GOVERNMENT OF MALAYSIA

THE FEASIBILITY STUDY ON TRANSPORTATION FACILITIES PROJECTS IN KLANG VALLEY

FINAL REPORT

FREIGHT TERMINAL PROJECT

TEXT

JUNE 1989

JAPAN INTERNATIONAL COOPERATION AGENCY

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CONTENTS

CHAPTER 1 : INTRODUCTION

1.1 Background

The Klang Valley Transportation Study, 1987 (hereinafter referred to as "KVTS"), in its preparation of the transport masterplan for Klang Valley to the year 2005 has identified the need for the construction of three freight terminals (Figure 1.1). The proposal is aimed at improving freight transport and upgrading its level of efficiency in the region. The construction of the terminals was one of the priority transportation facility development projects proposed by the KVTS.

The Government of Malaysia has accepted the proposal and further requested the Government of Japan to conduct the Feasibility Study on Transportation Facilities Projects in the Klang Valley Region (hereinafter referred to as "the Study") that includes the Freight Terminal Project for the Klang Valley Region.

The component of the Study on Freight Terminal Project was started in October 1987 and completed in September 1988. In the course of the Study, the Study Team submitted the Progress Report (I) in February 1987 and the Interim Report in September 1988. This report is the TEXT of the Final Report on the Freight Terminal Project submitted in July 1989.

1.2 Objectives of the Study

The Freight Terminal Project Study is to:-

(a) Examine the economic feasibility of the terminals;
(b) Carry out financial analysis and prepare implementation plan for the terminals;
(c) Prepare preliminary engineering design for the terminals;
(d) Propose legislative guidelines and suggest management/implementation organisations for the construction of the terminals.

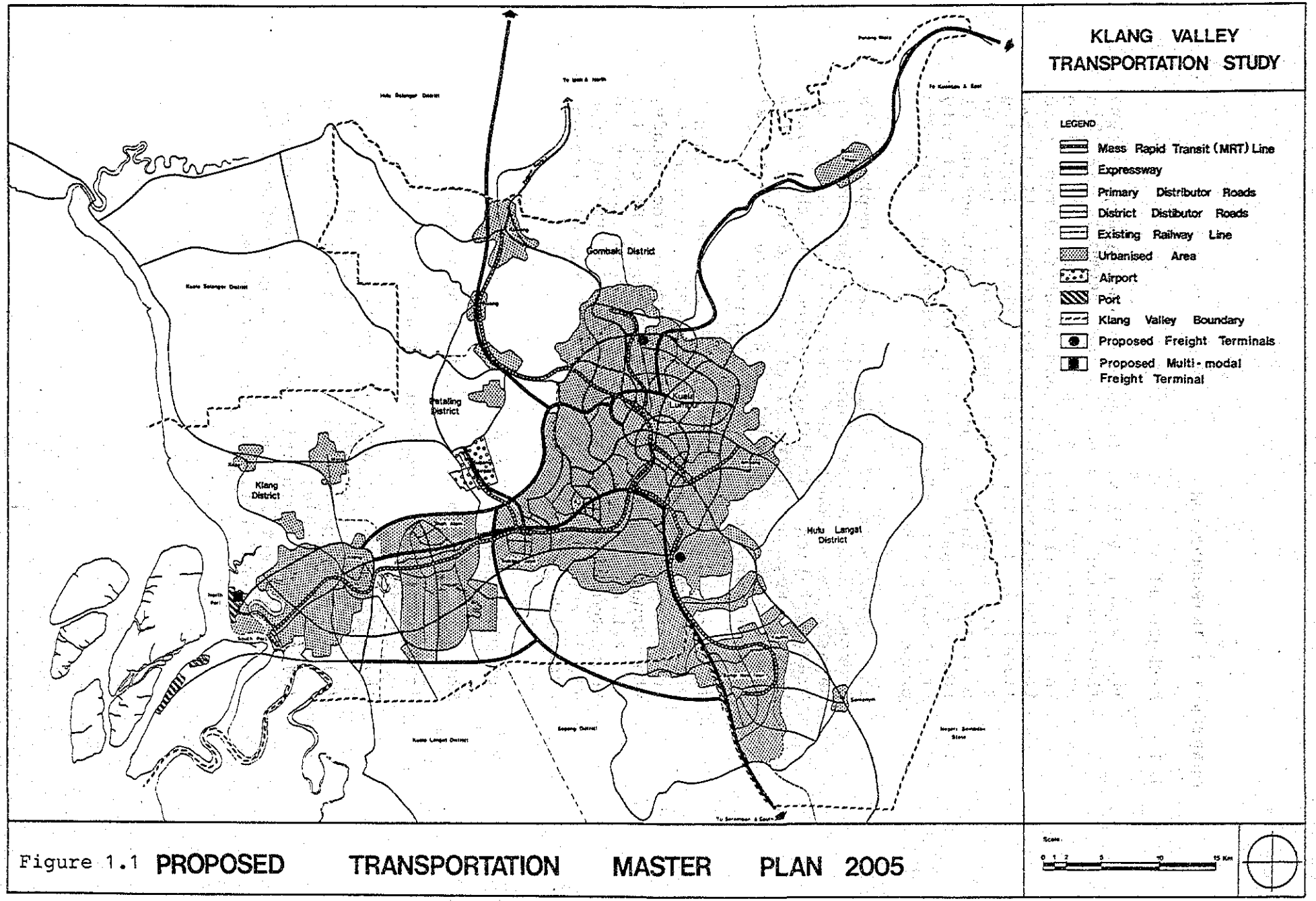


Figure 1.1 **PROPOSED TRANSPORTATION MASTER PLAN 2005**

1.3 Study Approach

Figure 1.2 illustrates the general flow of the study process for the Freight Terminal Project.

The major steps undertaken by the study are:-

* Examination of existing freight transport situation in the Study area, its related facilities and capacities and evaluation of its operational problems,

* Developing a conceptual plan for the function and operation of the terminals,

* Forecasting future freight traffic and utilization rate of terminals,

* Location Study for selecting most advantageous sites for the terminals,

* Topographic and geological surveys on the selected sites,

* Preliminary design for the terminals and their facilities,

* Economic evaluation,

* Financial analysis,

* Management and implementation organisations Study,

* Legislative measures and guidelines proposals

* Final recommendations and implementation programme proposal.

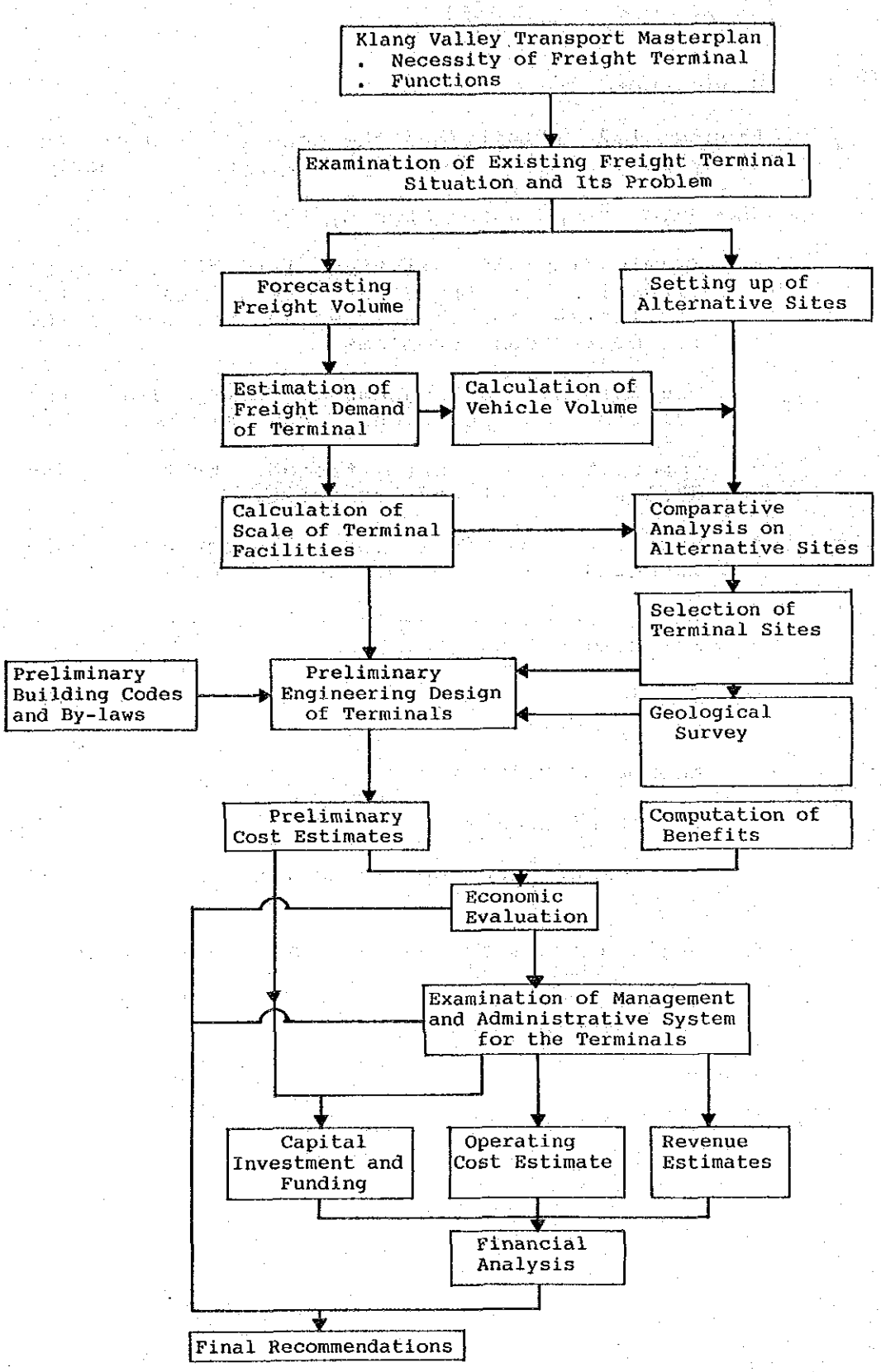


Figure 1.2 : Study Approach Flowchart

1.4 Structure of the Report

This report comprises of 10 chapters. Chapter 1 gives the background and general study process of the "Freight Terminal Project".

Chapter 2 discusses the existing freight transport situation in Klang Valley and its problems.

Chapter 3 describes the basic concept in planning for an efficient freight transport system with Freight Terminal as a key element in organizing and rationalizing freight movement. The functions of a terminal complex are discussed. This chapter also lays out the conceptual plans for the three terminals in Klang Valley and points out the various benefits that are expected from the construction of Freight Terminals.

Chapter 4 discusses the methods and results of forecasting freight traffic volume and hence the basic spatial and facility requirements in the terminals.

Chapter 5 contains the result of the locational study for the three (3) terminals and presents the final output in the preliminary design of the three terminals.

Chapter 6 describes the cost estimates of the terminals.

Chapter 7 describes operation, administration and legal aspects of the Freight Terminals.

Chapter 8 discusses the economic evaluation results whether the Freight Terminals will bring about sufficient contribution to the national economy.

Chapter 9 discusses the results of the financial analysis for the Freight Terminals.

Chapter 10 contains the conclusion and recommendations of the Freight Terminals.

CHAPTER 2 : EXISTING FREIGHT TRANSPORTATION CONDITIONS

2.1. Social Background

The population of Peninsular Malaysia was about 14.0 million in 1988. About 20% or 2.5 million is concentrated in the Klang Valley. The continued tendency for the population to concentrate in Klang Valley is due to the snowballing effect of growth in the region and it is anticipated that by 2005, 28% of the population is expected to live in Klang Valley. Therefore, it is apparent that the volume of goods movement in Klang Valley in years to come will be even greater because consumer goods volume is proportionate to population size. The growth rate for goods volume in Klang Valley is also expected to be higher than population growth rate because goods consumption per capital is higher in this capital region.

In recent years, primary commodities such as palm oil and petroleum and their related products show an increasing trend in volume; while logs, tin and rice remain stagnant. However, volume of goods movement for logs and rice in Klang Valley is large because they are processed and consumed in the region. Goods movement for petroleum and other oil products on the other hand are mostly through traffic.

2.2 Freight Transportation by Road

(1) Existing Lorry Transport Operations

The Study Team's surveys reveal that transporters' operations are comparatively small scale. Although there exists a few lorry operators' associations, they are not well organised or active. The transport operators gather themselves into groups of like sector, and operate according to the fluctuating demand of their respective sectors.

Goods vehicles are classified into two categories according to their licence or permits.

To operate a lorry for hire, the operator requires an 'A' permit from the Road Transport Licensing Board. 'C' permit is meant for the transport of licence holders own goods only. Lorries with laden load of less than 2500kg come under the "Decontrolled" category. In the Klang Valley 'A' permit lorries comprise only 8% compared to 29% for 'C' permit lorries. According to the number of registrations with the Road Transport Department, lorries registered in the Klang Valley comprise 35% of the total registration in Peninsular Malaysia.

(2) Road Transport within Klang Valley

The road network pattern in Klang Valley shows one radial road to the northern region, one radial road to the east coast and two radial roads to the southern region. All these roads converge at Kuala Lumpur. Besides an arterial road which links Kuala Lumpur to Klang on an east-west axis, two major ring roads, namely the Inner Ring Road and the Middle Ring Road complete the configuration of the existing major roads in Klang Valley.

Urban streets in Kuala Lumpur are heavily trafficked and in order to reduce traffic congestion, one way systems and restriction on heavy vehicle movement at the morning and evening peak hours have been introduced. Figure 2.1 shows the major roads on which restricted hours for heavy vehicle movement are enforced.

As a result, during the restricted hours, lorries are often found parked by the roadside beyond the affected roads. During the noon hours which do not fall within the restricted hours, lorries are the major cause of traffic congestion in the cities where they load and unload their goods.

Figure 2.2 shows the traffic volume on the major roads. Traffic volume between Kuala Lumpur and Petaling Jaya is the highest, followed by the section of Petaling Jaya-Shah Alam and Shah Alam-Klang. The Kuala Lumpur-Klang corridor consisting of Federal Highway is therefore the most congested at peak hours.

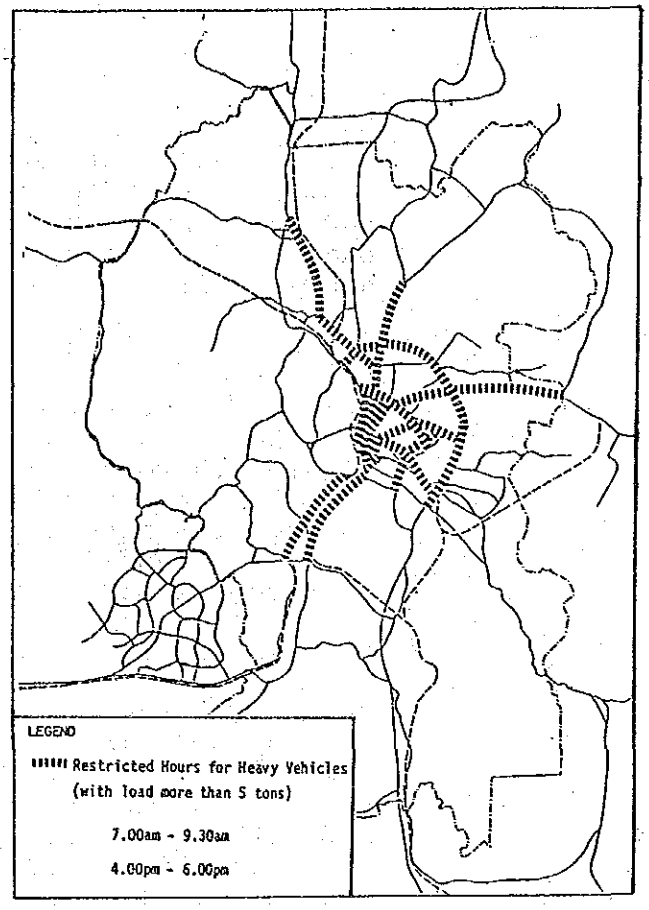


Figure 2.1 :

Restriction on Heavy Vehicle Movement at peak hours on Major Roads in Kuala Lumpur.

