69,892 million at 1995 price and the population in 1995 is estimated as 4,028 thousand, therefore, the per capita GRDP is calculated to be RM17,352 in 1995 price.

Assuming the average residual life be 30 years, the accumulated value of the life discounted at 12% per annum is RM156,550. Hence, the total loss due to casualties is estimated to be about RM557 million.

Table 12-10 : Statistics of Casualties

(person)

Year	Mortality	Serious Injuries	Minor Injuries	Total death due to Injuries
1989	3,099	7,932	19,015	3,773
1990	3,011	7,458	14,215	3,345

Source : Transport Statistics

The total annual vehicle - km in 1990 is estimated at 123,363 million. As a consequence, the unit accident cost is estimated as RM6.91/1,000 veh-km.

(4) Benefits Estimation

Economic benefits are calculated by summing up the total savings in the vehicle operating cost, the passenger time cost and the accident cost, obtained from the differences in vehicle-km and vehicle-time between the "Without" project case and "With" project case. At present, various highway development projects are on-going in Kl. metropolitan region, such as the Middle Ring Road, Dedicated Highway, South Klang Valley Expressway etc. Assuming the following network conditions, the completion year of these projects are assumed as shown in Table 12-11 in the traffic assignment.

Table 12-11 : Assumed Completion Year of Major Highway Projects

Highway Project		Assumed Completion Year
Middle Ring Road II	:	1997
- East Half	:	1999
- West Half		
Shah Alam Expressway		
- KL-Seremban to N-S Central Link	:	1997
- N-S Central Link - Jln Langat	:	2001
N-S Central Link	:	1997
KL-Karak Highway Widening	:	1997
Karak-Kuantan Expressway	:	2001
(East Coast Expressway)		
Ampang Bypass	:	1997
Dedicated Highway	:	1997
Damansara - Puchong Road	:	1998
South Klang Valley Expressway	:	1998
(Westside of N-S Central Link)		

Table 12-12 shows the estimated benefits in 2003, 2010 and 2020. The benefits are interpolated by assuming a constant annual growth rate for the intermediate years and assumed to remain at the same level as that in 2020 for the years after 2020.

Table 12-12 : Estimated Economic Benefits

(RM Million)

		Benefit	2002	2010	2020
Whole Length of ORR		VOC Saving	334.9	1,632.8	3,256.5
		Time Saving	193.5	836.5	1,498.0
		Accident Saving	0.5	3.5	3.5
		Total	529.0	2,472.9	4,788.0
Section 1		VOC Saving	50.7	247.0	476.6
		Time Saving	19.5	127.1	209.9
		Accident Saving	0.5	0.5	0.9
		Total	70.6	374.5	687.4
Section 2	Segment 1	VOC Saving	11.4	80.0	152.7
		Time Saving	1.8	31.8	70.9
		Accident Saving	0.2	0.6	0.7
		Total	13.4	112.4	224.3
	Segment 2	VOC Saving	22.8	346.9	778.0
		Time Saving	10.2	174.7	347.3
		Accident Saving	0.1	0.9	1.2
		Total	33.1	522.6	1,126.5
Section 3		VOC Saving	74.1	838.1	1,651.4
		Time Saving	33.5	417.5	738.8
		Accident Saving	0.5	2.3	2.4
		Total	108.2	1,257.9	2,392.6

12.2.3 Results of Evaluation

1) Evaluation as a whole

Firstly, the economic feasibility of the KLORR as a whole is evaluated based on the assumed schedule. The result of the economic indicators is shown in Table 12-13.

It is found that the KLORR project is highly economically feasible.

Table 12-13 : Evaluation Indicators for Whole Length

Benefit-cost Ratio (B/C)	3.05
Net Present Value (NPV) (RM Million)	5,498.5
Internal Rate of Return (IRR) (%)	22.7

2) Evaluation by Section

The evaluation results of the KLORR by section are shown in Table 12-14, which indicates that the B/C ratios in all the sections are higher than 1.0 except for the segment 1 of the section 2. .These sections are economically feasible even if they are implemented individually.

The highest B/C ratio is found in the cases of Section 3, which is the southern part of the KLORR, where impressive development projects like Putra Jaya are on going.

The second highest is the segment 2 of the Section 2, the south eastern part of the Ring Road. As a result, the section 3 should be given the highest priority for the implementation .

After the completion of the section 3, the section 2 segment 2 is given the higher priority than the other sections, considering that the additional implementation of section 2 segment 2 has the higher evaluation indicators than the other cases.

Table 12-14 : Economic Evaluation Indicators by Section

	B/C	NPV (RM Million)	IRR (%)
Section 1	1.62	484.1	16.2
Section 2 Segment 1	0.51	-366.7	7.2
Segment 2	4.38	1,331.5	25.4
Section 3	5.45	3,329.2	29.0
Section 3 + Section 1	3.30	3,538.5	23.0
Section 3 + Section 2 Seg. 1	2.85	2,774.6	21.4
Section 3 + Section 2 Seg. 2	5.16	4,775.5	28.0

3) Evaluation on Proposed Implementation Schedule

The implementation schedule is proposd in the Chapter 13. Based on the schedule, where it is implemented from 1997 to 2005 in accordance with the priority by section, the project feasibility is re-examined.

The results of the benefits cost analysis tabulated in Table 12-15 show that the KLORR as a whole is highly economically feasible. Those figures, the internal rate of return of 25.4%, the net present value amounting RM5,700 million, assure the appropriateness of the schedule as well as the economic soundnese of the project.

Table 12-15 : Evaluation Indicators for the Whole Length Based on Proposed Schedule

Benefit-cost Ratio (B/C)	3.49
Net Present Value (NPV) (RM Million)	5,700.0
Internal Rate of Return (IRR) (%)	25.4

12.3 Financial Analysis

12.3.1 General

1) Objectives

The Outer Ring Road project is likely to be implemented as a privatized project and operated as a toll road. The purpose of financial analysis is two-fold; one is to find

the financial viability under the given implementation schedule, while the other is to find the conditions required for the privatization.

These are achieved by examining the following issues under the condition that the KLORR is operated as a toll road.

(a) Whether the project cost and operation / maintenance cost can be reimbursed by the levied toll or not under the given conditions regarding various influencing factors such as toll level, loan, equity share, traffic volume, phasing plan etc.

The project should be attractive as a business venture, therefore, the revenue should be sufficient not only to cover all the investment but also to produce enough profit within a reasonably short period.

(b) On the contrary, what kind of conditions will be required for making the project financially viable?

In case of privatization scheme, the questioned condition might be toll level, concession period or procurement of other income resources such as development profit of land in the project corridor, additional toll revenue by packaging other highway, etc.

2) Project to be evaluated

As the total length of the KLORR is about 89 km passing through the mountainous area, there may be some difficulties to implement the whole stretch at once.

Accordingly, the whole length has been divided into three sections, Section 1 ~ Section 3, denoted clockwise from the North end to the South end.

Each section is further subdivided into two segments as shown in Figure 12-3, thus, the whole length consists of 6 segments in total. The project cost by segment is summarized in Table 12-16. The operation and maintenance costs are already summarized in Chapter 11.

12.3.2 Implementation Schedule

Based on the economic evaluation, the highest priority is given to the Section 3, followed by the Segment 2 of Section 2. The construction costs for each segment are shown in Table 12-16. Taking into account the development schedule of the related projects such as two ambitious projects of Putra Jaya and KLIA in the south, as well as the highway projects like Middle Ring Road II, KL-Karak Highway and East Coast Expressway etc., the implementation schedule of the KLORR is set up as shown in Figure 12-4 as the base case.

Out of the whole project, the Segment 2 of Section 3 might be included in the South Klang Valley Expressway (SKVE) project, which is on going as an another privatized project, hence, the case excluding this section is also additionally examined.

The schedule intends to construct starting from the Segments 2 and 1 of the Section 3, then the Segment 2 of Section 2 and proceeding to Section 1 skipping the Segment 1 of Section 2 in the mountainous area, which will be implemented at last. Taking into account that the project scheme involves the construction of tunnels and bridges, the construction period of each segment may require two or three years, thus the period for the whole length becomes eight years, completing by the year 2005.

Thus, the completed section will be open to traffic one after another, the first one, the segment 2 of Section 3 in the year 2000, and the last one, the Segment 1 of Section 2 in the year 2006.