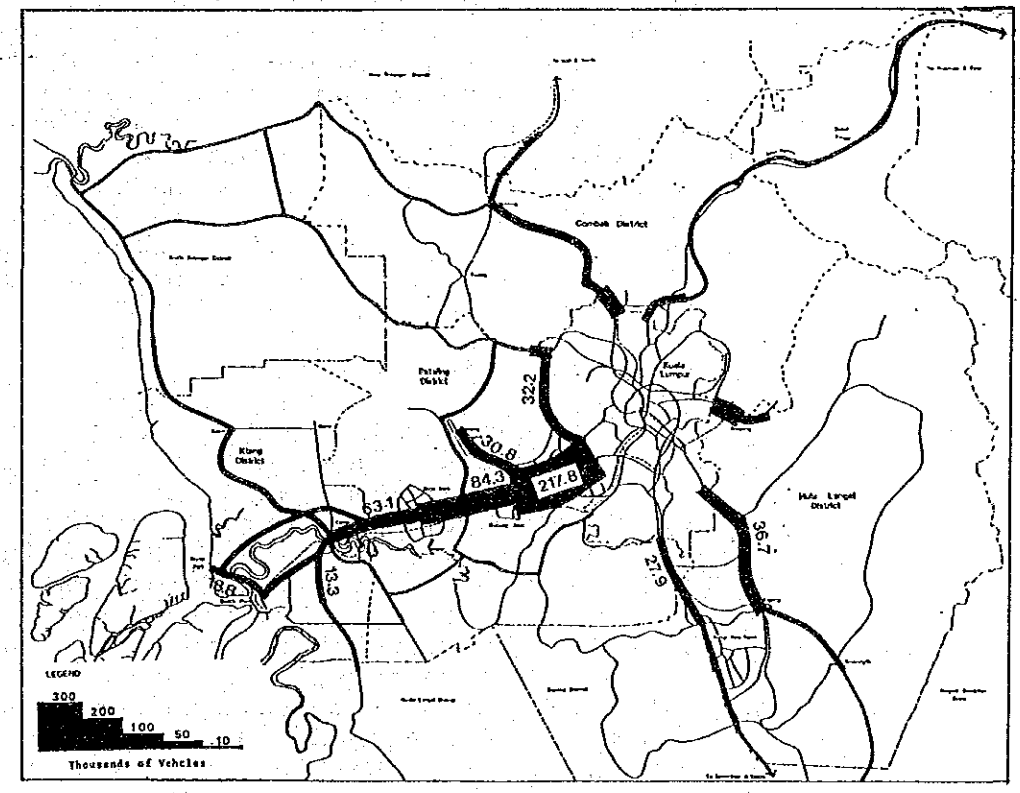


Figure 2.2 : 16 Hours Traffic Volume on the Major Roads in Klang Valley in 1985.

This road not only carries the normal commuter traffic to and from Kuala Lumpur, Subang International Airport and the industrial areas, but also large volume of goods traffic to and from Port Klang.

Wholesalers located in downtown Kuala Lumpur are observed to conduct their loading and unloading activities on the streets oblivious of the congestion created by the lorries parked there. Goods handling is still done manually because the old shophouses are too narrow for handling by machinery. Thus a longer handling time compounds the seriousness of traffic congestion.

(3) Road Transport on National Highway

Most of the major towns in Peninsular Malaysia are located on the west coast. In the central area is Kuala Lumpur, the capital city, and to the north are Ipoh and Penang and other smaller towns such as Butterworth and Kota Setar. Seremban, Malacca and Johor Baru are located in southern region. On the east coast there are fewer towns; the three major ones being Kota Baru, Kuala Trengganu and Kuantan. All these towns are linked by the national road network. The distance between Kuala Lumpur and Kota Baru by road is 658km. Assuming an average speed of 40km/h, this trip will take about 16.5 hours. Similarly, a trip form Kuala Lumpur to Kota Setar which is 487km away will take about 12 hours. To the south of Kuala Lumpur, Johor Baru which is 367km away can be reached by road in about 9 hours.

2.3 Freight Transportation by Rail

The Malayan Railway (KTM) operates freight trains on its rail network. However, the volume of cargoes handled by KTM has been declining annually, mainly due to long transport time incurred. For example, the time taken, excluding the handling and marshalling time at the terminals, for a freight train to travel from Kuala Lumpur to Butterworth or Singapore varies from 13 to 19 hours for a distance of about 400km. The time taken from Kuala Lumpur to Kuala Krai via Gemas, a distance of about 600km, varies from 26 to 30 hours. Within the Klang Valley region, the distance between Kuala Lumpur and Port Klang, about 46km, can be covered in 2 1/2 hours.

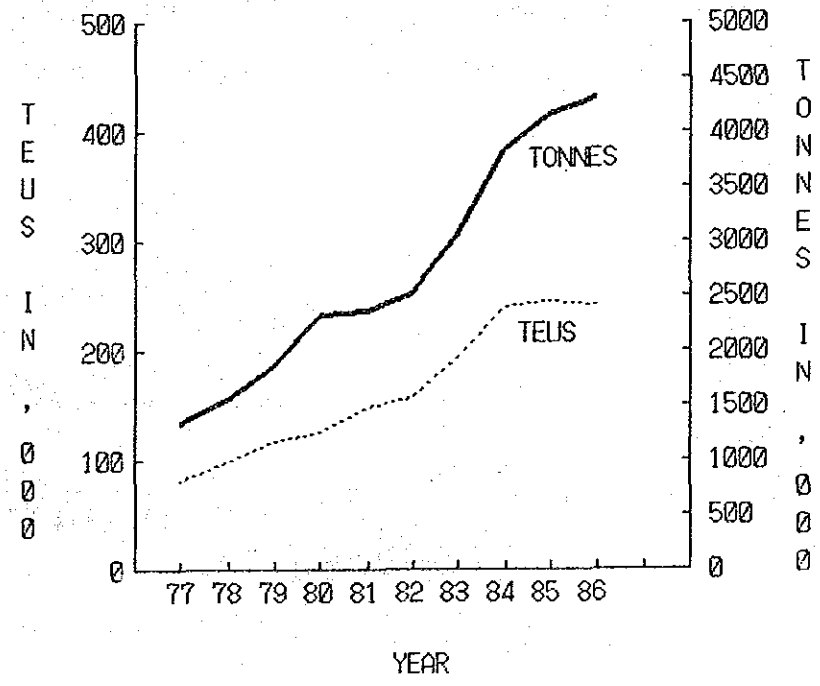
Bulk commodities form a major part of the freight traffic. Consumer products transported by KTM are mainly rice and sugar.

2.4 Freight Transportation by Sea

Many towns are located along the east and west coast of Peninsular Malaysia and naturally sea transportation linking these towns could be considered. But sea transportation is more appropriate for mass volume and is not suitable for the transport of small cargoes.

Figure 2.3 shows the trend of containerization at Port Klang from 1977 to 1986. The total containers throughput has increased by more than 3 times in the past decade, from 82,300 TEUs in 1977 to 242,200 TEUs in 1986.

Table 2.1 shows that while the overall share between imports and exports are about equal, the shares of less than car load (LCL) compared to full car load (FCL) are only 13%-16% for imports and 20-21% for exports.



Source : Lembaga Pelabuhan Kelang (LPK)

Figure 2.3 : Trend of Containerization at Port Klang

Table 2.1 : Breakdown of Import/Export Containerised cargoes by FCL and LCL

(Unit : TEU)

	IMPORT					EXPORT					TOTAL
Year	FCL	%	LCL	%	Total	FCL	%	LCL	%	Total	
1986	100,351	86.9	15,184	13.1	115,535	87,102	78.9	23,265	21.1	110,367	225,902
1987	98,318	83.9	18,776	16.1	117,094	89,370	79.4	23,124	20.6	112.494	229,588

Source : LPK

Figure 2.4 illustrates the existing physical distribution system by containers. At Port Klang there is only one company (Klang Container Terminal Sdn Bhd) handling containers from sea to port or vice-versa. Two haulers (Kontena Nasional Sdn Bhd and Shapadu Kontena Sdn Bhd) move containers from the port to inland destinations. The former company has an inland depot in Seri Setia at Sungei Way with an area of 73,000 sq.m. While the latter has a depot in Port Klang with an area of 56,000 sq.m. Both haulers move containers either by FCL or by LCL using their depots for stuffing and unstuffing.

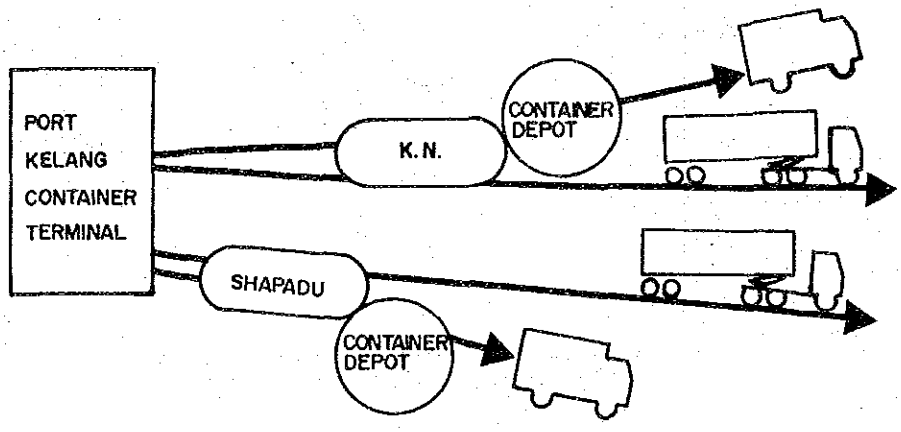


Figure 2.4: Existing Organization of Container Haulers

2.5 Existing Warehousing Facilities

Warehouses used by import/export related enterprises and manufacturing concerns are relatively new and large (more than 1,000 sq.metres). These warehouses are of modern design, and using equipment such as pallets and forklifts for cargo handling. These warehouses are mainly located in the hinterland of Port Klang, and in the industrial areas of Petaling Jaya, Shah Alam and Klang.

In the city area, except for a few godowns near the railway yard in Brickfield and some old shophouses in the CBD being converted to stores, there are infact very few warehouses.

In terms of utilization, there are warehouses for storing goods for a long period, warehouses for storing goods temporarily and warehouses wherein goods are stored for only a few days to facilitate sorting and redistribution of the goods.

Since storage must result in an activity of entering or leaving a warehouse, the utilization rate at the warehouse is highly related to the storage period and the efficiency of hauling the goods in and out of the warehouse. For long period storing, the warehouse's storage efficiency is more important than hauling efficiency. In a distribution centre where goods are stored for only a short period, the hauling efficiency rather than the storage efficiency is the main concern.

At most of the narrow shophouses in the CBD, manual handling is inevitable because there is hardly space to manoeuvre a forklift around the floor area. Although the use of handling equipment will reduce the floor space for storage, nevertheless goods can be stacked higher and be moved in and out of the store faster.

Therefore, for all practical purposes the use of handling equipment must be considered. That is, warehouse area must be at least large enough for mechanical handling.

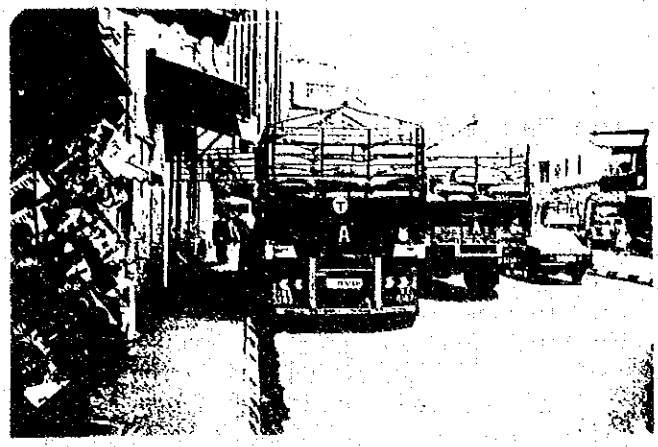


Photo 1:
Double parking of unloading lorries in Kuala Lumpur CBD

Photo 2:
Various shophouses used as warehouse in Kuala Lumpur CBD

Photo 3:
Manual cargo handling at roadside in Kuala Lumpur CBD

Photo 4:
Example of a modern warehouse in Petaling Jaya

2.6 Existing Problems of Lorry Transport Industry

The following existing problems concerning lorry transport industry are identified:

(1) Lack of Terminal Facilities

The present 'terminals' in Klang Valley for lorries mainly consist of warehouses constructed by large-scale manufacturers or traders, old shophouses where storage and administrative functions are performed, and roadside areas in the Central Business Districts (CBD).

Although the use of public roadways for business operation may at one time have been tolerable, the growth of this type of operation in the future is limited for the following reasons:-

(a) Pressure for stricter enforcement of traffic regulations relating to the use of road space is growing;
(b) Awareness of the cost of inefficiencies in the transport system (whether caused by location in congested areas or lack of economies of scale) is increasing;
(c) Expansion within the CBD involves prohibitive land acquisition costs.

(2) Delay due to Traffic Congestion on Urban Streets

In the Klang Valley, the environment for cargo handling by lorries shipment has developed over time without planning. Facility was not designed as a freight terminal to meet the needs and activities related to the industry and the growth of the region. Consequently, landuse and road capacity are not matched. The present lorry transportation involves the use of heavy vehicles making frequent trips to the CBD, whereas the cargo handling district at the centre of the CBD has a network of narrow roadways which are densely signal controlled and therefore slow to enter and leave. Delays in access have a disadvantage for the nation since most non-bulk commodities in Malaysia are transported by lorry. The rising cost of fuel consumed during periods of delay and the increased transport time have helped to inflate commodity prices unnecessarily.

(3) Restriction on Heavy Vehicle Movement

As a result of traffic congestion on the urban roads, the authorities have to resort to measure in restricting the movement of heavy vehicles (with tare weight of more than 5 tonnes) during the morning and evening rush hours, i.e. 7.00am to 9.30am and 4.00pm to 6.00pm on sixty (60) roads in Kuala Lumpur (see Figure 2.1). Such measure aims at mitigating traffic congestion in CBD is detrimental to the efficiency of freight transport industry.

(4) Environmental Impact on Residential Area

The encroachment of lorry traffic on residential area creates noise and air pollution, damages to local access roads and is a potential accident hazard. Many lorries are parked in residential areas overnight or during the restricted hours.

(5) Others

Other inefficiencies and problems of the present lorry transport industry are listed below:-

(a) Many small lots of commodities shipped at different times involve either repetitive scheduling or delays;

(b) Expansion of the business area increases the distribution territory causing longer trips and duplication of routes;

(c) The lack of space and unsystematic cargo handling increase the frequency of handling which may cause damage to the contents;

(d) Wholesale business located in congested downtown area increases transport time and costs, and parking areas are harder to find;

(e) Areas to expand facilities for physical distribution are more difficult to find and increasingly expensive;

(f) Employees for cargo transport are increasingly difficult to find as employees work conditions worsen due to low profit margins which cannot finance benefits.

CHAPTER 3 : CONCEPTUAL PLAN FOR FREIGHT TERMINAL PROPOSALS IN KLANG VALLEY

3.1 Necessity for Freight Terminals in Klang Valley

The analysis of the existing freight transport in Klang Valley has identified the various problems discussed above. The freight transport industry therefore requires a more systematic organization of operators and movement of goods. The following are needs which have been identified for improving and upgrading freight transport effectively and efficiently in Klang Valley.

(1) the need for a proper place to conduct activities such as loading/unloading, sorting of goods according to like destination and temporary storage;

(2) the need to achieve higher transport efficiency and more economical transport operations through rationalization of line-haul and collection/delivery operations;

(3) the need for a place to consolidate small cargoes into unit load or to unstuff LCL containers;

(4) the need for heavy vehicles to avoid using congested urban streets;

(5) the need to prevent the encroachment of lorry traffic on residential area; and

(6) the need to provide lorry parking area.

The above reaffirmed the need for the provision of general cargo freight terminals within Klang Valley as proposed by the Klang Valley Transportation Study.

In addition, according to the Lembaga Pelabuhan Kelang (LPK's) forecast, the growth of containerized cargoes is expected to increase annually. The handling of containerized cargoes is different from that of conventional small cargoes and therefore should be treated separately. A multi-modal freight terminal is therefore required to handle such needs.

Ideally, full car load (FCL) containers are shipped door-to-door, i.e. directly from consignor to consignee. However, consolidated cargoes can be transported by less than car load (LCL) containers when small cargoes are concentrated and classified at the freight terminal. The freight terminal is necessary as a place for consolidating small cargoes into a unit load or to unstuff the LCL containers.

In contrast to the function of a containerport as an area for coordinating the transfer of containers between ship and land, a multi-modal freight terminal has the objective to absorb the temporary fluctuation between the time a consignment is received at the port and when it is required by the consignee, i.e. when a manufacturer (or importer) has no immediate need for the imported consignment, he could store it at the freight terminal. On the other hand, the consignment can quickly be picked up from the freight terminal when required.

3.2 Concept of An Orderly Physical Distribution System

3.2.1 Basic Concept

The concept of an orderly physical distribution system network in future with Kuala Lumpur as the centre can be seen in Figure 3.1.

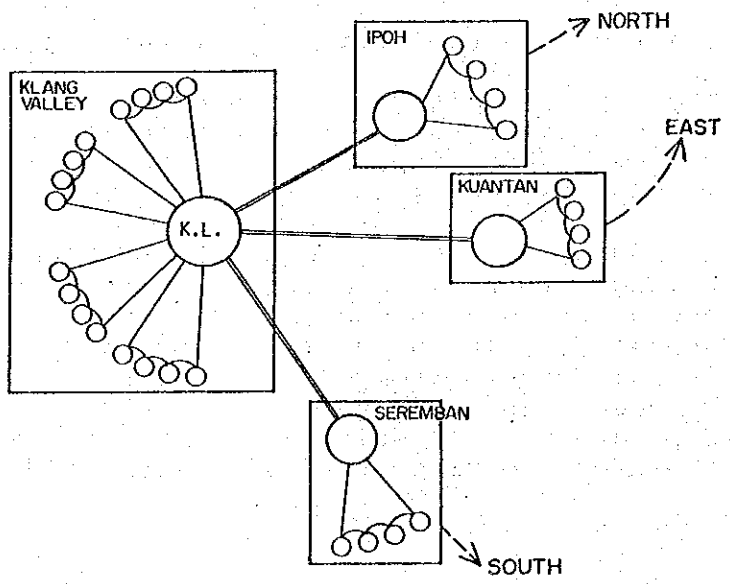


Figure 3.1: Concept of Physical Distribution System for Klang Valley

Line-haul or scheduled routes for lorry transport between Kuala Lumpur and other towns are foreseeable. Line-haul trucks on designated routes will be operated on time-schedules. The operation will be done exactly and promptly according to user's requirements. Efficient loading, unloading and improvement of the unit vehicle size will be promoted by the establishment of freight terminals.

Pick-up and delivery services within the urban area will be served by small lorries according to time-schedules. Unloaded cargoes from line-haul lorries will therefore be delivered within the urban area without having heavy line-haul vehicles enter into the CBDs.

It is standard practice for line-haul lorries to travel by night in order to increase delivery speed. The cargoes which arrive at the terminal the next morning are sorted and distributed on the same day. In the evening the consignments picked up during the day are loaded on to the line-haul lorries.

3.2.2 Functions of Freight Terminals

It is obvious from the above discussion that freight terminals are the pivotal element in striving for an efficient freight transport system. Figure 3.2 further illustrates the functions of freight terminals in relation to lorry movements.

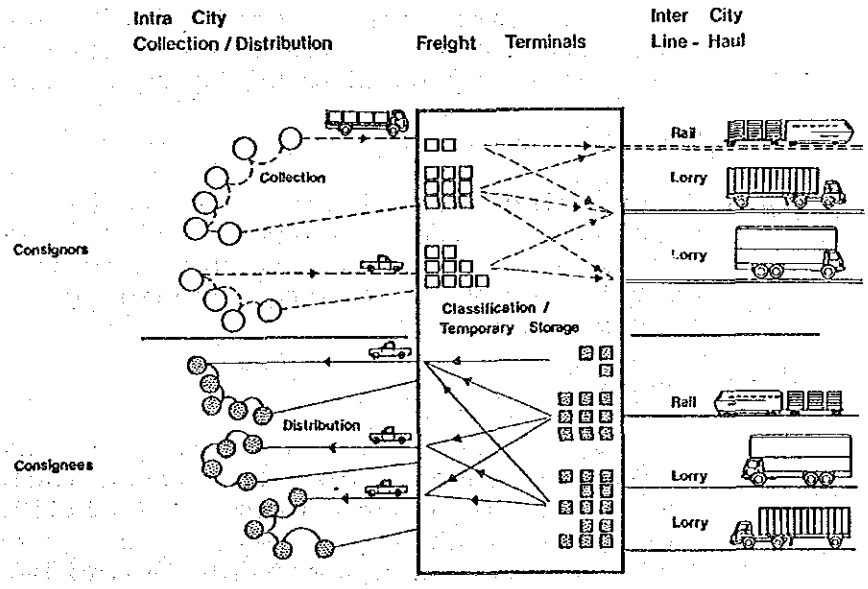


Figure 3.2: Functions of a Freight Terminal

The type of facility to be incorporated into the design of the freight terminal depends on whether it is for a lorry terminal or a multi-modal freight terminal.

(1) Handling Platform

Unloading from pick-up lorries and sorting by shipping destination will be performed so that cargo is transferred onto a specific shipping block on the platform for loading to line-haul lorries or containers.

Unloaded cargoes from line-haul lorries or containers will be sorted for trans-shipment to other line-haul lorries or for delivery by zone in delivery lorries. The platform can also be used as a temporary storage area.

(2) Engineering Workshop

Vehicles can be fueled, cleaned, inspected and given running repairs at the freight terminal. Handling equipment can also be repaired here.

(3) Lorry Parking Facilities

Lorries can be parked while the drivers take rest at the terminal.

(4) Container Yard

This is an open yard for stacking of fully laden or empty containers. With the use of forklifts or by straddle or gantry cranes, containers may be stacked three to five deep.

(5) Storage and Warehousing Facilities

Warehousing facilities in the freight terminal hold cargoes for detailed distribution over an extended time period and permit ready access to needed goods from nearby areas.

(6) Others

Office space for customs, transporters, forwarding agents, etc. are often included in the administration block. Facilities for employees such as canteen, rest rooms and lockers, etc. are sometimes provided at the freight terminal.

3.2.3 Benefits Derived from a Systematic Physical Distribution System

With the establishment of a physical distribution system for transportation of inter-city and intra-city goods using freight terminal, the following benefits can be expected.

(1) The reduction of transport cost, total truck traffic volume and consumption of fuel can be expected based on increased loading factors, route simplification, increased vehicle size on line-haul routes and the rationalization of cargo transfer.

(2) At the freight terminals, merits of scale for terminal users (transporter) will be increased by the common use of various terminal facilities and land space.

(3) When the existing individual small-sized transport 'terminals' which are located in the centre of the city are moved to the constructed terminal areas, their vacated land can be used to improve urban facilities. Furthermore, access roads in the city will be relieved of heavy vehicle traffic.

(4) By the establishment of terminals the inhabitants who live in the areas surrounding the terminal will have an opportunity to get jobs related to the terminal. Furthermore, working conditions for employees will improve with the provision of better facilities.

(5) The stocks maintained at the depot in each region can be reduced by having the merchandises stocked centrally in the warehouse at the terminal instead. Thus, the overall inventory can be reduced. In turn, the total physical distribution cost is reduced.

3.3 Conceptual Plan of Freight Terminals for Klang Valley

(1) Present and Expected Volume of Freight Movement

A total of about 23,760 tons/day of cargo passes through Klang Valley in 1985. This volume is expected to grow to some 67,380 tons/day by 2005 (Figure 3.3).

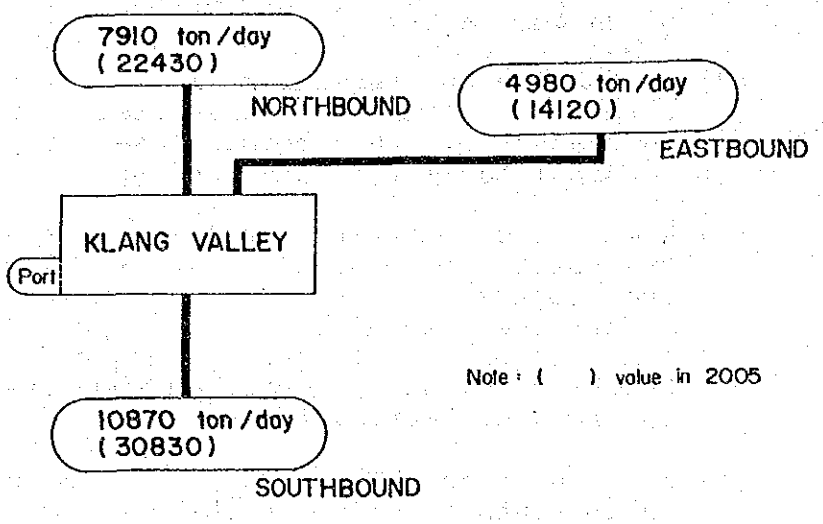
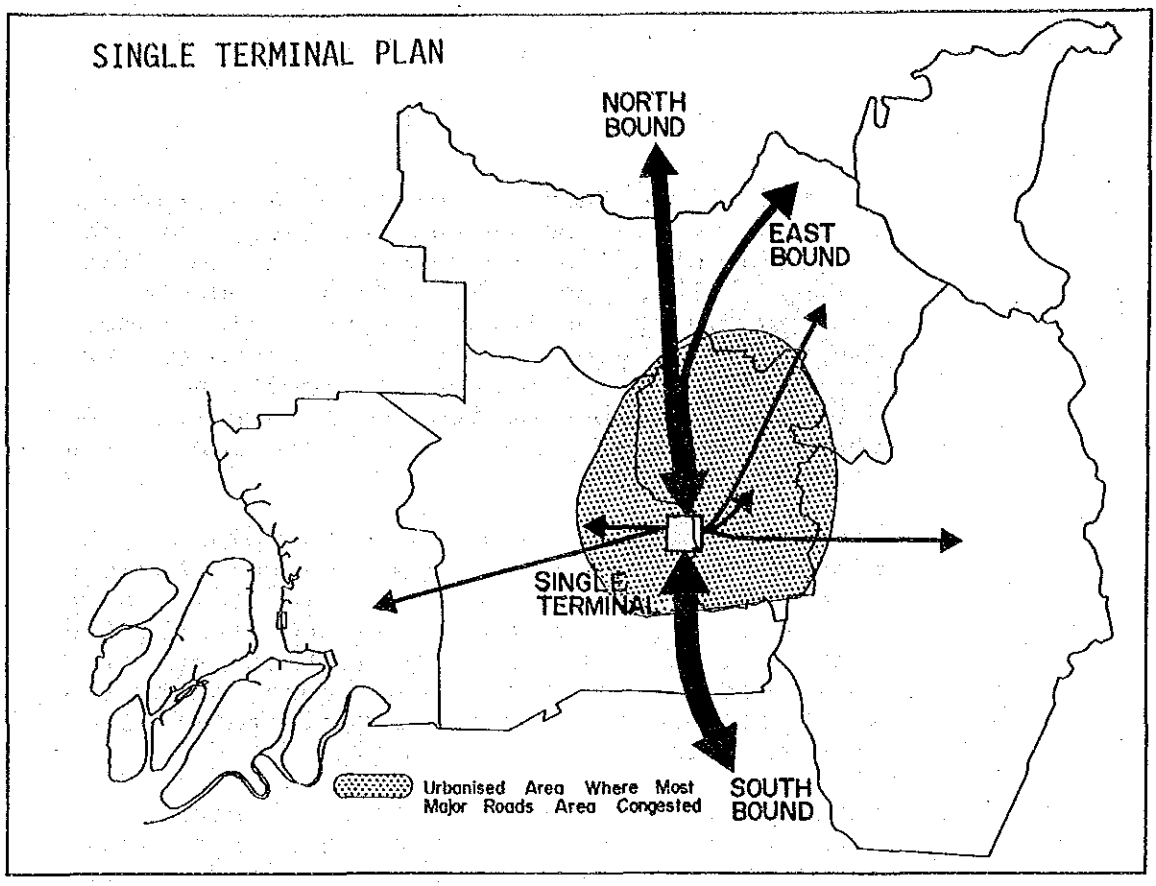


Figure 3.3: Volume of Inter-Regional Freight Movement, 1985-2000

The southern corridor transported the largest volume or 46% of all external goods movement. The northern and eastern corridors transported 33% and 21% respectively.

(2) Single Terminal Versus Two Terminal Plan

In view of the large volume of internal goods movement, the collection and delivery activities in Klang Valley must also be considered in the freight terminal planning. Therefore, based on the scale of activities, the concepts of a single terminal plan and a two terminal plan for lorry transport operations in Klang Valley can be illustrated in Figure 3.4.



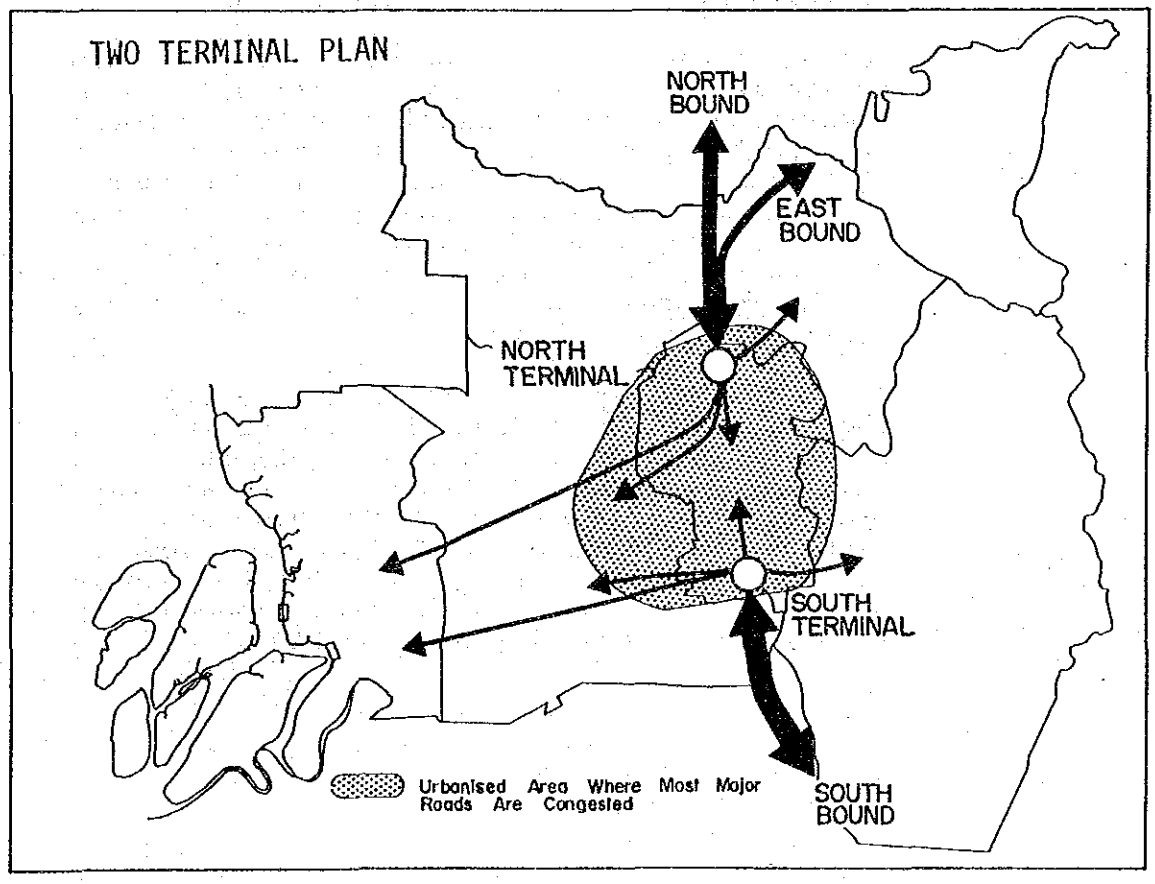


Figure 3.4 : Concepts for Alternative Freight Terminal Plans

In the single terminal plan, the strategic location would be in the vicinity of the centroid of all goods movement in the Klang Valley. This point is determined to be located in the western part of Kuala Lumpur Conurbation Area. In the case of two terminals, the strategic locations are determined to be located in the north and south of Kuala Lumpur Conurbation Area respectively.

From the comparison of these two plans, the single terminal plan appears to be less favourable because heavy vehicle still have to enter the urban areas to reach the terminal and traffic congestion at the intersection of its access road with the arterial road will affect normal traffic flow at peak hour.

Furthermore, a suitable location which meets the required site area for a large scale single terminal is difficult to find in the vicinity of Kuala Lumpur Conurbation Area.

Taking all the above facts into consideration, the two terminal plan comprising of one terminal serving the lorry transport operations to the northern and eastern regions and another terminal to serve the lorry transport operations to the southern region of Klang Valley is proposed. Hereinafter, the former will be known as North Terminal and the latter as South Terminal.