Table 12-16 ; Project Cost

(RM million)

	Construction Cost	Engineering Cost	Land Acquisition	Environmental Protection	Total
Section 1					
Segment 1	520.2	26.0	29.5	5.2	580.9
Segment 2	687.2	34.4	69.7	6.9	798.2
Total	1,207.4	60.4	99.2	12.1	1,379.1
Section 2					
Segment 1	1,042.7	52.1	183.9	10.4	1,289.1
Segment 2	605.2	30.3	42.7	6.1	684.3
Total	1,647.9	82.4	226.6	16.5	1,973.4
Section 3					
Segment 1	352.1	17.6	55.3	3.5	428.5
Segment 2	737.2	36.9	83.4	7.4	864.9
Total	1,089.3	54.5	138.7	10.9	1,293.4
Grand Total	3,944.6	197.3	464.5	39.5	4,645.9

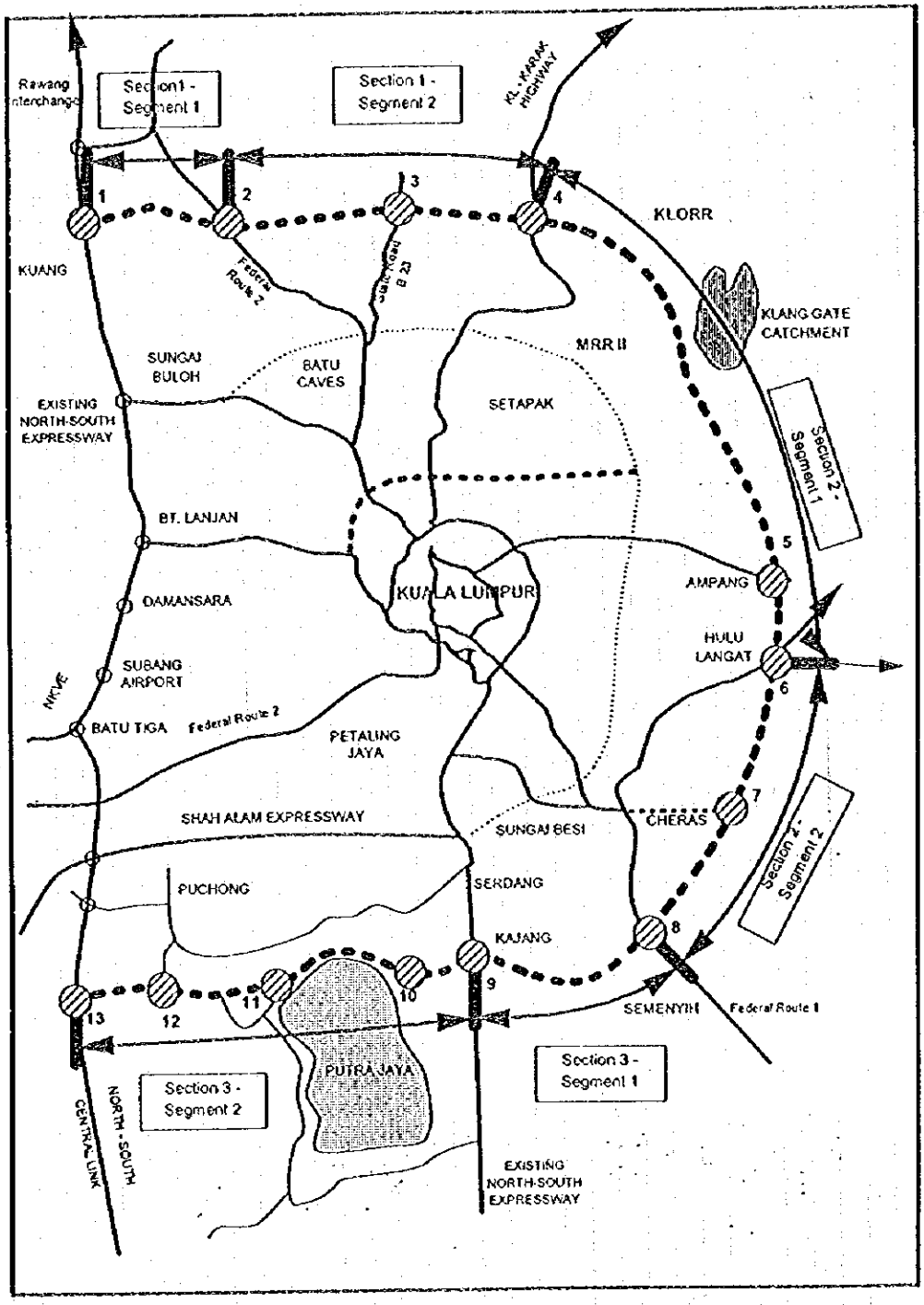


Figure 12-3 : Segments of the KLORR

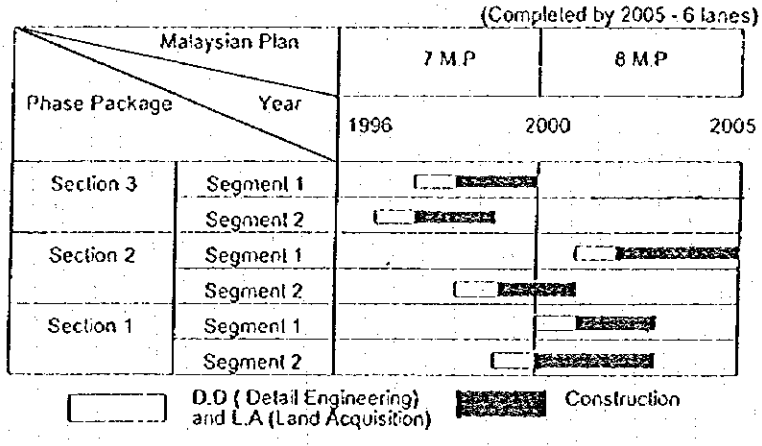


Figure 12-4 : Implementation Schedule for Base Case

12.3.3 Toll Revenue

1) Toll Level

As elaborated in Chapter 5, the Outer Ring Road would be utilized as part of the nation-wide expressway, the North - South Expressway, therefore, the same toll system, a closed system should be adopted for the project road as well.

The toll charge presently applied for the North - South Expressway is as shown in Table 12-17.

Table 12-17 : Current Toll Charge for North - South Expressway

(sen/km)

Class	Description	Toll Charge
1	Passenger cars	7.5
2	Two axles and six wheels excluding bus	12.5
3	Three or more axles	17.5
4	Taxi	3.75
5	Bus	6.25

According to the concession agreement between the government and PLUS, the toll charge is calculated at 7.5 sen per km until the end of 1995 and 10 sen per km from January of 1996.

From 1996 to 2018 when the agreement ends, the rate is to be increased by six percent per annum or higher should the consumer price index become higher.

As of the end of January, 1996, however, the rate is still remaining at 7.5 sen per km, taking into account the current circumstances that the toll has been raised only three years ago from 5 sen per km and that the inflation rate during the period has

not been so high. Thus, the toll raise may be either postponed or carried out by reducing the increase rate.

However, according to the concession agreement for North - South Central Link, which is also considered as a part of North - South Expressway, the same toll rate and same toll charge escalation have been agreed.

Hence, the toll rate for the Outer Ring Road is assumed to be set as shown in Table 12-18 as the base case, the growth rate of which is following the case of the North - South Expressway and North - South Central Link.

Table 12-18 : Toll Rate of Project Road

Year	Base Case[1)]
2000	12.6 Sen/km

Note : 1) Base Case : Following the concession agreement for North - South Expressway the toll rate in 2000 is obtained from 10.0M¢/km in 1996 x 1.06^4 = 12.6 M¢/km, the toll rate is raised every 10 yrs at 6% per annum after the year 2000.

2) Above figure is applied to passenger cars. For the other vehicles, the same growth rate is applied to the current rates.

2) Traffic Volume

The traffic volume on the project road is obtained from the traffic assignment for the respective cases, the method of which is explained in Chapter 4. The traffic volume for the base case based on the implementation schedule is summarized as shown in Table 12-19.

Table 12-19 : Traffic Volume on the KLORR

(veh/day)

Section	Year						
	2000	2001	2002	2004	2006	2010	2020
IC 13 ~ IC 12	10,900	21,100	29,100	46,300	56,900	69,000	84,700
IC 12 ~ IC 11	10,900	21,100	29,100	46,300	56,900	69,000	84,700
IC 11 ~ IC 10	10,900	20,800	29,200	46,400	57,100	70,000	80,800
IC 10 ~ IC 9	11,400	20,000	28,900	45,300	58,500	76,100	93,500
IC 9 ~ IC 8	-	22,800	51,900	51,900	67,100	79,000	92,300
IC 8 ~ IC 7	-	-	47,200	60,800	72,600	86,000	100,900
IC 7 ~ IC 6	-	-	51,000	60,800	81,000	93,300	119,000
IC 6 ~ IC 5	-	-	-	-	76,000	81,000	90,000
IC 5 ~ IC 4	-	-	-	-	12,500	22,000	50,600
IC 4 ~ IC 3	-	-	-	19,000	29,500	46,000	71,100
IC 3 ~ IC 2	-	-	-	36,500	44,300	56,700	80,900
IC 2 ~ IC 1	-	-	-	17,800	24,700	41,800	66,600

Note : Refer to the Figure 12-3 for IC numbers.