Figure 3.5 shows the proposed locality for the North Terminal and South Terminal in relation to the future road network. The salient features of this proposal are proximity to expressways and highways for line-haul linkages and a distance of about 12 to 13km from the CBD which will be easily accessible by using the planned Middle Ring Road II for intra-city distribution.

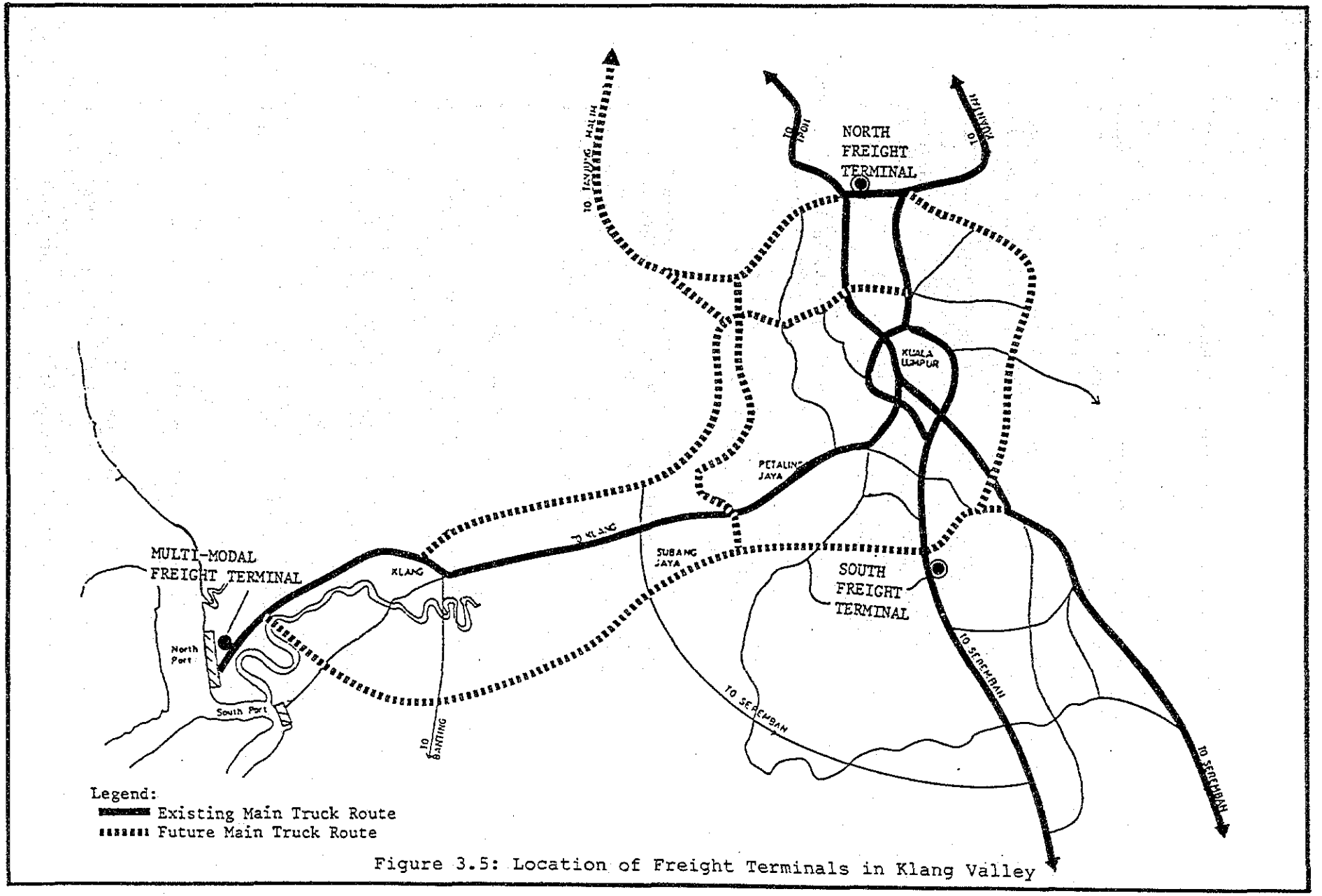


Figure 3.5: Location of Freight Terminals in Klang Valley

(3) Conceptual Plan for the Multi-modal Freight Terminal

A multi-modal terminal is a facility which provides a connection between two and more different transport modes such as between sea, road and rail transport.

The tendency to containerize non-bulk commodities transported by sea is ever increasing. The development of containerization eliminates problems such as lengthy cargo handling time during loading or unloading and long berthing time. The introduction of unit load system has brought about higher transport efficiency and shorter transport time to sea-land transport operation.

In line with the modernization of sea transportation, it is also necessary to rationalize the hauling of the cargoes on land. The speed-up of delivery time and reduction of physical distribution cost must be planned.

The centroid of container movement is obtained as about 23km from North Port. This distance is still within the distribution area of the port, indicating that the freight terminal for containerized cargoes should be located near the port to reduce transport cost.

The land transport modes at the multi-modal freight terminal are motor transport and rail transport. Rail is an appropriate mode for long distance transport. However, since most containerized cargoes are consumed within the Klang Valley, the utilization of rail is very low at 5% only. Therefore, in the multi-modal freight terminal a new rail siding is not considered at this stage. In the future when a plan to link up the major towns in each region has been established, then the addition of a rail siding will be most desirable.

Hereinafter, the freight terminal for containerized cargo will be known as Multi-modal Freight Terminal.

Figure 3.5 also shows the proposed locality of the Multi-modal Freight Terminal. The salient feature of this proposal is the proximity to the existing containerport.

CHAPTER 4 : ESTIMATION OF DEMAND AND BASIC REQUIREMENTS FOR FREIGHT TERMINALS

4.1 General

The demand and hence requirements for general cargo freight terminals and multi-modal freight terminal for container cargoes are different. The forecasting of their demands are hence treated separately in this Study.

The North and South Terminals for internal goods transport have to be designed to meet demands due to growth of freight volume and movement in and out of Klang Valley. On the other hand, the Multi-modal Freight Terminal is to cater for LCL container cargoes and therefore it has to be designed to meet the LCL cargo growth in future taking into consideration the present container yard facilities and their capacities.

4.2 Estimation of Demand at North and South Terminals

4.2.1 Methodology

In order to estimate the amount of freight volume which can be expected at the lorry terminals, it is necessary to understand the existing OD pattern of goods movement and their consignment pattern. Existing OD pattern of goods movement is analyzed using the data collected by the Klang Valley Transportation Study (KVTS) in 1985.

Consignment pattern refers to whether a shipment consisting of a single type cargo or mixed cargoes is sent to a single consignee or multiple consignees. Consignment pattern generally depends on commodity type and this information is collected by a supplementary Cordonline Lorry Interview Survey conducted in December 1987.

Terminal utilization level by commodity type applied to the external goods movement gives the amount of freight demand for line-haul operations. Through traffic movement contributes to the portion of transit freight demand. On the other hand, the goods movement within Klang Valley (internal goods movement) contributes to the portion of freight demand at terminal for intra-city collection and distribution.

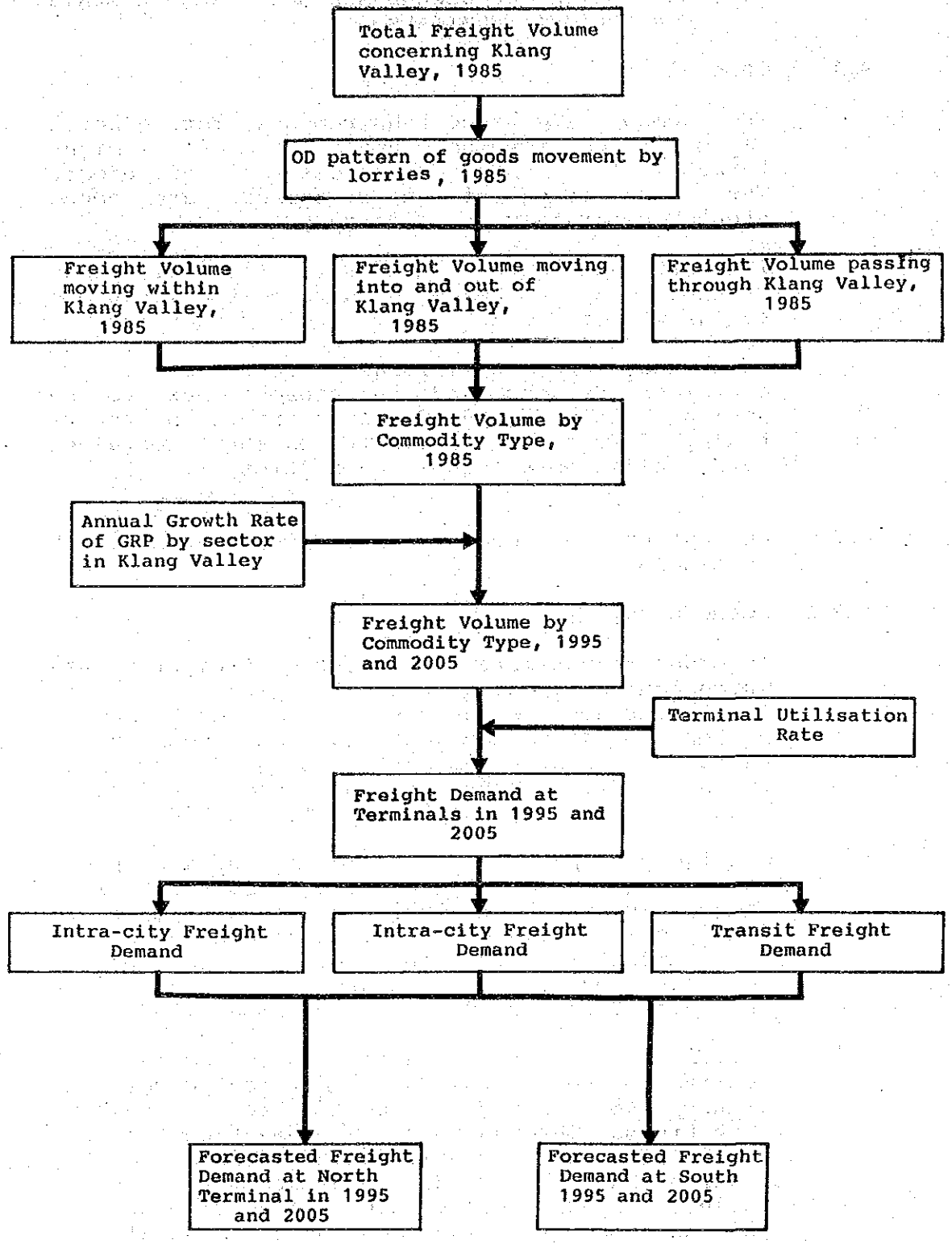


Figure 4.1 : General Procedure for Forecasting Freight Demand at North and South Terminals

The share of freight demand between the North Terminal and South Terminal is determined from the ratio of freight in their respective distribution area.

With 1985 as the base year, the freight volume for 1995 and 2005 are forecasted by using the annual growth rate of GRP by sector in Klang Valley. Thereafter the freight demand at the lorry terminals to be constructed in Klang Valley is forecasted in accordance to the general procedure shown in Figure 4.1.

4.2.2 Forecast of Internal and External Freight Volume for Klang Valley

Based on the result of the Cordonline Interview Survey (1987), the Study Team estimates that non-bulk commodities comprise 66.6% of the total external goods movement. Bulk carriers such as tank lorries, timber lorries and other bulk carriers are not expected to use the lorry terminal.

Thus, the non-bulk freight volume by commodity type for external and through goods movement in 1995 and 2005 are forecasted based on the estimated values for 1985 and the annual growth rate of GRP by sector in Klang Valley. The results of which are shown in Table 4.1.

Similarly, the future freight volume by commodity type for internal goods movement is forecasted and the result is shown in Table 4.2.

Table 4.1: Forecast of External Goods Movement for Klang Valley, 1995-2005

Commodity Type	1985 (1)		1995		2005		Annual Growth Rate (2)	
	Volume (tonne)	(%)	Volume (tonne)	(%)	Volume (tonne	(%)	'85-'95	'95-'05
Agricultural produce	5400	28.2	6100	23.8	6900	18.4	1.2	1.2
Mineral and ore	200	1.0	200	0.8	300	0.8	1.7	2.0
Construction material	3400	17.2	3400	13.3	4900	13.0	0.0	3.7
Petroleum & Chemical products	2000	10.2	2400	9.4	2900	7.7	1.7	2.0
Machinery & parts	1100	5.7	1800	7.0	3000	8.0	5.2	5.2
Consumer products	4800	25.5	8000	31.3	13400	35.6	5.3	2.0
Empty containers	1200	7.0	2000	7.8	3400	9.0	5.2	5.5
Miscellaneous	1000	5.2	1700	6.6	2800	7.5	5.2	5.5
Total(exclu. thru' traffic)	19100	100.0	25600	100.0	37600	100.0	(3.0)	(3.9)
Through Goods Movement	1000	100.0	1700	100.0	2800	100.0	5.2	5.5
Total External Goods Movement	20100	-	27300	-	40400	-	(3.1)	(4.0)

Notes : (1) Excluding bulk commodities carried by tank and timber lorries, etc.
(2) Annual Growth rate of GRP by sector in Klang Valley estimated by Study Team

Table 4.2: Forecast of Internal Goods Movement for Klang Valley, 1985-2005

Commodity Type	1985 (1)		1995		2005		Annual Growth Rate (2)	
	Volume (tonne)	(%)	Volume (tonne)	(%)	Volume (tonne)	(%)	'85-'95	'95-'05
Agricultural produce	17000	7.1	19200	6.2	21600	4.6	1.2	1.2
Mineral & ore	600	0.2	700	0.2	900	0.2	1.7	2.0
Construction material	119200	49.5	119200	38.8	171400	36.4	0.0	3.7
Petroleum & Chemical products	9900	4.1	11700	3.8	14300	3.0	1.7	2.0
Machinery & parts	14900	6.2	24700	8.0	41100	8.7	5.2	5.2
Consumer products	39700	16.5	66500	21.6	110500	23.4	5.3	5.2
Empty containers	2900	1.2	4800	1.6	8200	1.7	5.2	5.5
Miscellaneous	36500	15.2	60600	19.8	103500	22.0	5.2	5.5
Total	240700	100.0	307400	100.0	471500	100.0	(2.5)	(4.4)

Notes : (1) Based on OIS, Klang Valley Transportation Study, 1985
(2) Annual Growth Rate of GRP by sector in Klang Valley estimated by Study Team

4.2.3 Determination of Terminal Utilization Level

The terminal utilization level for external and internal goods movement are different by nature of their trip length and consignment pattern. Internal goods movement are mostly short distance trips and using privately owned vehicle. From the results of OD surveys and based on experience at freight terminals in Japan, it is estimated that the utilization level of internal goods movement will be 10% of the level for external goods movement.

The percentage of through traffic volume for all commodity type which is expected to go through a freight terminal on transit is estimated as twice the utilization level of external goods movement. This portion of the freight demand from through traffic will be included in the line-haul operations.

The results of the Cordonline Interview Survey (1987) reveals that 91.7% of lorry trips carried consignment for a single consignor to another single consignee. The number of trips carrying mixed cargoes for a single consignor to multiple consignees comprises 6.7% and the number of trips carrying mixed cargoes for multiple consignors to multiple consignees comprises the remaining 1.6%. A breakdown by commodity type is indicated in Table 4.3.

Potential freight terminal users are those lorries which are presently transporting mixed cargoes for multiple consignors or consignees. The Study Team assumes that half the volume of freight transported by lorries for a single consignor to multiple consignees and the full volume of freight transported by lorries for multiple consignors to multiple consignees will be conducted from a freight terminal.

Thus, the freight terminal utilization level for each type of commodity is estimated as shown in Table 4.4. About 4.9% of all external goods movement is expected to use the freight terminal. Therefore the utilization level of through goods movement will be about 10% of its total volume and that for internal goods movement will be 0.49% of its total volume.