If the average volume in 2020 is less than the capacity, the traffic demand for the years after the 2020 is assumed to grow up to the capacity by applying the growth rate of the period from 2010 to 2020, and then remain at the constant till the end of the concession period.

12.3.4 Basic Conditions for Financial Analysis

1) Implementation / Operation Body

There are three alternative cases as an implementation and operating body for the Project Road, namely:-

- Government or Related Agency
- Private Sector
- Third Sector

The project road is most probably implemented and operated by a private sector considering the recent government policy. However, there may be some possibilities that some portion of the project cost, or some section or entire project could be borne by the government, which will be clarified through the financial analysis.

As the private sector's implementation requires the most severe test in financial analysis, the government contribution is assumed to be minimum in this study.

Nevertheless, because of its characteristics as a social infrastructure for public use, the Government in general has to have a right of overseeing the due performance of the implementation / operating body in any case.

The Government also has to retain the prerogative over the issue of toll charges and control over traffic surveillance.

2) Concession Period

Under its privatization policy, the government has granted to private companies the right and authority to collect toll from the users of the corresponding projects for a concession period. The concession period varies from 9 years to 30 years depending on the terms of the agreement.

The concession period is significantly sensitive for the financial viability. The project requires a huge amount of project cost and rather long period for its construction, therefore, it is tentatively assumed to be as follows in this Study.

a. 30 years including construction period
b. 35 years including construction period
c. 40 years including construction period
d. 45 years including construction period

3) Equity Share and Dividend

Because of the large amount of investment, the equity share (equity to loan allocation ratio) is supposed to be comparatively low if exclusively prepared by the private sector. Hence, the equity loan allocation plan is assumed as follows :

Table 12-20 : Equity Loan Allocation

	Equity	Loan
Equity Loan Ratio	20%	80%

As for the dividend, the higher the dividend rate and the earlier the start of payment, the easier the equity can be prepared.

Dividend should be paid in accordance with the profitability of the business entity, however, if the first year of the surplus is in the far future, investors may not be interested in this project. Accordingly, the dividend payment is assumed to be started in the fifth year from the opening to traffic irrespective of the financial situation of the corresponding years.

The dividend rate is assumed as 8% per year, which is higher than the interest rate of the long term fixed deposit.

4) Long Term Loan Condition

The shortage of the initial investment of the project will be covered by a commercial loan and a government support loan, being assumed as the following table.

Table 12-21 : Long Term Loan Conditions

Loan Conditions	Loan Type	
	Commercial Loan	Government Loan
Annual Interest Rate	11%	6%
Draw down	Pro-rate to the Costs during construction period	-
Maximum Lending Period	15 years	15 years
Grace Period	5 years	5 years
Repayment	Uniform Amount including interest portion	Uniform Amount including interest portion

Assuming that the maximum amount of the government support loan would be as much as the equity, the long term loan allocation ration is given as follows.

Table 12-22 : Financing Plan

Financial Resources	Share
Equity	20%
Commercial Loan	60%
Government Loan	20%
Total	100%

5) Short Term Loan

As the project requires large amount of long-term loans for the initial investment, once the repayment is started, the implementing / operating business entity will often encounter a shortage of cash in hand.

This shortage has to be offset by the short-term loan financed by an ordinary commercial bank, otherwise, the entity cannot continue its operation.

The lending period of short-term loan is assumed to be one year and the interest rate is 9% per year.

6) Land Acquisition

The land acquisition and compensation cost will be paid by the government at the initial stage. However, all the costs are assumed to be reimbursed to the government by the concession company after the repayment of long-term loan.

It is also assumed that the reimbursement is made during three years.

7) Inflation Rate

According to the Annual Report, 1994 issued by the Bank Negara Malaysia, the consumer price in Malaysia during the years from 1989 to 1994 is fairly stable with an average annual growth rate of 3.7% as shown in Table 12-23.

The average growth in consumer price of the industrialized countries is also very stable, only 3.2% per annum during the recent seven years.

Table 12-23 : Growth in Consumer Prices

Year	Growth Rate to the Previous Year
1989	2.8
1990	3.1
1991	4.4
1992	4.7
1993	3.6
1994	3.7
Average Growth Rate	3.7%

Hence, taking some allowance into account, the inflation rate for the financial analysis is assumed to be 4% per annum for both the foreign and local portion of the construction and operation / maintenance costs.

8) Tax

The total tax is set at 30% of the gross profit, taking into account the corporate income tax.

12.3.5 Evaluation Indices

The financial viability of the project is evaluated from the following viewpoints :-

* Project as a whole and
* Investor

As to the evaluation indices from the viewpoint of the project as a whole, Financial Internal Rate of Return (FIRR), Financial Net Present Value (FNPV), Financial Cost Benefit Ratio (B/C) are used. On the other had, Return on Equity (ROE) is used as the evaluation index from the viewpoint of the investors.

FIRR shows the marginal interest rate with which the investment cost balances with the accumulated net profit.

Therefore, if the FIRR exceeds the interest rate of long term loan, the project is judged to be financially viable. In this Study, 11% is adopted as the interest rate to be compared with the calculated FIRR.

Likewise, ROE indicates the rate of return on the paid-up equity.

The Financial Internal Rate of Return (FIRR) is determined as the discount rate that equalizes the present value of the stream of the financial costs and benefits over the concession period. The FIRR can be express as the following formula :-

$$\sum_{t=1}^{T} \frac{I_t}{(1+\gamma)^t} = \sum_{t=1}^{} \frac{B_t - C_t}{(1+\gamma)^t}$$

Where:-

γ	- FIRR
I_t	- Investment costs in year t
B_t	- Revenue in year t
C_t	- Operating expenses in year t

The Financial Net Present Value (FNPV) and Financial Cost Benefit Ratio (B/C) are expressed by the following formula:-

$$FNPV = \sum_{t=1}^{T} \frac{B_t}{(1+\gamma)^t} - \sum_{t=1}^{T} \frac{I_t - C_t}{(1+\gamma)^t}$$

$$B/C = \sum_{t=1}^{T} \frac{B_t}{(1+\gamma)^t} \Big/ \sum_{t=1}^{T} \frac{I_t - C_t}{(1+\gamma)^t}$$

Where :-

γ - Discount rate

The Return on Equity (ROE) can be expressed as the following formula :-

$$\sum_{t=1}^{T} \frac{E_t}{(1+\gamma)^t} = \sum_{t=1}^{T} \frac{B_t - C_t^1 - C_t^2 - C_t^3}{(1+\gamma)^t}$$

Where:-

γ - ROE
E_t - Paid-up Equity in year t
C_t^1 - Operating expenses in year t
C_t^2 - Repayment of principal portion of debt borrowed in year t
C_t^3 - Repayment of interest portion of the debt borrowed in year t
B_t - Revenue in year t

12.3.6 Results of Analysis

1) Evaluation for Base Case

Table 12-24 shows the evaluation indicators for the base case by alternative concession period. Other conditions applicable to all the cases are exactly those as denoted in the previous section, namely;

- Equity share to the initial investment is 20%.
- The percent share of the government support loan and commercial loan is 20%, 60% respectively.
- Toll rate in 2000 is 12.6 sen/km which will be raised every 10 years with the rate of 6% p.a.

From the results, the following findings are pointed out.

(1) The FIRR is lower than 11% in any case, even for the 45 years concession period, therefore the financial return of project is not sufficient under the given conditions.

(2) As for the case "Excluding Section 3 Segment 2", it is found that the FIRR is further lower and less profitable compared to the "Whole Project" case.

(3) As shown in Table 12-25, under the condition of uniform repayment, the first year of the operation surplus will be 12th year after the opening, which is not attractive for private sector.

Moreover, the short term loan expands to huge amount till the 17th year. The actual repayment condition of long term loans may not be uniform but scheduled as the repayment increases toward the end of the repayment period so as to ease the repayment, because the revenue generally increases according to the traffic growth.

However, the above table suggests that the operation without considerable amount of short term loan may not be easy for the base case.

(4) If the concession period is further extended to more than 50 years,

FIRR may reach at 11%, however, the Debt Service Coverage Ratio is too low, which indicates that the operating body may suffer from the inadequate cash flow for considerably long period.