Table 4.3: Composition of lorry trips by consignment type by main commodity

Commodity Type	Single Cargo	Mixed Cargoes 1 Consignor, 1 Consignee	Mixed Cargoes 1 Consignor Many Consignees	Mixed Cargoes Many Consignors Many Consignees	Total
Agriculture produce	84.4	10.5	5.1	0.0	100.0
Mineral & ore	94.2	5.8	0.0	0.0	100.0
Construction Material	83.0	12.4	3.3	1.2	100.0
Petroleum & Chemical products	84.4	11.9	3.1	0.6	100.0
Machinery & parts	77.2	15.8	2.7	4.3	100.0
Consumer products	56.5	26.3	14.5	2.7	100.0
Empty Containers	90.9	7.1	0.5	1.5	100.0
Miscellaneous	68.4	29.2	0.0	2.4	100.0
Total	74.9	16.8	6.7	1.6	100.0

Table 4.4: Truck Terminal Utilization Level

Commodity Type	External Goods Movement (%)	Through Goods Movement (%)	Internal Goods Movement (%)
Agricultural produce	2.6	-	0.26
Mineral & ore	0.0	-	0.00
Construction Material	3.0	-	0.30
Petroleum & Chemical products	2.1	-	0.21
Machinery & parts	5.7	-	0.57
Consumer products	10.0	-	1.00
Empty Containers	1.8	-	0.18
Miscellaneous	2.4	-	0.24
Total	4.9	10.0*	0.49

Note : * Through goods movement is not broken down into commodity type because its total volume is very small compared to other type of goods movement.

In Klang Valley where two freight terminals will be constructed, the share of demand between North Terminal and South Terminal has to be determined. This is determined for each type of goods movement using the ratio of freight volume in the distribution area for each terminal.

Therefore, the share between the North Terminal and South Terminal is obtained as shown in Table 4.5 below.

Table 4.5: Share in Goods Movement Between North and South Terminal

Type of freight	North Terminal	South Terminal
External Goods Movement	56.7%	43.3%
Through Goods Movement	50.9%	49.1%
Internal Goods Movement	56.4%	43.6%

4.2.4 Forecast of Freight Demand at Terminals

Based on the background information obtained in the preceding sections, future freight demand at North Terminal and South Terminal are forecasted and shown in Table 4.6. The target year for the facility planning of the terminals is 2005. The freight demand at the North Terminal is estimated at about 2,600 tonnes/day while the demand at the South Terminal is about 2,000 tonnes/day. A schematic diagram showing the forecasted demand at both terminals is shown in Figure 4.2.

Table 4.6: Forecast of Freight Demand at North and South Terminals

(Unit: tonnes/day)

Location	Operation	Year 1995	Year 2005	Annual Growth Rate
North Terminal	External Traffic	733	1151	
	Transit Traffic	96	159	
	Internal Traffic	859	1318	
	Total	1688	2628	4.5%
South Terminal	External Traffic	560	880	
	Transit Traffic	74	120	
	Internal Traffic	663	1018	
	Total	1297	2018	4.5%

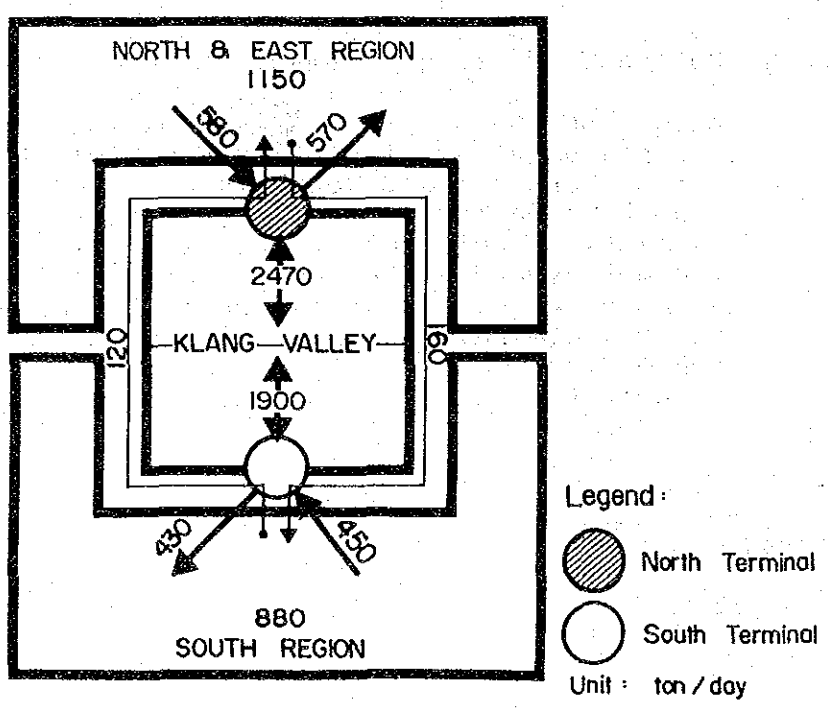


Figure 4.2: Schematic Diagram Showing Freight Demand at North and South Terminals in 2005

4.2.5 Estimation of Basic Requirements for North and South Terminals

The basic requirement for each component in the North Terminal and South Terminal to meet the design freight capacity are determined and summarized in Table 4.7.

A typical layout of the basic components for the North or South Terminal is shown in Figure 4.3.

Table 4.7: Outline of Basic Requirements of North and South Terminals

Item		North Terminal	South Terminal
1.	Freight Volume Capacity	2,600 ton/day	2,000 ton/day
2.	Freight Terminal Area *	7.0 ha	5.4 ha
(a)	Platform Area	0.93 ha	0.72 ha
(b)	Parking Area	0.83 ha	0.64 ha
(c)	Warehouse Area	0.27 ha	0.20 ha
(d)	Others **	4.97 ha	3.84 ha
3.	Public Lorry Parking Area ***	4.0 - 5.0 ha	5.0 - 6.0 ha
4.	Total Site Area	12.0 ha	11.4 ha
5.	Manpower	1,143 persons	876 persons
(a)	Administrative and office staff	105 persons	82 persons
(b)	Site workmen	184 persons	139 persons
(c)	Lorry drivers	800 persons	613 persons
(d)	Others	54 persons	42 persons
6.	No. of Vehicles	499 vehicles	382 vehicles
(a)	Line-haul Vehicles	71 vehicles	54 vehicles
(b)	Pick-up and Delivery	412 vehicles	316 vehicles
(c)	Forklift	16 vehicles	12 vehicles

Notes : * This is the minimum area requirement under ideal site layout plan for terminal facilities
** Others include area required for administration building, service and repair workshop, fuel stand, circulation area, landscaping, etc.
*** The operation of public lorry parking area is suggested as a freight terminal related business for overnight parking of some 'A' and 'C' permit lorries in the Klang Valley

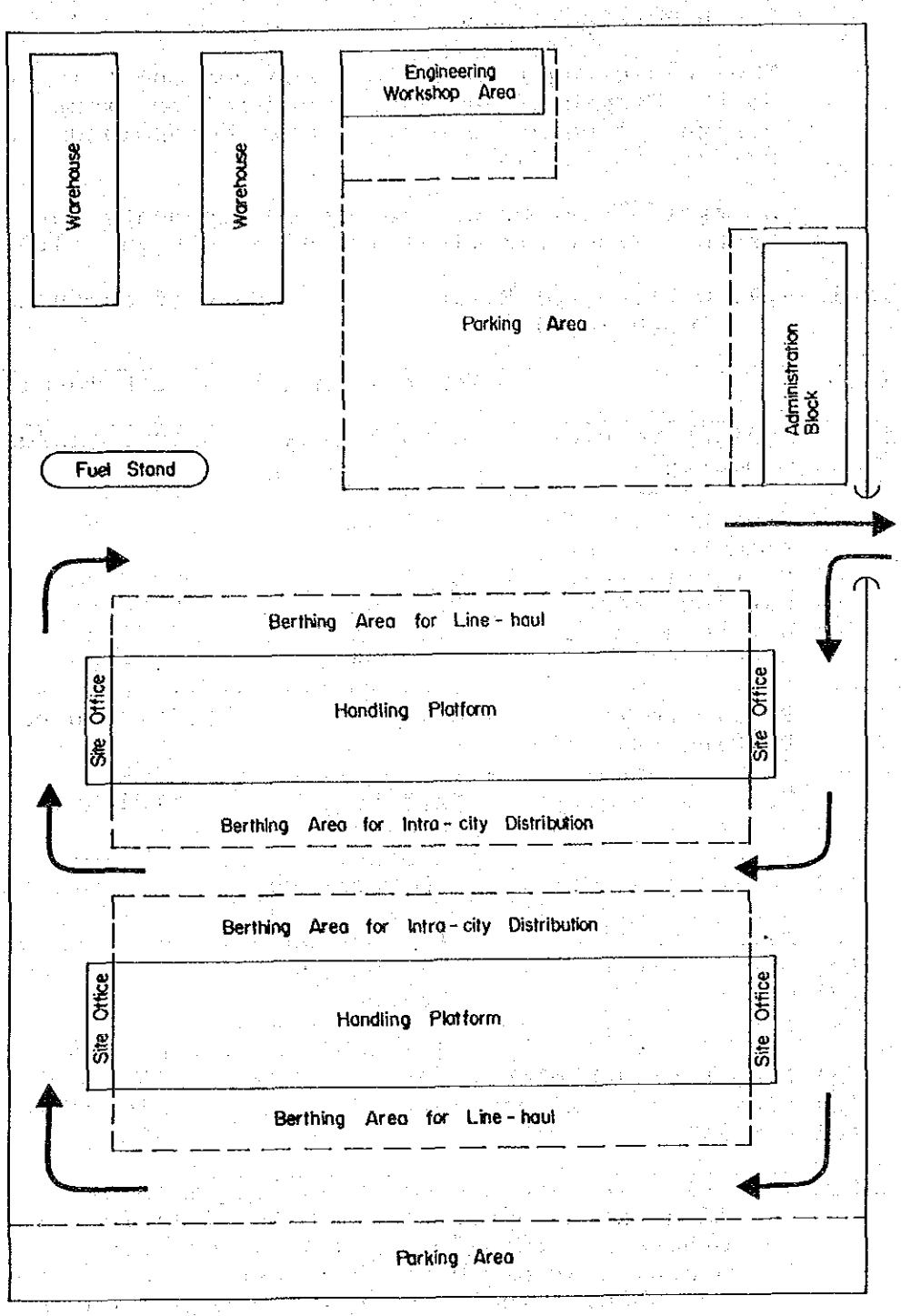


Figure 4.3 : Typical Layout Plan for the North or South Terminal

4.3 Estimation of Demand at Multi-modal Freight Terminal

4.3.1 Methodology

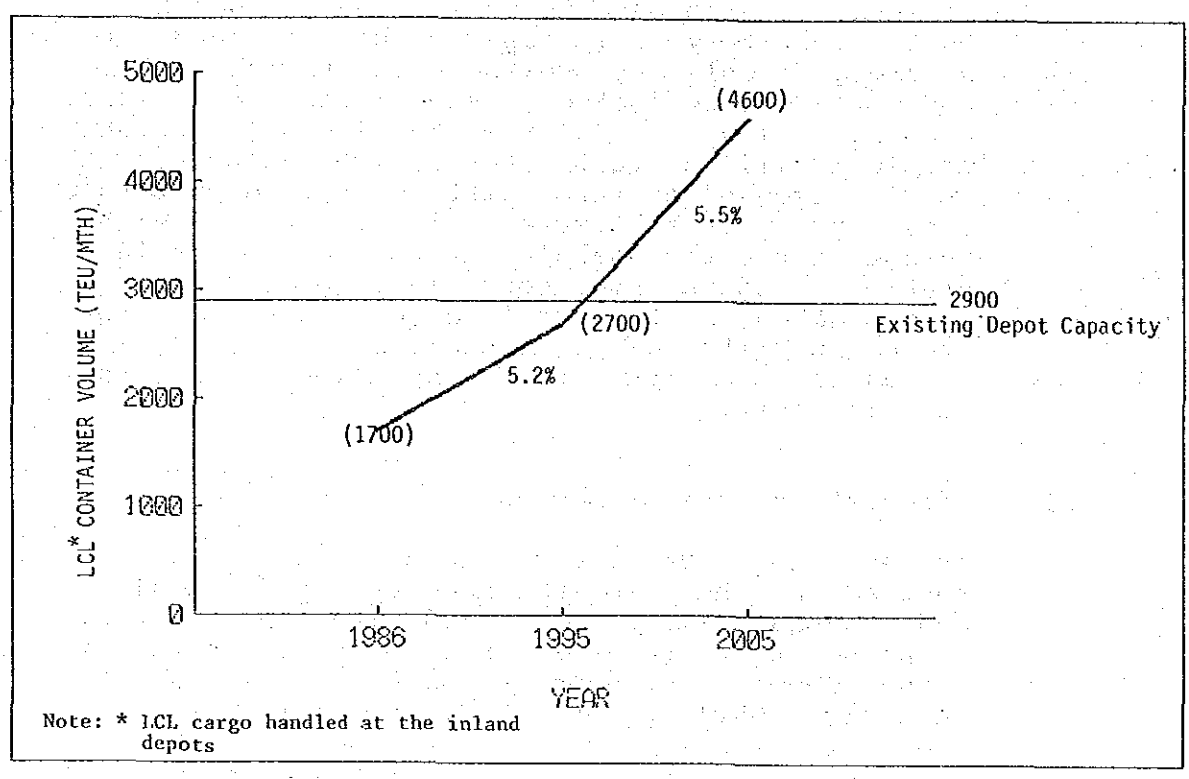
In this study, although the Multi-modal Freight Terminal is proposed to be located in the North Port territory, it is to be designed to accommodate only the growth in LCL freight volume currently consolidated at the inland container depots. That is, the Multi-modal Freight Terminal will serve the LCL freight volume that is in excess of the existing inland depots' capacity. Future increase in the LCL freight volume currently handled at the cargo freight station inside the port is expected to be accommodated by the port's development plan for expanding its cargo consolidation area in conjunction with the expansion of the containerport.

4.3.2 Forecast of Freight Demand

The existing (1986) LCL container freight volume handled at the depots managed by Kontena Nasiona and Shapadu amounts to 1,700 TEUs per month. Assuming that the growth rate of throughputs at these depots would be at the same rate as the economic (GRP) growth in Klang Valley region, then it is forecasted that the monthly LCL container freight volume in 1995 and 2005 will increase to 2,700 TEUs and 4,600 TEUs respectively. Figure 4.4 shows the result of the forecast of LCL container throughput at the existing depots.

On the other hand, based on the analysis of actual performance at the existing depots and data collected from the operators, the maximum handling capacity of existing facilities is estimated at 2,900 TEUs per month. This freight volume is expected to be attained after 1996 and by 2005 a deficiency in capacity for 1,700 TEUs per month is foreseeable. The target year of the freight terminal plan being 2005, a multi-modal freight terminal with a capacity for 1,700 TEUs per month or 1,200 tonnes per day will therefore be examined in this study.

Figure 4.4 : Forecast of LCL Container Throughput at Existing Depots



4.3.3 Summary of Basic Requirement

In terms of site area requirements, a total site area of 88,000 sq.m would be required for the Multi-modal Freight Terminal.

Furthermore, the scale of each component facility required to handle the design freight volume efficiently is calculated and the outline of its basic requirement is listed in Table 4.8.

A typical layout of all the basic components of the Multi-modal Freight Terminal is shown in Figure 4.5.

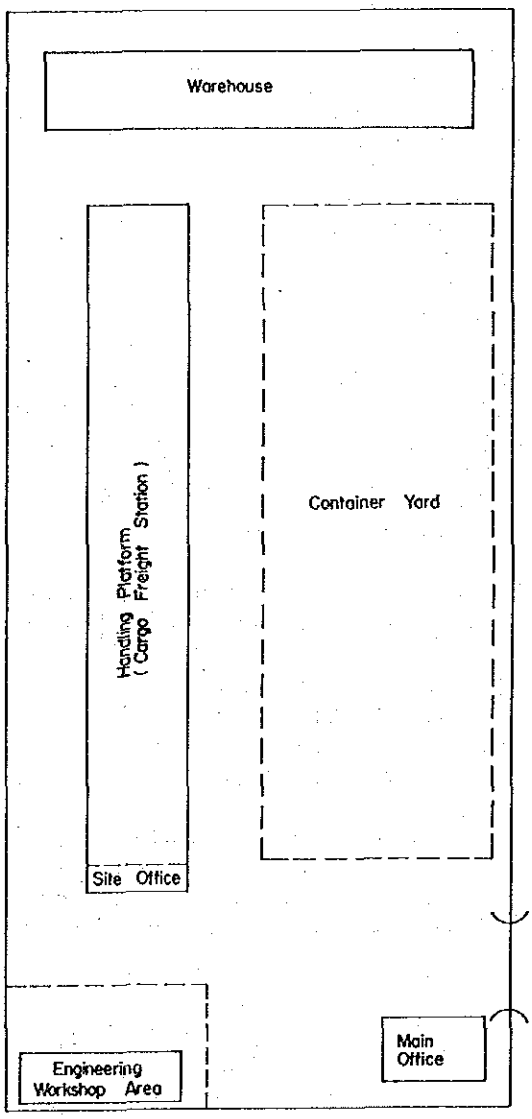


Figure 4.5 : Typical Layout of Facilities at the Multi-modal Freight Terminal

Table 4.8: Outline of Basic Requirements of Multi-Modal Freight Terminal

Item		Basic Requirement
1.	Freight Volume Capacity	1,700 TEUs/month or 1,200 t./day
2.	Freight Terminal Area *	8.8 ha
	(a) Platform Area	1.1 ha
	(b) Warehouse Area	0.5 ha
	(c) Parking Area	0.3 ha
	(d) Container Yard Area	2.3 ha
	(e) Others **	4.6 ha
3.	Public Lorry Parking Area ***	5.0 - 6.0 ha
4.	Total Site Area	14.8 ha
5.	Manpower	193 persons
	(a) Administrative and Office Staff	34 persons
	(b) Workmen	43 persons
	(c) Drivers	106 persons
	(d) Others	10 persons
6.	Number of Vehicles	112 vehicles
	(a) Trailer	12 vehicles
	(b) Tractor	8 vehicles
	(c) Pick-up and Delivery	62 vehicles
	(d) Forklift	17 vehicles
	(e) Straddle Carrier	1 vehicle

Notes : * This is the minimum area requirement under ideal site layout plan for terminal facilities

** Others include area required for administration building, service and repair shop, fuel stand, circulation area, landscaping, etc.

*** The operation of public lorry parking area is suggested as a freight terminal related business for overnight parking of some 'A' and 'C' permit lorries in the Klang Valley

CHAPTER 5 : PRELIMINARY ENGINEERING DESIGN AND COST ESTIMATE FOR THE FREIGHT TERMINALS

5.1 General

Having forecasted the demands and thus estimated the appropriate site area requirements for the three terminals, the next step was to decide on the site location. For this, alternative sites for each of the terminals were examined and evaluated against a set of criteria before the final site was selected for each of the three terminals.

Geological surveys in the form of bore hole tests were carried out to ensure the load-bearing capability of each of the three sites. Topographic surveys were conducted to prepare the needed 1:1,000 topo-maps for the preliminary design work. Consequently, the preliminary design for the terminals and their cost estimates were carried out.

5.2 Location Study of the Freight Terminals

As a first step to selection of sites, a number of plausible alternative sites for each of the three terminals were shortlisted using the following site features as criteria:-

(a) Absence of approved development projects
(b) Absence of squatter settlement
(c) Ease in land acquisition

Alternative sites that satisfied these basic factors were then examined in detail and assessed by the following site conditions:-

(a) Land Condition
- Land area, land form, land configuration;

(b) Traffic Aspect
- Accessibility, traffic flow, distance to highway or interchange;

(c) Socio Environmental Aspect
- Community disruption, pollution, effects on local traffic flow;

(d) Planning Consideration
- Infrastructures in the vicinity, land acquisition.

The best site for each of the three terminals were than selected with confirmation with the Selangor State Government before geological and topographical surveys were carried out.

5.2.1 North Terminal

Three alternative lots in the vicinity of Jalan Batu Caves (Northern area of Kuala Lumpur and Gombak area) were shortlisted and duly evaluated.

(1) Location

The selected site Lot No.10903 is located to the north of Kuala Lumpur in the district of Gombak, alongside Jalan Batu Caves. It is about 2.0km from the intersection of Jalan Batu Caves with Jalan Ipoh (Figure 5.1).

(2) Landuse and Transport Network

The land is a former JKR quarry site on which all quarrying activities have since been suspended. Nevertheless, the Gombak District Public Works Department (JKR) is retaining part of the area for its store. In a discussion with Selangor State Government and Gombak District JKR, it was agreed in principle that the area outside the portion for JKR store can be used for the North Freight Terminal.

The northern boundary of the site is defined by Batu Caves limestone hills. The eastern and western boundaries are defined by lots occupied by light manufacturing industries. The southern boundary is defined by Jalan Batu Caves, across which lies a mixed area of light industries and housing.

A wholesale market for perishable goods is located about 3km away along Jalan Ipoh.

The existing primary roads to the site are the north-south bound Jalan Ipoh and east-bound Karak Highway. Both primary roads are connected to the site by Jalan Batu Caves which serves as a secondary road. Jalan Batu Caves has been planned to be improved as the Middle Ring Road II and this new road will also be connected to the Kuala Lumpur-Tanjung Malim Expressway which heads north.

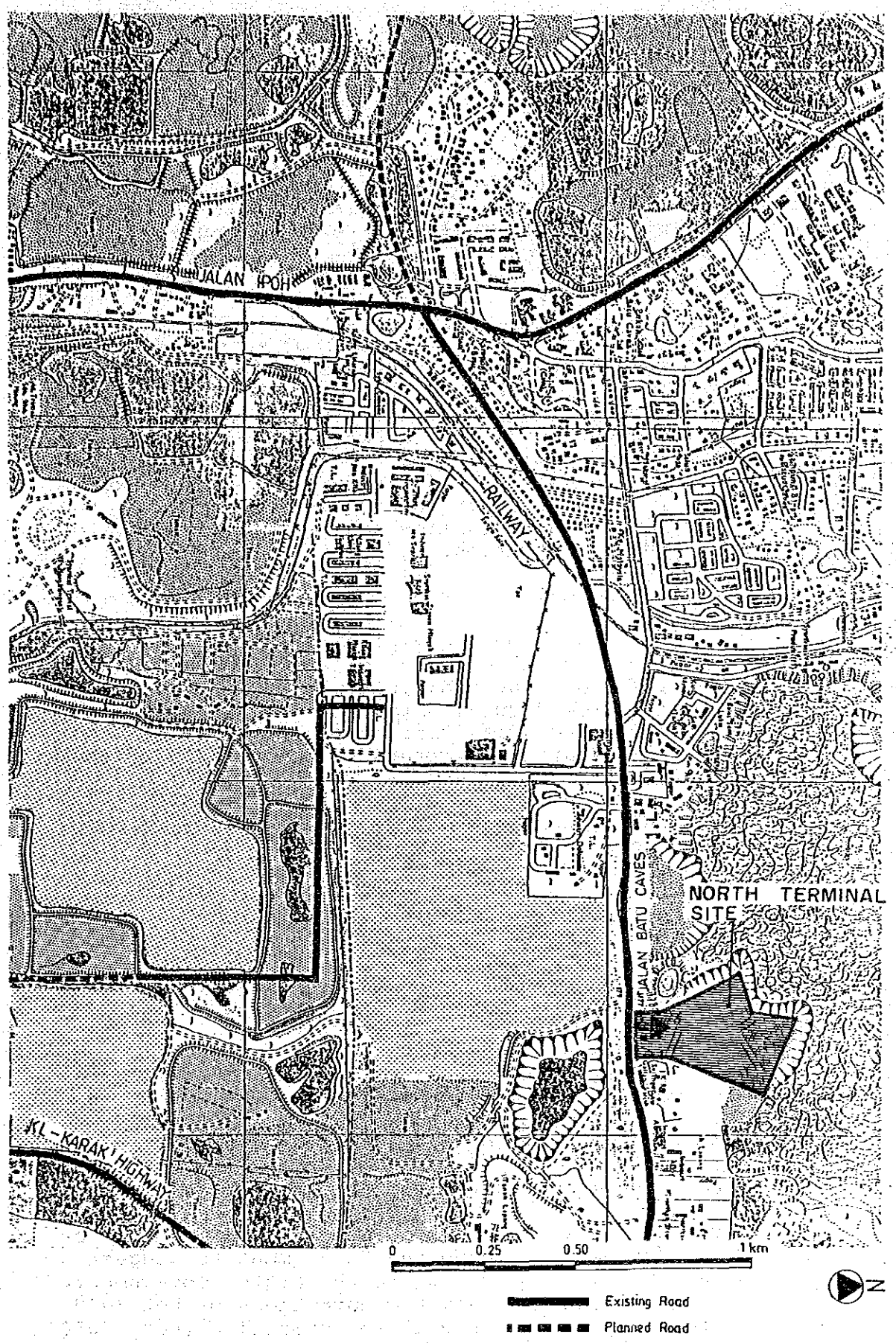


Figure 5.1: Location of North Terminal Site

A rail siding from the north-south railway line of KTM terminates at Batu Caves. While passenger service is restricted to run during the annual Thaipusam festival only or on special events, there is daily freight traffic service to the nearby cement factory.

(3) Topographic Condition

The north and west sides of the site face steep limestone cliffs with relative height of 250m and 1200m in radius, while the outer sides are opened to the alluvial plain which is an ex-mining area. The site was reclaimed and levelled at 55m above sea level, except for the center portion where there are two ramps and a shallow pond formerly used for quarry operation.

(4) Geological Condition

Results from two exploratory drillings sunk at the site reveal a soil profile which shows limestone at shallow depth of between 10 to 15m from ground surface. Recent weak sandy soil and clay soil rest on the limestone. Fill material covers the whole area of the site.

The ground water table is about 1 to 2m below the ground surface.

5.2.2 South Terminal

Three alternative sites to the south of Kuala Lumpur and in the vicinity of Kuala Lumpur-Seremban Expressway were examined and evaluated.

Lot 3049 was first found to be a better site over the other two sites. Results of geological survey conducted at the site however turned out to be that the site is consisted of slime and soft silty clay to a depth of 7 metres. The site is therefore deemed unsuitable for the construction of a freight terminal.

Discussion with the Selangor State Government on the outcomes prompted the Government to suggest a nearby site belonging to the State Government. This lot also has all the advantages of Lot 3049. Geological survey results of this site (Lot 3050 with portions of Lot 3051, 5910 and 14988) indicated firm sub-soil strata that are suitable for the construction of freight terminal.

(1) Location

The proposed site comprising of Lot Nos.3050 and portions of 3051, 5910 and 14988 is located about 13km to the south of Kuala Lumpur CBD and is sandwiched between Kuala Lumpur-Seremban Expressway and the north-south railway line (see Figure 5.2).

The land is a former tin mining area. Except for the portion of Lot No.14988, the mining lease on the land has been terminated and ownership of land belongs to the Selangor State Government. It has been agreed in principle that the area can be utilized for the South Freight Terminal.

(2) Landuse and Transport Network

The site is physically separated from existing residential area on the west by Kuala Lumpur-Seremban Expressway and on the south by vacant ex-mining land and ponds. To the north lies slimy ex-mining land which has been allocated to SB Development Sdn. Bhd., an investment arm of the Selangor State Government which is undertaking a massive recreational resort development located to the east of the site across the railway track and Jalan Sungei Besi.

The existing transport network in the area includes Kuala Lumpur-Seremban Expressway which is accessible via Jalan Sungei Besi from either Sri Petaling East Interchange or UPM Interchange, both of which are about 3.5km away. The north-south railway line of KTM runs along the eastern boundary of the site. The two nearest stations are Sungei Besi Station to the north and Serdang Station to the south of the site. Both stations provide passenger and freight services although the volumes are low.

Future transport network will include a major arterial that is Middle Ring Road II with access from Sri Petaling East Interchange and a minor arterial that is Puchong-Sungei Besi road with access from a new interchange to be constructed about 1.5km to the north of the site. This interchange will also provide a nearer access from the site to Kuala Lumpur-Seremban Expressway.

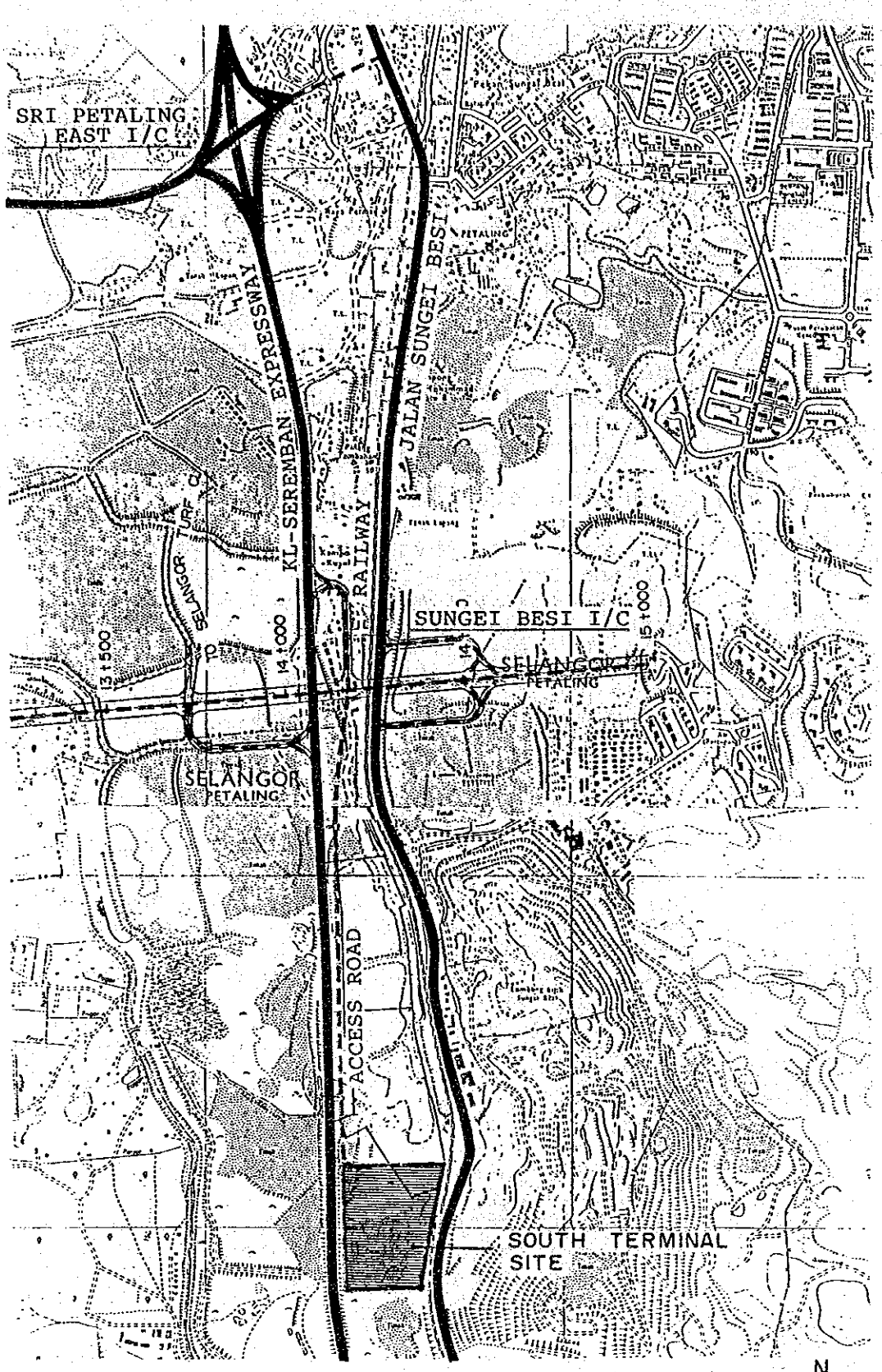


Figure 5.11 : Location of South Terminal Site

(3) Topographic Condition

Being a former tin mining area, the site has many different ground levels with ponds and sandy hills. Trenches formed by erosion are found on the south western area. The highest level is about 47m above mean sea level while the lowest level is about 34m. The available site area has a trapezoid configuration with length 400m and width of 200m on the south and 260m on the north.

Apart from a few scattered trees, the area is generally barren.

(4) Geological Condition

Results from two exploratory drillings sunk at the site reveal a soil profile which shows layers of sandy soil and decomposed shale on top of a limestone layer located about 12m from ground level. A thin layer of very soft to soft clay is located at depth of about 4m from ground level but laboratory tests result indicated that soil condition can be considered as stable and the load bearing stratum can be located at depth of 15-30m from existing ground level.

5.2.3 Multi-modal Freight Terminal

Two alternative sites in the Klang North Port area were examined for the multi-modal freight terminal site. Both areas are within the future North Port Boundary in view of the need to integrate the planned terminal with the existing containeryard and warehousing facilities.

(1) Location

The selected site is very close to the North Port Terminal within the existing North Port boundary (Figure 5.3) and belonging to the Klang Port Authority. The site is therefore at about 45km west of Kuala Lumpur.

(2) Landuse and Transport Network

The site is one of the vacant lots in Klang North Port area presently covered by weed. The western boundary is limited by Jalan Parang while the eastern boundary is demarcated by Sungai Dua Besar. The surrounding landuses comprise the North Port wharves and warehouses located in the west, bulk commodities handling and storage facilities located in the north and swampy land which constitute Kapar forest reserve in the east.