Table 12-24 : Financial Evaluation Indicators for Base Case

Case	Financial Evaluation Indicators	Concession Period (yrs)			
		30	35	40	45
Whole Project	Financial Internal Rate of Return (FIRR)	6.89%	8.57%	9.64%	10.38%
	B / C Ratio	0.61	0.70	0.81	0.89
	Net Present Value (NPV) (RM'million)	-1,268.0	-941.0	-637.0	-347.0
	Return on Equity (ROE)	4.89%	7.82%	9.46%	10.50%
	Debt Service Coverage Ratio (DSCR) min	0.87	0.87	0.87	0.87
Excluding Section 3 Segment 2	Financial Internal Rate of Return (FIRR)	5.89%	7.56%	8.85%	9.76%
	B / C Ratio	0.52	0.61	0.70	0.79
	Net Present Value (NPV) (RM'million)	-1,454.0	-1,165.0	-885.0	-614.0
	Return on Equity (ROE)	3.67%	6.41%	8.41%	9.67%
	Debt Service Coverage Ratio (DSCR) min	0.71	0.71	0.71	0.71

Note 1) DSCR is defined as follows :- $DSCR = (Bt - Ct) / (Lt + It)$

Bt : Revenue in year t
Ct : Operating Cost in year t
Lt : Repayment of principal portion of loans
It : Repayment of interest portion of loans

The more detailed results on the cash flow for the base case are shown in the Technical Report.

Table 12-25 : Financial Situation of the Base Case During the Concession Period

	Equity Share	
	20%	30%
First Year of Operation Surplus	12th	12th
Maximum Short-Term Loan in Single Year (RM'million) (Year)	550.0 (9th)	474.4 (9th)
Maximum Accumulated Short-Term Loan (RM'million) (Year)	5,257.3 (17th)	4,551.1 (17th)
Clearing up Year of Loan	26th	25th

2) Alternative Cases

Since the base case is not financially desirable, some alternative conditions are assumed by either reducing the construction cost and debt service or increasing the revenue. The alternative conditions are as follows:-

(a) Staging of Construction

This alternative aims to reduce the financial cost at the initial stage by employing a temporary scheme of the ORR such as a four lane road operation at the first stage.

(b) Reduction of Implementation Length

The implementation length for privatization is reduced to some portion only and the rest may be carried out by the government.

(c) Application of Higher Toll Rate

By increasing the toll rate, the improvement of the financial situation will be examined.

3) Stage Construction

Two types of stage construction are examined in this study; one is the staging of section, the other is the staging of road width.

(a) Staging of Section

Staging of section is to postpone the construction of relatively less profitable sections. In the case of the project, those to be postponed are the Section 1 and the Segment 1 of Section 2.

The staging plan is assumed as shown in Figure 12-5. The completion of the project is postponed from the year 2005 in the base case to the year 2010.

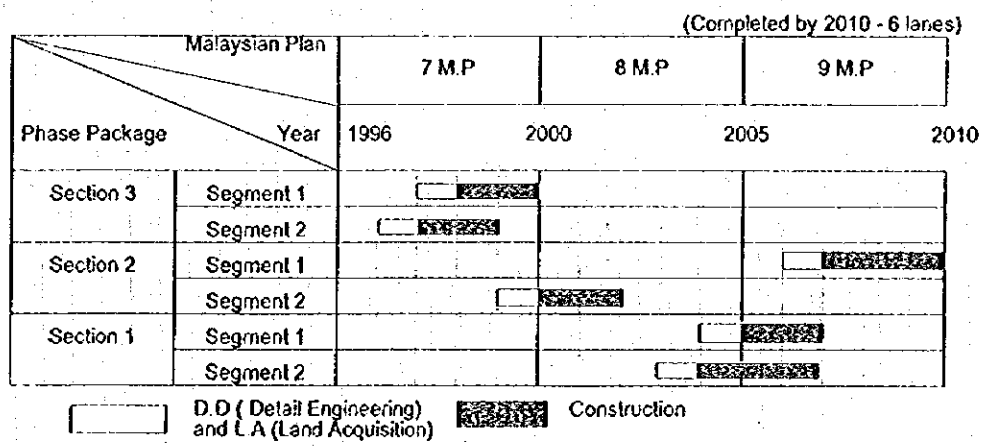


Figure 12-5 : Staging Plan of Section

Except for the implementation schedule, all the other conditions are assumed to be same as the basic case. The financial evaluation indicators are shown in Table 12-26.

Table 12-26 : Evaluation Indicators for Staging of Section

	Concession Period (yrs)		
	35	40	45
Financial Internal Rate of Return (FIRR)	8.96%	10.12%	10.91%
B / C Ratio	0.78	0.88	0.98
Net Present Value (NPV) (RM'million)	-626.0	-330.0	-47.0
Return on Equity (ROE)	8.38%	10.22%	11.35%
Debt Service Coverage Ratio (DSCR)	1.34	1.34	1.34

In case of the staging plan of section as well, the FIRR does not exceed 11% in any cases of concession period, although the financial returns are somewhat improved compared to the base case, particularly for the DSCR.

As a result, the staging plan of section based on the above schedule will not bring about sufficient profit.

(b) Staging of Road Width

Staging of road width is to open to traffic as temporarily a 4-lane road. By the early 2000's, a sufficient traffic demand for 6 lanes can be expected for the Section 3 and Segment 2 of Section 2, therefore, those sections should be constructed with the final scheme. On the other hand, the traffic volumes on Section 1 and Segment 1 of Section 2 will be not so high, therefore, only these sections are planned with stage construction, namely constructed as a 4 lanes road by the year 2005 and widened to 6 lanes by the year 2015. (Refer to Figure 12-6).

The construction schedule by section is basically following the base case.

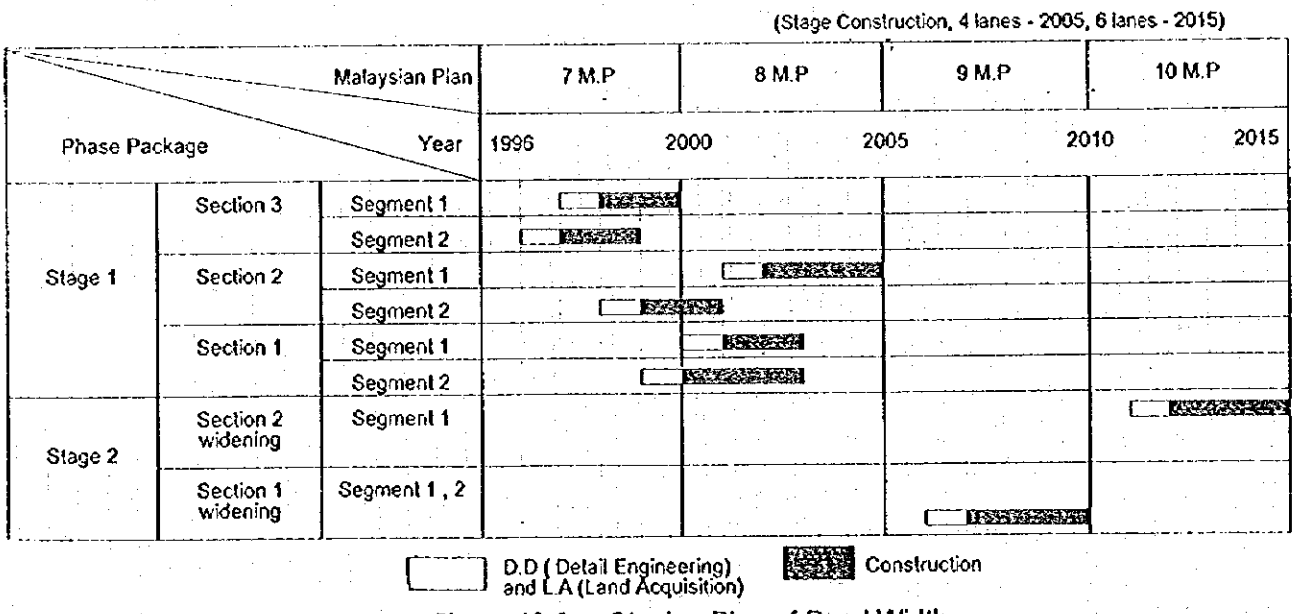


Figure 12-6 : Staging Plan of Road Width

The construction cost of the staging sections are shown in Table 12-27.

Table 12-27 : Construction Cost for the Staging Sections

(RM million)

	Stage Construction		Total	Original Construction Cost
	Stage 1	Stage 2		
Section 1				
Segment 1	373.7	207.4	581.1	520.2
Segment 2	515.0	247.7	762.7	687.2
Total	888.7	455.1	1,343.8	1,207.4
Section 2				
Segment 1	712.9	478.4	1,191.3	1,042.7

The results of the analysis are shown in Table 12-28. It is found that the improvement of the profitability by the staging of the road width is not significant. The FIRR is still less than 11% even for the 45 years concession period. This is partly because the construction cost will increase about 10% to 15% due to the stage construction, and partly because of the adverse impacts on the traffic demand.