Future landuses include the conversion of conventional wharves to container wharves on the sea front and the development of industrial sites on the swampy land which will be reclaimed.

Two existing major roads to the site are North Klang Straits Bypass and Jalan Pelabuhan. The former is a highway which goes eastward and is connected to Federal Route II. The latter is a primary road which goes southward to Port Klang town. Both roads are connected to Jalan Parang which is the main access road to all North Port facilities.

Future roads in the vicinity include a planned access road running along the eastern boundary of the site between Jalan Kerisi in the northern and Jalan Parang in the southern end. The proposed Shah Alam Highway which is expected to tie up with North Klang Straits Bypass about 5km from the site is expected to provide high mobility for goods vehicles travelling between North Port and Kuala Lumpur on the southern region of Peninsular Malaysia.

A single track rail siding which originates from the Port Klang Station passes along the western boundary of the site. The rail track is used to transport containers and bulk cargoes but freight service by rail is operated on demand basis only.

PROFILE OF MULTI-MODAL FREIGHT TEMINAL

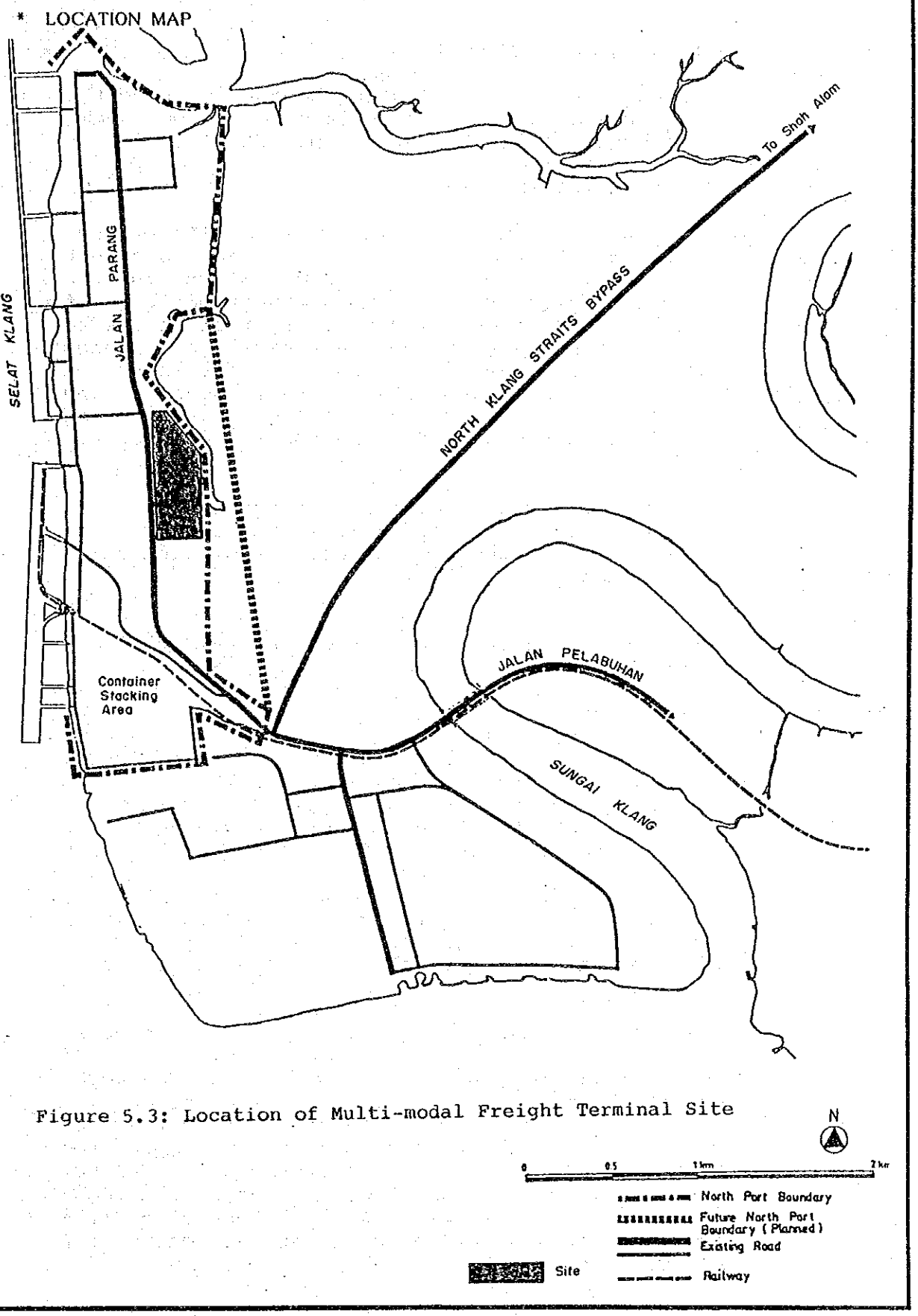


Figure 5.3: Location of Multi-modal Freight Terminal Site

(3) Topographic Condition

The site is levelled to about 3.5m above the mean sea level after reclaimation from swamp and backfilling of Sungai Dua Kechil.

(4) Geological Condition

Results from the exploratory drillings sunk to about 55m from ground surface did not confirm the bed rock. Sand fill covers the whole site with 2.3m thickness on top of about 30m thick silty clay layer or marine to estuarine deposits of the recent age. Deeper than this layer are found the sandy layers of Pleistocene deposits. Very dense sand distributes at the entire area at depth of 50m from the ground. The confirmed thickness was about 5m to 6m.

The groundwater table exists about 65cm below the ground surface. However the level may be affected by the precipitation and fluctuation of tide.

5.3 Preliminary Engineering Design for the North and South Terminals

5.3.1 Site Planning

The lot title of North Terminal (Lot No.10903) shows an area of 28.2ha of which 15.7ha consists of limestone hills whose physical forms are legally protected from further quarrying. The North Terminal is to be located within the available space of about 12.5ha. However, the eastern boundary of the site plan is constrained by the need to reserve an area of 3.9ha (width 120m) for the use of JKR Gombak District. In addition, a portion of the lot amounting to 0.2ha will be taken up for the right-of-way of the planned Middle Ring Road II (Jalan Batu Caves). Therefore the maximum space which can be secured for the terminal is about 0.5ha. In consideration of the effect of construction works on the limestone hills, each building will maintain a minimum distance of 15m from the foot of the hill. This space can be landscaped for aesthetic purpose. Only the southern boundary of the site which is 110m long is fronting the road. Therefore ingress/ egress will be considered from this side only since there will be no road on the other sides.

The South Terminal site has ponds and sandy hills creating large differences in ground level. There is a maximum difference of 13m across the East-West direction. The width of the South Terminal site is narrow because it is sandwiched between Kuala Lumpur-Seremban Expressway on the western boundary and North-South railway line on the eastern boundary. The countermeasure taken for the first constraint is to determine an appropriate datum level for the freight terminal site so that earthwork quantities can be rationalized.

5.3.2 Functional Zoning

To effect the most efficient layout of the terminal with its various functions within the complex, a systematic zoning of the site area is applied. The functional zoning of the North Terminal site and South Terminal site are shown in Figures 5.4 and 5.5 respectively.

From the viewpoint of separating vehicle and human activities, a clear division of the site area into two sectors is adopted in the layout plan.

In the western sector, in order to maximize efficiency of space utilization, parking spaces are allocated around Zone 2 which is the cargo handling zone. In the eastern sector, facilities wherein many human activities occur are grouped together in order to reduce distance between employees' welfare facilities and their working area, as well as to simplify the network system for utilities such as water and electricity supply and waste water treatment, etc., thus reducing capital investment on utility facilities.

Facilities to be located in Zone 3 are arranged in such a way that those with a higher expected frequency of lorry movements like the petrol station will be located nearer to the entrance/exit gate.

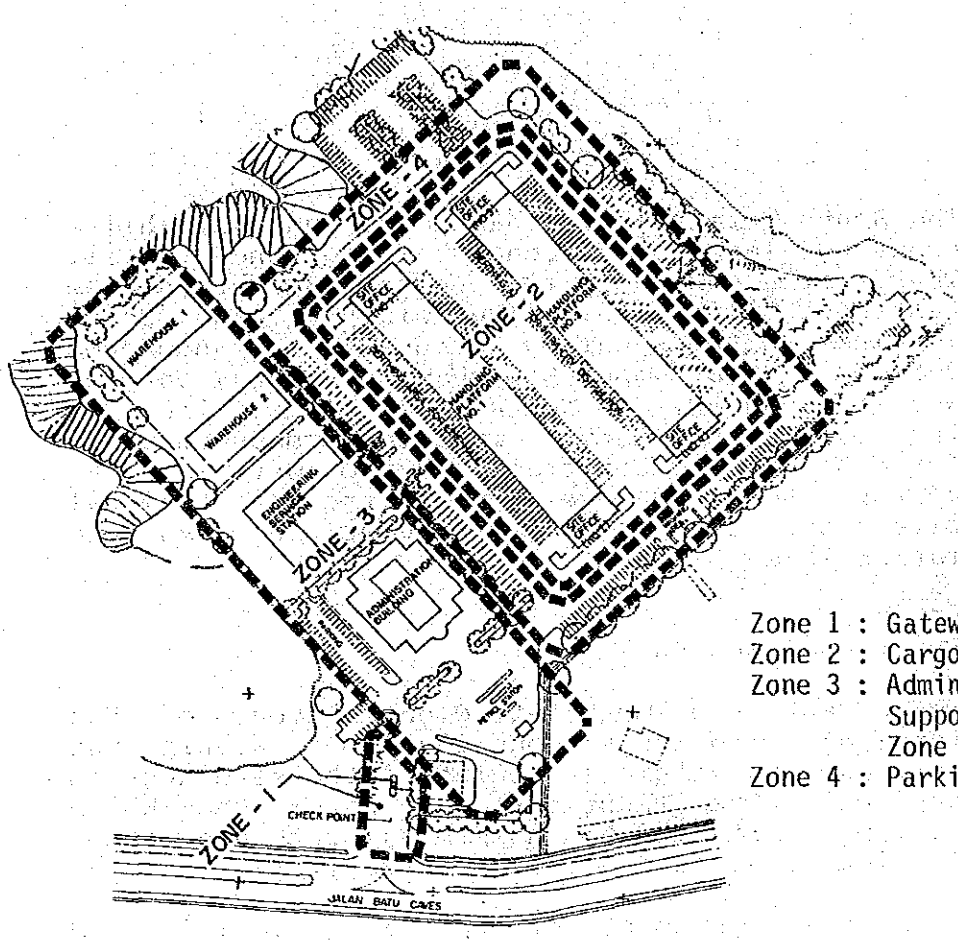


Figure 5.4: Functional Zoning for North Terminal

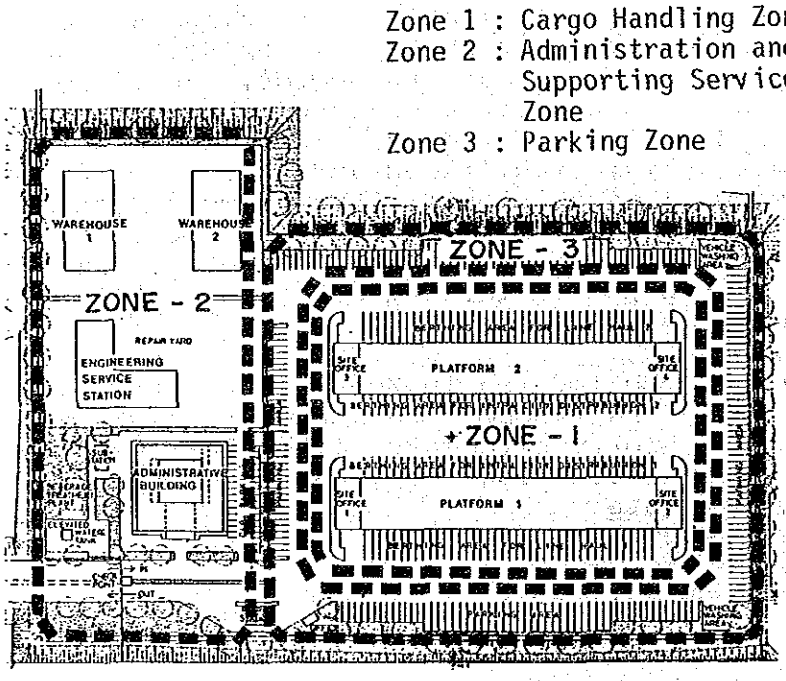


Figure 5.5: Functional Zoning for South Terminal

5.3.3 Vehicle Circulation

A one-way traffic circulation system on site is adopted for smooth flow of vehicles and to prevent conflict of movement. Vehicle should also circulate in a clockwise direction because right-turning by large vehicles allow the drivers a clear view of the tail-end of the vehicles. The traffic circulation system in the North Terminal and South Terminal are shown in Figures 5.6 and 5.7 respectively.

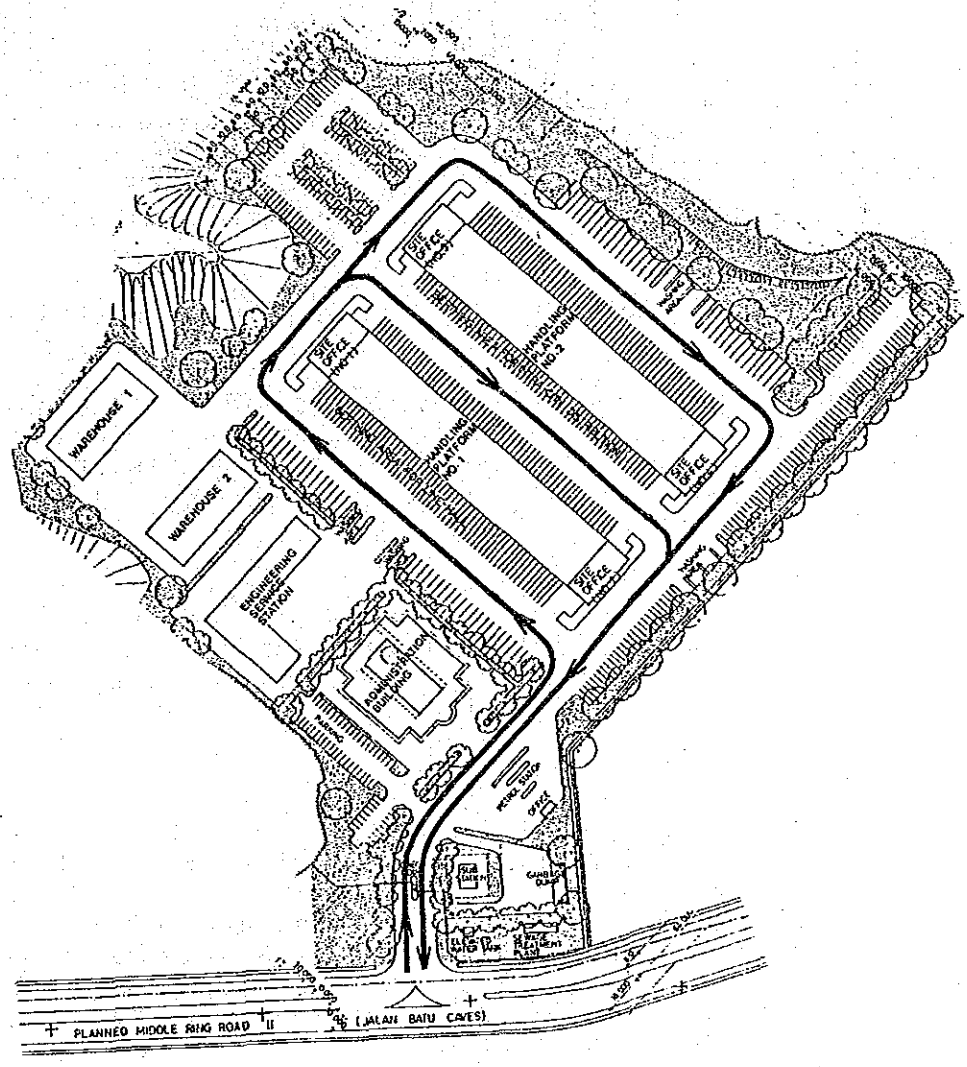


Figure 5.6: Vehicle Circulation System in North Terminal

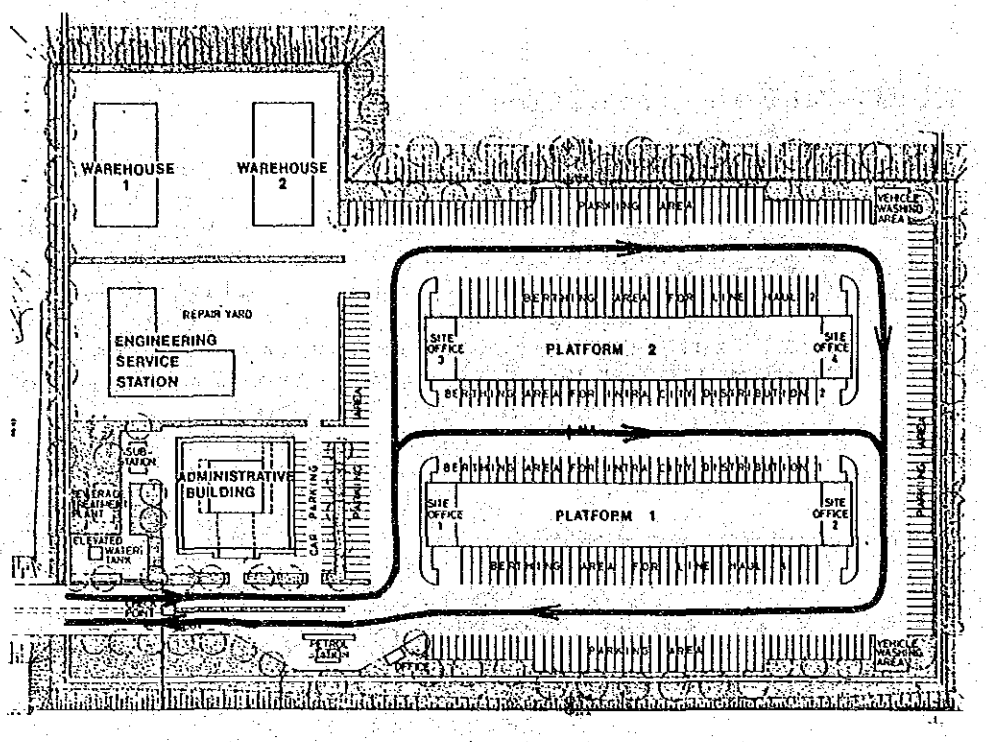


Figure 5.7: Vehicle Circulation System in South Terminal

A two-directional traffic flow through the gateway is applied at both the terminals. The roadway at the entrance/exit point is 20m. This is sufficient in providing two lanes per direction.