Table 12-28 : Financial Evaluation Indicators for Staging of Road Width

	Concession Period (yrs)		
	35	40	45
Financial Internal Rate of Return (FIRR)	8.54%	9.67%	10.47%
B / C Ratio	0.73	0.83	0.91
Net Present Value (NPV) (RM'million)	-834.0	-547.0	-271.0
Return on Equity (ROE)	7.63%	9.50%	10.65%
Debt Service Coverage Ratio (DSCR)	1.96	1.96	1.96

4) Reduction of Implementation Length

For improving the profitability, the project length is reduced to the Section 3 and the Segment 2 of Section 2 only, namely the portion from the N-S Central Link to the Hulu Langat road.
The implementation schedule is assumed as same as the base case as shown in Table 12-29.

Table 12-29 : Implementation Schedule for Reduced Length Case

	1997	1998	1999	2000	2001	2002
Section 3 Segment 2	----------					
Section 3 Segment 1			————			
Section 2 Segment 2	----------		————			

Note : ---------- : Detail Engineering / Land Acquisition
———— : Construction

Assuming that all the other conditions including toll rates are same as the base case, the financial evaluation indicators are calculated as shown in Table 12-30.

Table 12-30 : Evaluation Indicators for Reduced Length

	Concession Period (yrs)		
	35	40	45
Financial Internal Rate of Return (FIRR)	10.27%	11.15%	11.79%
B / C Ratio	0.90	1.02	1.14
Net Present Value (NPV) (RM'million)	-162.0	34.0	229.0
Return on Equity (ROE)	10.4%	11.6%	12.4%
Debt Service Coverage Ratio (DSCR)	0.87	0.87	0.87

By reducing the implementation length, the indicators can be significantly improved; if the concession period is 40 years or over, the FIRR becomes higher than 11%, ROE also shows sufficiently high values, therefore, the project brings about a high return in the given period.

However, the DSCR is fairly low, only 0.87, which indicates that a large amount of short term loan will be required in the repayment period of long term loan, even if the repayment schedule is changed to a favourable conditions, e.g. from the uniform one to the unequal repayment.

Accordingly in order to improve the above situation, either the equity injection or government soft loan should be increased more, for example 25% of the construction cost.

5) Application of Higher Toll Rate

If a higher toll is applied, the traffic demand on the project road will decrease, because some traffic would divert to other routes which might be more economical. But some traffic will still remain on the project road, because of less travel time required. In the assignment model of EMME/2, the traffic demand is assigned to the network so as to minimize the travel time, where the toll is also converted to time, taking into account the time value, RM9.5/hr per vehicle in average in 1995 price.

The time value is calculated from the labour productivity, therefore, will increase in future in accordance with the GDP growth.

As a result, the profitability depends on how much the traffic volume would decrease, how much the revenue would decrease or increase if a higher toll is applied.

The results of the analysis are shown in Table 12-31 and Figure 12-7. The following points are noted from the results.

(1) The higher the toll, the higher profitability is attained when the toll level is less than five times the Base Case. This is because the decrease in the traffic volume on the ORR due to the higher toll

application is not so large, since the traffic volume on the MRR II will be sufficiently heavy by the early 2000's.

The traffic demand on the ORR under the toll condition of 1.5 times the Base Case is shown in Table 12-32.

It is found that the reduction in the traffic volume compared to the Base Case is about 18%, 11% and 5% for the years 2005, 2010 and 2020 respectively.

(2) If the toll level is 1.5 times the base case or more, that is 18.9 sen/km or more, the FIRR exceeds 11% in any case of concession period.

Simultaneously the ROE becomes higher than 11.0%, DSCR also shows higher than 1.0. Accordingly it can be said that the project is financially feasible to be privatized, under the higher toll application.

(3) Although the project is financially feasible under the toll of 1.5 times or more, FIRR should be preferably about 12% since various uncertain factors are anticipated for the project.

Therefore, if the toll level of 18.9 sen/km is applied, 40 years including construction period will be required for the concession period.

Table 12-31 : Indicators for Higher Toll Application

Toll Case		Concession Period (yrs)			
		30	35	40	45
1.5 x (Base Case)	FIRR	9.59	11.10	12.05	12.69
	B / C	0.84	1.02	1.18	1.32
	NPV (RM million)	-513.0	55.0	575.0	1,063.0
	ROE	9.27	11.70	12.93	13.71
	DSCR	1.19	1.19	1.19	1.19
2.0 x (Base Case)	FIRR	11.37	12.85	13.70	14.22
	B / C	1.04	1.29	1.51	1.72
	NPV (RM million)	136.0	944.0	1,678.0	2,364.0
	ROE	12.19	14.29	15.34	15.91
	DSCR	1.44	1.44	1.44	1.44
3.0 x (Base Case)	FIRR	13.63	14.95	15.73	16.17
	B / C	1.36	1.72	2.06	2.38
	NPV (RM million)	1,175.0	2,350.0	3,475.0	4,526.0
	ROE	15.92	17.59	18.42	18.84
	DSCR	1.19	1.85	1.85	1.85

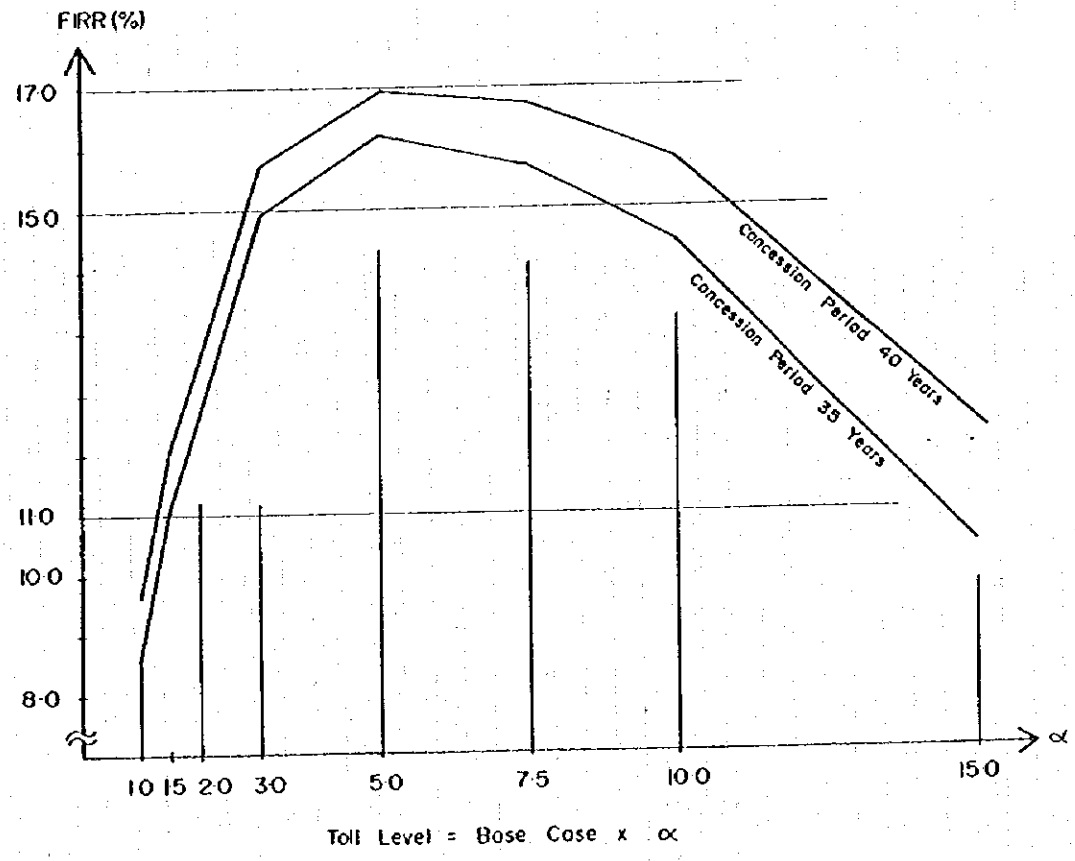


Figure 12-7 : FIRR for Higher Toll Application

Table 12-32 :Traffic Volume on the KLORR for the Toll Application of 1.5 times Base Case

(veh/day)

Section	2006	2010	2020
IC 13 - IC 12	45,100	66,800	82,500
IC 12 - IC 11	45,100	66,800	82,500
IC 11 - IC 10	46,000	67,800	78,300
IC 10 - IC 9	49,200	73,700	90,800
IC 9 - IC 8	63,800	76,000	89,800
IC 8 - IC 7	70,100	82,800	98,400
IC 7 - IC 6	76,900	89,500	116,500
IC 6 - IC 5	69,200	74,600	87,800
IC 5 - IC 4	2,500	12,200	41,200
IC 4 - IC 3	17,400	33,400	66,800
IC 3 - IC 2	38,400	49,300	78,900
IC 2 - IC 1	15,800	34,300	64,700

Note : Refer to the illustration below Table 12-19 for IC No.

(4) As shown in Figure 12-7, the FIRR turns to decrease from the toll level of about 5.0 times the Base Case, i.e., 63.0 ¢/km, because of the decrease in traffic volume due to the toll raise gradually becomes longer and larger and when the toll is excessively high, the reduction in traffic volume will be more sensitive to the revenue than the increase in toll charge.

Accordingly, about 63 ¢/km can be theoretically regarded as the optimum toll level for the concession company since it realizes the highest profitability.

For the users of the KLORR, however, the optimum toll level would be zero, i.e. toll free.

As a consequence, the optimum toll in more practical sense, will be the equilibrium point between the concession company and the users, that is the minimum toll level with which the concession company can be satisfied for the privatization.

Hence, the above mentioned toll level, 18.9 ¢/km in 2000 is deemed as the optimum one.

12.3.7 Summary of Financial Analysis

As a result of the financial analysis, the cases where high profitability, higher than 11 % of FIRR, can be expected are summarized as follows:

Table 12-33 : Case with Higher Profitability

Case	Conditions	
	Toll Rate	Concession Period
1) Reduction of Implementation Length (Section 3 + Segment 2 of Section 2)	M¢12.6	40 years or more
2) Higher Toll Application (1)	M¢18.9	35 years or more
3) Higher Toll Application (2)	M¢25.2	30 years

As for the first one, the half of the project can be realized by privatization, but the another half will not be implemented for long period, say two decades at least, since the government budget is not sufficient to carry out.

This situation will not be consistent with the government perspectives of the KL metropolitan region.

In the second and the third cases, a higher toll rate should be applied on the ORR. The second case, where the toll rate is 1.5 times the base case, requires more than 35 years for the concession period. In the third case, the concession period is 30 years only, however, the toll rate should be raised to the double of the base case. A higher toll application may be justified by the following reasons.

a) Benefit Principle

Based on the benefit principle, the beneficiaries should pay for the project cost. The KLORR is designed so as to have the capability to offer a congestion free travel above design speed of 100 km/hr. with controlled access, which provides the users operational freedom.

At the same time, it is designed to minimize the adverse impacts on road-side environment, protecting from disasters as well as public nuisance by employing many tunnels and viaducts.

The road users are the primary beneficiaries of the project, therefore, should pay for the cost in terms of toll charge.

b) Toll Rate on Other Highways

As mentioned above, the toll rate for the North-South Expressway is calculated on the basis of the agreement, where the toll rate be M¢12.6 in 2000.

In case of other highways, a higher toll rate can be found according to the concession agreement. In case of the Shah Alam Highway, the toll rate for the section from KL-Seremban Expressway to the N-S Central Link will be RM3.20 in the year 2001, which is equivalent to M¢16.8/km.

In case of the Dedicated Highway, the toll rate is calculated to be about M¢21.0/km.

c) Benefit from the KLORR

The financial benefit of the users of the KLORR can be estimated as follows:

The Table 12-34 shows the total vehicle-km and vehicle-time of only the KLORR users when the KLORR is implemented according to the schedule. If the KLORR is not constructed, those users have to use other congested roads instead of the KLORR.

The total vehicle-km and vehicle-time of the KLORR users in case of without ORR is also estimated and shown in the Table 12-34.

Accordingly the difference is deemed as the benefit received by the ORR users.

The financial benefit is obtained from the above difference multiplied by the unit running cost and fixed cost as explained in the section for vehicle cost.

Excluding the time benefit and accident benefit, since they might differ by individuals, the benefit received by the KLORR users are estimated as shown in Table 12-35.

Table 12-34 : Total Vehicle-km and Vehicle-time of KLORR Users

		With ORR	Without ORR	Difference
2000	Total Veh-km	562,344	569,685	7,341
	Total Veh-hr	8,818	14,278	5,420
2005	Total Veh-km	9,380,451	9,654,242	273,791
	Total Veh-hr	197,249	327,976	130,727

Note: The figures are expressed as the total of the ORR portion and the other roads portion used by the KLORR users.

Table 12-35 : Benefit Received by the KLORR Users

(unit : RM)

	2000	2005
Running Cost Saving	2,041	76,114
Fixed Cost Saving	46,124	1,112,487
Total	48,165	1,188,601
Total veh-km on ORR by ORR users	186,592	3,696,767
Benefit per vehicle per km	0.258	0.322

The average benefit received by the KLORR users is estimated at M¢25.8/km for the year 2000 and M¢32.2/km for the year 2005 in 1995 prices.

If the time benefit of the passengers is also included, the benefit becomes about 70% higher than the above figures.

As a consequence, the financial analysis suggests that the project can be privatized under the following conditions:

1) Higher Toll Application

A higher toll rate, M¢18.9/km should be applied in 2000 for realizing stable operation.

As for concession period, at least 35 years are required taking into account the long construction period. In practical sense longer concession period, say 40 years will be required in order to make the project sufficiently attractive to the private sector.

In addition, the government support is also required in terms of soft loan and land acquisition.

2) Other Alternatives

In case that a higher toll application is difficult due to various social circumstances, other income source should be pursued.

The application of land development profit can be one of the alternatives.

Prior to the financial analysis, detailed development scheme based on the region-wide development guideline should be prepared.

12.3.8 Sensitivity Analysis

The sensitivity analysis was made for the following factors.

a. Higher growth rate of GRDP in Selangor
b. Changes in the estimated project cost
c. Changes in the estimated traffic volume

(1) Higher growth rate of GRDP in Selangor

The traffic forecast in this study has been made on the basis that the average annual growth rate of GRDP in Selangor is 7.0% for the period from 1995 to 2020. However the target growth rate for the Selangor state is 7.8% per annum as commented in the third Steering Committee Meeting. Hence, the influence of the higher growth rate in Selangor to the project is examined as a sensitivity analysis. As a result of traffic demand analysis the influence of the higher economic growth on the traffic demand is found to be about 3% increase in 2010 and about 12% increase in 2020. (See Appendix for more detail).

Table 12-36 shows the FIRR changes due to the difference in GRDP growth rate in Selangor.

Table 12-36 : FIRR Changes Due to Difference in GRDP Growth

	Concession Period (years)	Original Case (GRDP Growth 7.0%)	GRDP Growth 7.8% Case
Base Case	35	8.57%	9.39%
	40	9.64%	10.40%
	45	10.38%	11.07%
Toll Rate 1.5 times Base Case	35	11.10%	12.12%
	40	12.05%	12.97%
	45	12.65%	13.55%

In general, compared to the original case, the FIRR is pushed up by applying the higher GRDP growth rate.

In case of Base Case, where the toll rate is 12.6 ¢/km in 2000, the FIRR increases as much as about 0.7% to 0.8% point higher than the original case. However the FIRR is at most 11.07% even for the 45 years concession period under the conditions of Base Case, which may not be so attractive for private sectors.

In case of higher toll rate,i.e. 1.5 times Base Case in 2000, the FIRR increases as much as 0.9% to 1.0% point higher than the original case by applying the 7.8% growth rate.

In this case, the FIRR exceeds 12% in any case of concession period in the

table. Hence, it suggest that the following options may be possible for the privatization if the higher economic growth rate is promising.

a. Application of the toll rate of 1.5 times Base Case,i.e. 18.9 ¢/km for 35 years concession
b. Application of lower toll rate,i.e. about 16 ¢/km for 40 years concession.

(2) Changes in estimated project cost

The project cost has uncertain factors such as ;

- Structure Length
- Construction quantity
- Escalation of unit construction cost

The KLORR particularly passes through a mountainous area, which may involve more uncertain factors.

Hence the following cases are examined in the sensitivity analysis.

a. 20% increase of Project Cost
b. 20% decrease of the Project Cost

Table 12-37 and Figure 12-8 show the FIRR changes due to the changes in the estimated cost for the alternative toll level cases.

Table 12-37 : Changes in FIRR due to Project Cost Changes

Alternative Toll Level	Project Cost		
	-20%	Original	+20%
Base Case	11.5%	9.64%	8.50%
1.5x Base Case	13.72%	12.05%	10.80%
2.0x Base Case	15.37%	13.70%	12.39%

Note : 1) Toll level in the Base Case is 12.6 sen/km in 2000
2) Concession Period is assumed to be 40 years.
3) Other conditions are unchanged from the basic assumptions.

In any case, 20% increase of the project cost reduces the FIRR by as much as about 1.2% point, whereas 20% decrease of the project cost will push up the FIRR by about 1.6% point.

In case of 20% increase of the project cost, the conditions for privatization will become more severe ; even for the case of 1.5 times higher toll than the Base Case, the project is not so profitable. Accordingly the toll level should be further raised to 2.0 times the Base Case in order to privatize the project, since the application of longer concession period may be difficult.

In case the project cost is decreased as much as 20%, the FIRR for the Base Case

also exceeds 11.0%, therefore the toll rate of about 15 ¢/km may bring about sufficient revenue to privatize.

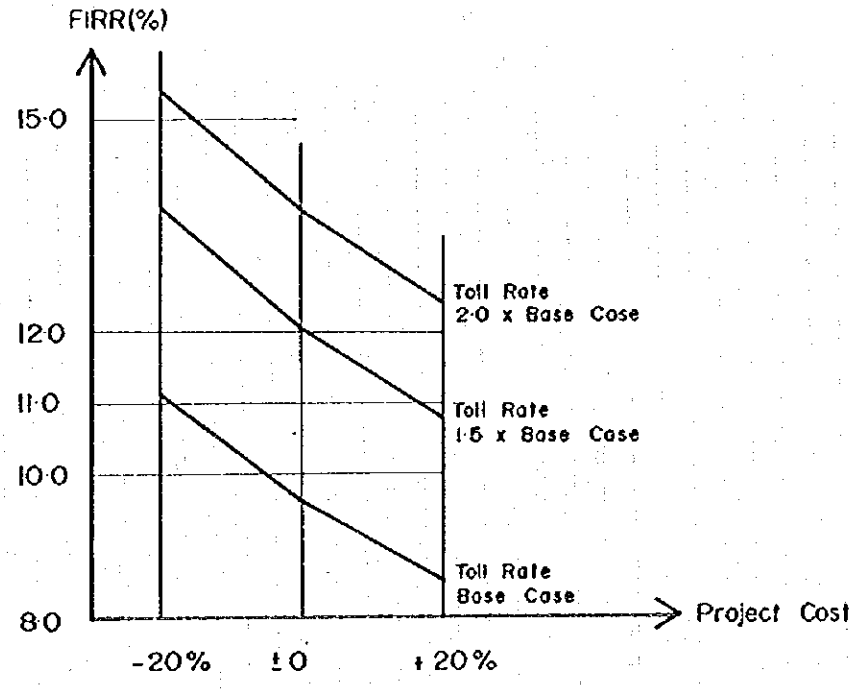


Figure 12-8 : FIRR Changes Due to Project Cost Change

(3) Changes in estimated traffic volume

The traffic demand on the project road also contains various uncertain factors such as ;

- population growth and its distribution
- economic growth rate
- modal choice of residents
- impacts of toll levy
- availability of alternative route etc.

In order to examine the influence of the traffic volume changes the sensitivity test is made for the following cases.

a. 20% increase of the traffic volume
b. 20% decrease of the traffic volume

Table 12-38 shows the FIRR changes due to the changes in traffic volume on the project road for the alternative toll level cases.

Table 12-38 : Changes in FIRR due to Traffic Volume Changes

Alternative Toll Level	Traffic Volume		
	-20%	Original	+20%
Base Case	8.10%	9.64%	10.90%
1.5x Base Case	10.43%	12.05%	13.51%
2.0x Base Case	12.04%	13.70%	15.17%

Note : Refer to the notes under the Table 12-37.

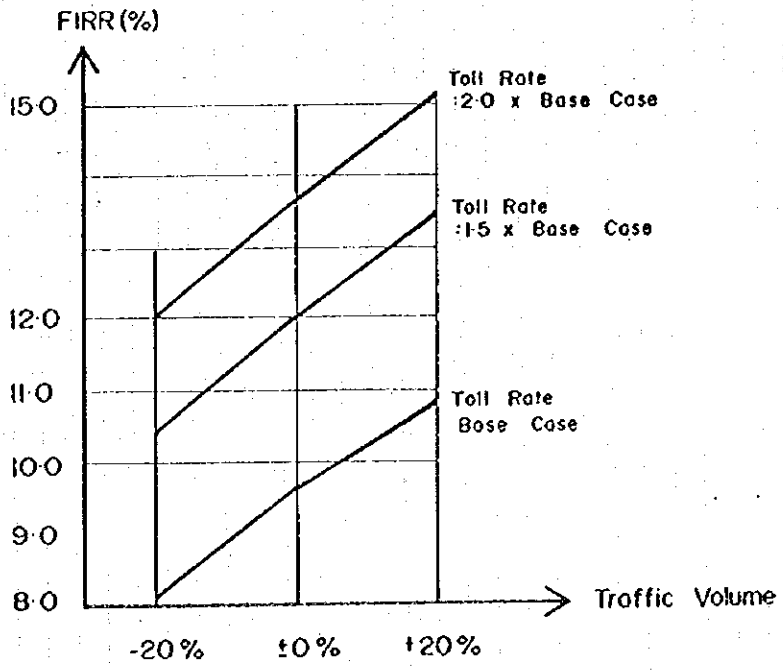


Figure 12-9 : FIRR Changes Due to Traffic Volume Change

Generally, the FIRR changes are proportional to the changes in the traffic volume for all the cases. The 20% increase of traffic volume will raise the FIRR about 1.5% point, on the other hand the 20% reduction of traffic volume will reduce the FIRR about 1.6% point.

In case of the 20% decrease, the toll level should be 2.0 times Base Case if is privatized.

On the contrary, the 20% increase of traffic volume will enable the privatization under the lower toll rate than the original case, i.e. the toll at around 15 ¢/km.

Chapter 13

IMPLEMENTATION

CHAPTER 13 IMPLEMENTATION PLAN

13.1 Examination of Development Funds

The past allocation of the Federal Government Funds to the transport sector together with its break down to roads and bridges is summarized in Table 13-1.

Table 13-1 : Past Development Allocation Expenditure of Federal Government

in current price (M$ Million)

	Plan Period				
	1971 - 1975 2MP	1976 - 1980 3MP	1981 - 1985 4MP	1986 - 1990 5MP	1991 - 1995 6MP
Total Development Expenditure of Federal Government	9,793 (100%)	24,937 (100%)	46,320 (100%)	35,300 (100%)	55,000 (100%)
Allocation to Transport	1,234 (12.6%)	2,843 (11.4 %)	6,990 (15.1%)	6,823 (19.3%)	10,759 (19.6%)
Allocation to Roads & Bridges	698 (56.5 %)	1,765 (62.1 %)	4,167 (59.6 %)	6,011 (88.1 %)	7,585** (70.5 %)*
- Highways	663	1,577	3,543	4,850	6,299
- Rural Roads	35	188	624	1,161	1,286

Note : 1. The figures for 2MP - 5MP are actual expenditures and those for 6MP indicate the development allocation.
2. The figures in the parenthesis for Transport shows the percent share to total expenditure.
3. * indicates the percent share to the allocation to Transport.
4. ** : The services loan of about M$ 1.5 billion for privatization is to be spent out of the allocation to highways.

Source ; TMP, FOMP, FMP, SMP

The future development funds have been estimated by using the correlation with the Gross Domestic Products in HNDP Study. The estimates are further converted to 1995 prices as shown in Table 13-2.

Table 13-2 : Estimation of Total Development Funds of Federal Government

(RM Million)

Plan Period	Development Funds		Gross Domestic Products	% to GDP
	(a) (Current Price)	(b) (1995 Price)		
1971 - 1975 (2MP)	9,793		90,987	10.8
1976 - 1980 (3MP)	24,987		196,845	12.7
1981 - 1985 (4MP)	46,320		346,856	13.4
1986 - 1990 (5MP)	35,300		458,232	7.7
1991 - 1995 (6MP)	55,000		765,743	7.2
1996 - 2000 (7MP)	71,000	81,254	1,073,445	6.6
2001 - 2005 (8MP)	96,020	109,887	1,490,251	6.4
2005 - 2010 (9MP)	129,069	147,709	2,085,275	6.2

Note : 1. Development Funds (a) : current prices for 1971 - 1990, 1991 prices for 1991 - 2010.
2. Development Funds (b) : 1995 prices
3. Development Funds for 1971 - 1990 are actual expenditures.
4. Development Funds (a) for 6MP and 7MP are planned allocation.
5. Development Funds (a) for 8MP and 9MP are estimated by a regression analysis.
DF = 0.55542 GDP + 12349 (R = 0.883)
where DF : Development Funds and GDP : Gross Domestic Products

Sources : TMP. FOMP, FMP, SMP, OPP2

In estimating the development allocation to highways, it is assumed in the HNDP Study that the percentage share of the highway development funds in the future will be maintained at the same level as the Sixth Plan Period.

The Table 13-3 shows the calculation result of the development allocation to highways.

Table 13-3 : Estimation of Development Allocation to Highways

(RM Million)

Plan Period	Allocation to Highways	Development Funds	% Share
1971 - 1975 (2MP)	663	9,793	6.8
1976 - 1980 (3MP)	1,577	24,987	6.3
1981 - 1985 (4MP)	3,543	46,320	7.6
1986 - 1990 (5MP)	4,850	35,300	13.7
1991 - 1995 (6MP)	6,299	55,000	11.5
1996 - 2000 (7MP)	9,344	81,254	11.5
2001 - 2005 (8MP)	12,637	109,887	11.5
2005 - 2010 (9MP)	16,987	147,709	11.5

Note : 1. The figures are expressed in current prices for 1971 - 1990 and 1991 prices for 1991-1995 and 1995 prices for 1996-2010.

Sources : TMP, FOMP, FMP, SMP.

The allocation to Selangor state is estimated by further assuming that the average percentage share of Selangor in the period from 4MP to 6MP can be applied.

As a result, the development allocation for highways to Selangor is estimated as RM486 million in 7MP period and RM657 million in 8MP period as shown in Table 13-4.

Table 13-4 : Estimation of Development Allocation to Selangor in 1995 Price

(RM Million)

	Allocation to Selangor	Allocation to Highway	% Share
1996 - 2000 (7MP)	486	9,344	5.2
2001 - 2005 (8MP)	657	12,637	5.2
2006 - 2010 (9MP)	883	16,987	5.2

Note : The % share of Selangor is assumed 5.2 %, which is the average of that for the period from 4MP to 6MP.

13.2 Implementation Schedule

Based on the analysis for determining the section priority and assessing the financial viability, the implementation schedule of the KLORR is proposed as follows. The scheduling of each sections is also shown in Table 13-5 and Figure 13-1.

1) North - South Expressway at South - North-South Central Link.
(Section 3 Segment 2)

This section is scheduled to be implemented from 1997 to 1999 including the detail engineering, therefore will be open to traffic in 2000.

2) Federal Route No. 1 at South - North-South Expressway at South.
(Section 3 Segment 1)

This section is scheduled from 1998 to 2000, therefore, will be open to traffic in 2001.

3) Hulu Langat Road - Federal Route No. 1 in the South. (Section 2 Segment 2)

This section is scheduled from 1999 to 2001 and will be open to traffic in 2002.

4) North - South Expressway at North - KL-Karak Highway. (Section 1)

This section is scheduled from 2000 to 2003 and will be open to traffic in 2004.

5) KL-Karak Highway - Hulu Langat Road. (Section 2 Segment 1)

This section is scheduled from 2002 to 2005 and will be open to traffic in 2006.

Among the proposed thirteen (13) interchanges, the interchanges of No. 5 and No. 7 are to be connected with new roads, i.e., the extension of the Ampang Elevated Bypass and the extension of East-West Link respectively.

Accordingly, those connecting roads should be timely constructed, otherwise the corresponding interchanges would not be accessible.

Table 13-5 : Proposed Implementation Schedule

Section	Total Length (km)	No. of Lanes	Project Cost (RM million)	Year 1997	1998	1999	2000	2001	2002	2003	2004	2005
Section 3 Segment 2 North South Expressway at South-N-S Central Link	18.30	6	864.9									
Section 3 Segment 1 Federal Route 1 at South - North South Expressway	10.20	6	428.5									
Section 2 Segment 2 Hulu Langat Road - Federal Route 1 at South	14.58	6	684.3									
Section 1 Segment 1 and 2 North South Expressway at North - KL - Karak Highway	22.83	6	1,379.1									
Section 2 Segment 1 KL - Karak Highway - Hulu Langat Road	23.00	6	1,289.1									
TOTAL	88.91	6	4,645.9	120.3	445.2	807.0	643.1	537.0	546.2	845.1	351.0	351.0

Note : E-W Link Extension is scheduled to be completed in 2001.
Ampang Elevated Bypass is scheduled to be completed by 2005.

Detail Engineering
Land Acquisition
Construction

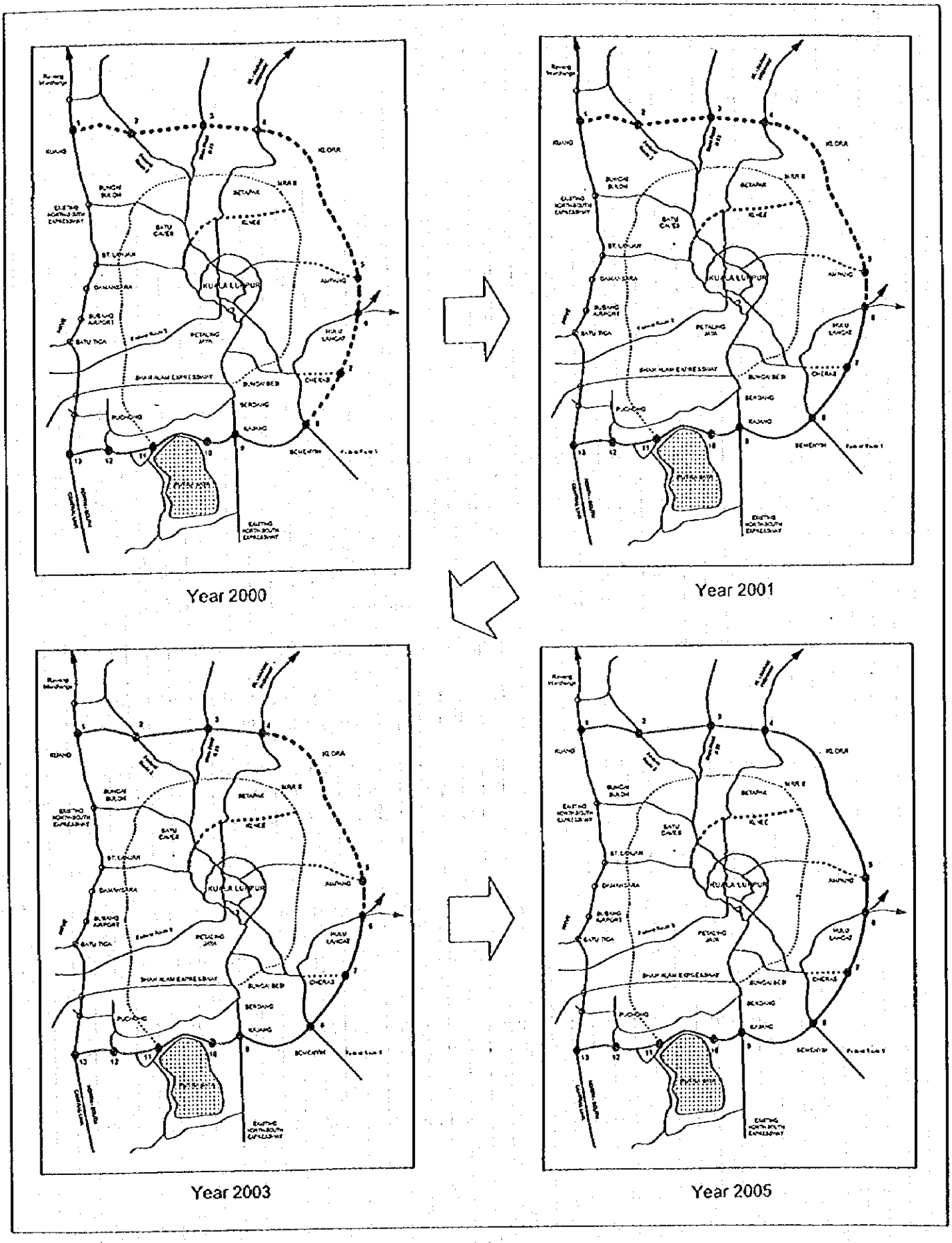


Figure 13-1 : Proposed Implementation Schedule

13.3 Conditions For Privatization

Whether or not the KLORR is implemented as a privatized project is a policy matter of the Government. If it is privatized, BOT system will be applied and the KLORR is to be operated as a toll road. The conditions for the case of privatization are as follows :

1) Project

Total Length	:	88.91 km
Total Project Cost (in 1995 prices)	:	RM4,645.9 million
of which Contruction Cost (Including Environmental Cost)	:	RM3,984.1 million
Detail Engineering	:	RM197.3 million
Land Acquisition Cost	:	TM464.5 million

2) Finance

Debt equity ratio is assumed as 80 : 20 in the analysis, however, it is more desirable to increase the equity to 25 % of the initial investment if possible, in order to realize more stable operation. In this case, the financial composition will be as follows :

		(in 1995 prices)	
Equity	:	RM1,045.35 million	(25%)
Commercial Loan	:	RM2,299.77 million	(55%)
Government Support Loan	:	RM836.28 million	(20%)

3) Toll Rate ; In the year 2000; M¢ 18.9 per km will be applied.

The toll will be raised every 10 years with the increase rate of 6 % per annum.

4) Concession Period ; 40 years including the construction period is applied. If the toll is higher than M¢18.9 per km, the concession period can be reduced.

5) Government Support

As a government soft loan, 20% of the initial investment, i.e., RM836.3 million is expected during the period from 7MP to 8MP. Taking into account the development funds described in the section 13.1, it is difficult to expect further more amount of government loan.

In addition, the land acquisition cost is assumed to be tentatively paid by the government as an advancement, it will be reimbursed at the later stage by the concession company.

Under the above conditions, the FIRR is expected to be 12.07% and ROE is to be 12.91%.