For the North Terminal, a right-turning storage lane and channelization for left-turnings are all provided at the intersection of the entrance roadway with Jalan Batu Caves. These measures are to ensure smooth ingress and egress of trucks.

A 20m width roadway for service road including apron for berthing is adopted in the design of both terminals. On the side of the line-haul lorry berths, an apron width of 16m ensures sufficient space for manoeuvring a 15-tonne trailer into a back-in type 8.5m wide stall on the handling platform. A width of 4.0m for service road enables non-berthing vehicles to pass by unobstructed.

As the platform are arranged in parallel, a 20m roadway between the intra-city collection/ distribution lorry berthing space on both platforms provide sufficient apron width to enable two lorries to manoeuvre back-in simultaneously at opposite berths.

5.3.4 Design of Terminal Facilities

(1) Handling Platform

The handling platform provides space for the use of forklifts or other cargo handling machines to unload cargoes from line-haul lorries and transfer them onto smaller intra-city lorries or vice-versa.

The platform space will also be used for classification of cargoes by destination and temporary storage.

The design of the platform allows berthing of lorries from both long sides of the platform, normally one side is for line-haul lorries and the other side for intra-city lorries.

In order to achieve a higher efficiency in loading and unloading activities, the platform is normally raised to the height of the lorry floor level. A rectangular shaped platform also provides higher utilization efficiency.

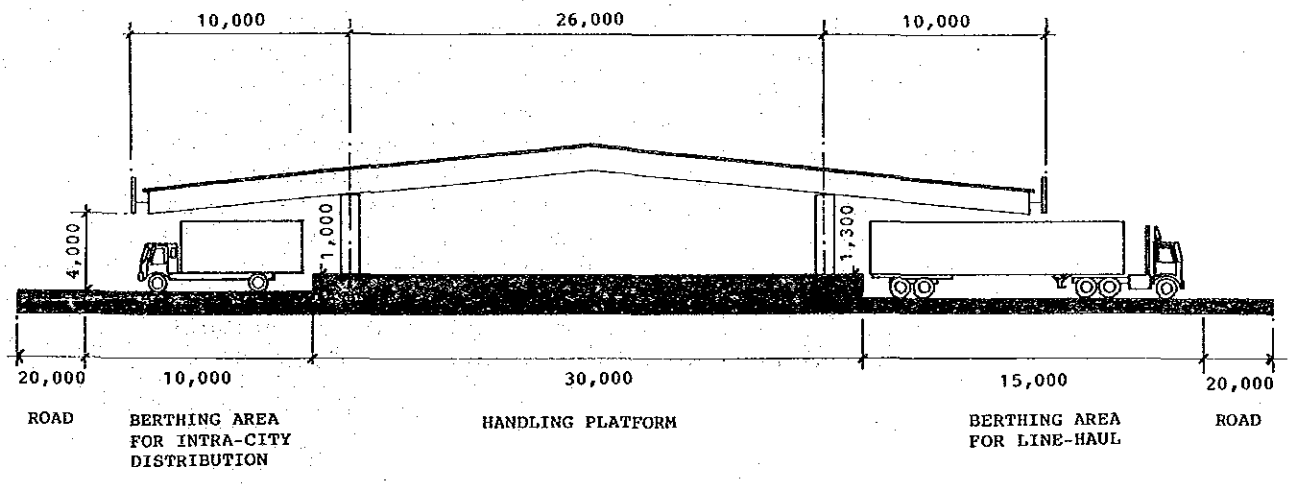


Figure 5.8: Cross-section of Platform Facility

In the actual design, platform length is also determined by the following factors:-

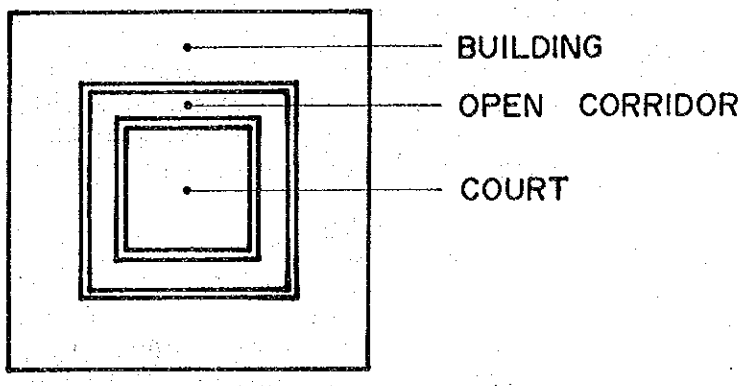
(i) Handling efficiency can be effected if the platform length is too long;
(ii) Considerations for efficient utilization of site area in relation to necessary space for vehicle circulation on site;
(iii) Site configuration and location of facilities.

Two parallel platforms are provided for both the North and South Terminals to avoid having too lengthy platforms.

In most standard platform design, the platform length is divided into spans of 7m long so that either two line-haul lorries or three intra-city lorries would be able to berth alongside each other within a span. That is, each stall on the line-haul lorry side measures 3.5m wide while on the intra-city distribution/ collection lorry side a width of 2.3m is provided.

(2) Administrative Building

Space in the administration building is broadly divided into space for office use and space for providing employees' welfare facilities and amenities. The building design for both the terminals comprise a single-storey of four block structure catering for separate functions such as reception, lounge, offices, canteen and shower room. The blocks are arranged to form a courtyard in the centre. The creation of a landscaped garden with pavement in this area provides a condusive vast area. The 3m wide open corridor provides space for circulation around the building whilst at the same time serving as an area from where the structure and the courtyard may be appreciated.



(3) Site Office Building

The site office building should be located nearest to the place of work of the cargo handling staff. The adopted design is to place the site offices at both ends of the handling platform. Therefore, four blocks of site offices are provided at both terminals.

A design comprising of two storeys with office space for supervisors and customs officers on level one while workmen rest area, locker space and other uses on level two is recommended.

(4) Warehouse

In designing a warehouse attached to a freight terminal, it is important to note that functionally, the length of time the cargo is being kept is comparatively shorter than that of cargoes kept in a general warehouse. Therefore, to ensure smooth and quick handling of the stored cargoes, sufficient space is required for moving goods across the floor for stowing, picking and for loading and unloading purposes.

To this end, the warehouse will be fixed with facilities for palletization and hence a flat floor design is adopted for both the North and South Terminals.

(5) Engineering Service Building

The engineering service buildings for both terminals are designed to provide general vehicular service as well as repairs. The buildings are therefore designed with general service area, repair space, parts storage space, general office area and rest rooms.

(6) Petrol Station

Petrol stations are provided at both the terminals to facilitate refuelling of lanes, thus making the terminals self-sufficient to all the needs of lorry operators.

(7) Vehicle Cleaning Area

This is an added facility at both the terminals. With this facility, lorry operators are encouraged to keep their vehicles clean. This would also help to maintain a high sanitary level within the terminal complexes.

(8) Parking Area

Parking space is provided for all line-haul vehicles and half of the intra-city vehicles using the terminal. In principle, parking space is located along the main roadway for lorry movement to platform area. However, in case where it is not possible to place all the parking space due to peculiar site configuration, then the line-haul vehicles which have poorer manoeuvrebility are given preference over the intra-city vehicles for parking. The smaller size intra-city vehicle will be parked in other places to make the best use of the irregular shaped spaces.

65 car parking spaces for employees and visitors are being provided near the administration building at the North Terminal and 30 car spaces at the South Terminal.

5.3.5 Utility Provisions

At both terminals, power supply sub-stations tapping off from the nearest 11kv high tension supply line are installed on site. Lighting requirements in each building are supplied with individual distribution board. A diesel generator will be provided at each terminal to account for emergency power supply during any power failure.

Water supply at both terminals is tapped-off from the existing street water pipes, pumped up and stored in an elevated water tank. From the tank, water will be piped to all the tap points.

5.3.6 Layout Plans

Based on the facility design considerations described above, layout plans for the North Terminal and South Terminal are then prepared.

A total of 18,700 sq.m of built-up area is required at the North Terminal. A breakdown of the various facility space and site area is shown in Table 5.1.

Table 5.1 : Summary of Area of Each Facility in North Terminal

Facility	Built-up Floor Area (sq.m)	
Platform - Block 1,2	9,060	(4,530 x 2)
Site Office - Block 1,2,3,4	3,840	(960 x 4)
Administration Building	1,472	
Warehouse - Block 1,2	2,592	(1,296 x 2)
Engineering Service Station	1,728	
Petrol Station Office	32	
Total	18,724	

Facility	Site Area (sq.m)
Platform and Site Office	13,200
Berthing Space - Line-haul Vehicle	4,600
Berthing Space - Intracity Vehicle	3,100
Administration Building	4,900
Warehouse	3,600
Engineering Service Station	4,000
Petrol Station	1,500
Lorry Parking	11,600
Car Parking	1,500
Vehicle Washing Space	700
Road Space	21,500
Turfing	26,500
Others	4,300
Total	101,000

For the South Terminal, a total of 14,760sq.m of built-up space is required. The breakdown of various facility space and site coverage areas is indicated in Table 5.2.

Table 5.2: Summary of Area of Each Facility in South Terminal

Facility	Built-up Floor Area (sq.m)
Platform - Block 1,2	7,200 (3,600 x 2)
Site Office - Block 1,2,3,4	2,896 (724 x 4)
Administration Building	1,323
Warehouse - Block 1,2	2,016 (1,008 x 2)
Engineering Service Station	1,296
Petrol Station Office	32
Total	14,763

Facility	Site Area (sq.m)
Platform and Site Office	7,400
Berthing Space - Line-haul Vehicle	4,200
Berthing Space - Intra-city Vehicle	2,800
Administration Building	3,000
Warehouse	7,600
Engineering Service Station	6,600
Petrol Station	800
Lorry Parking	7,000
Car Parking	900
Vehicle Washing Space	400
Road Space	19,500
Turfing	18,800
Total	79,000

The final layout plans for North Terminal and South Terminal are shown in Figures 5.9 and 5.10 respectively.

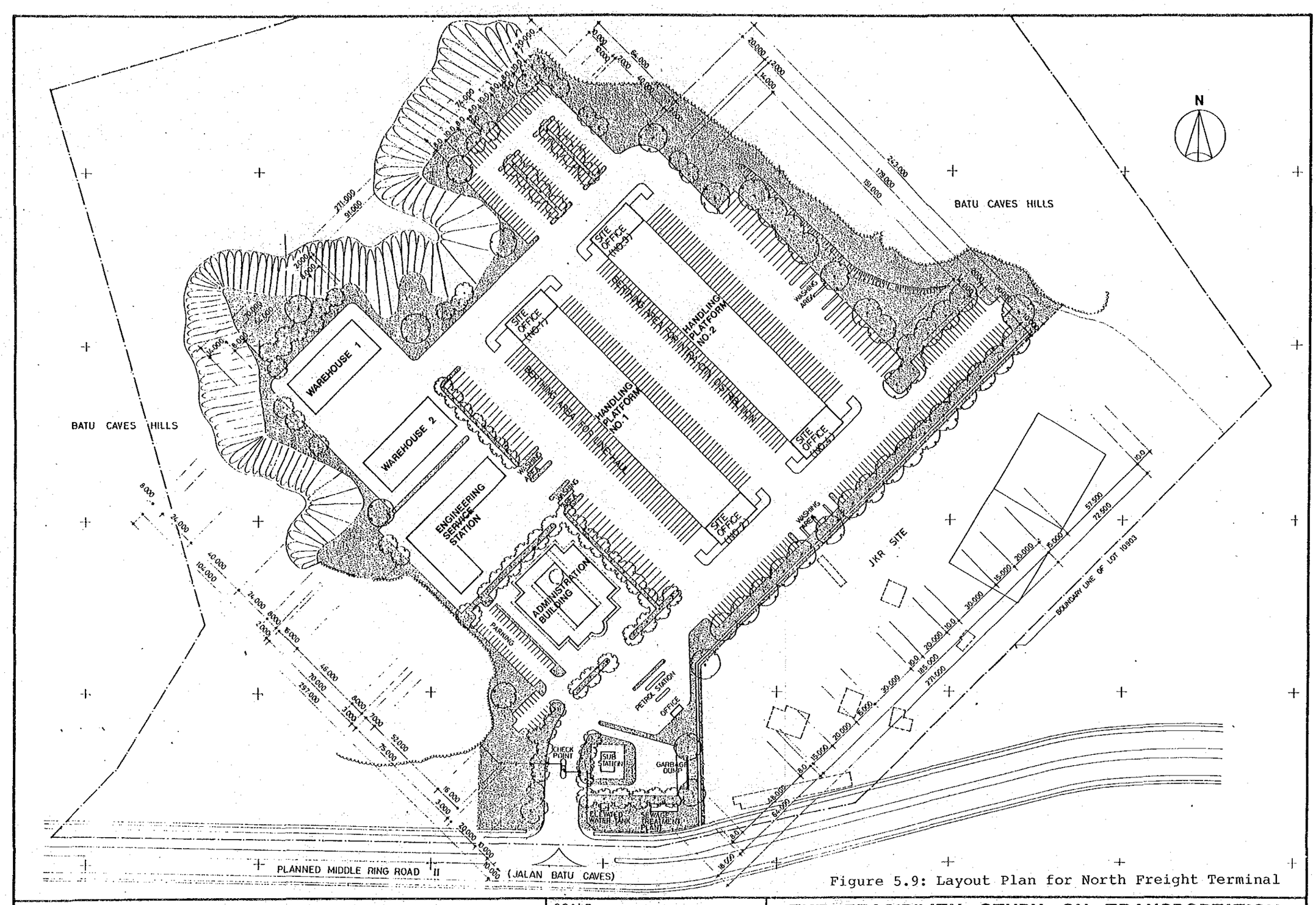


Figure 5.9: Layout Plan for North Freight Terminal

FREIGHT TERMINAL PROJECT		SCALE : 1:2000	THE FEASIBILITY STUDY ON TRANSPORTATION FACILITIES PROJECTS IN KLANG VALLEY
NORTH TERMINAL	SITE PLAN	DRAWING NO : N-1 / DATE : JULY 1988	JAPAN INTERNATIONAL COOPERATION AGENCY

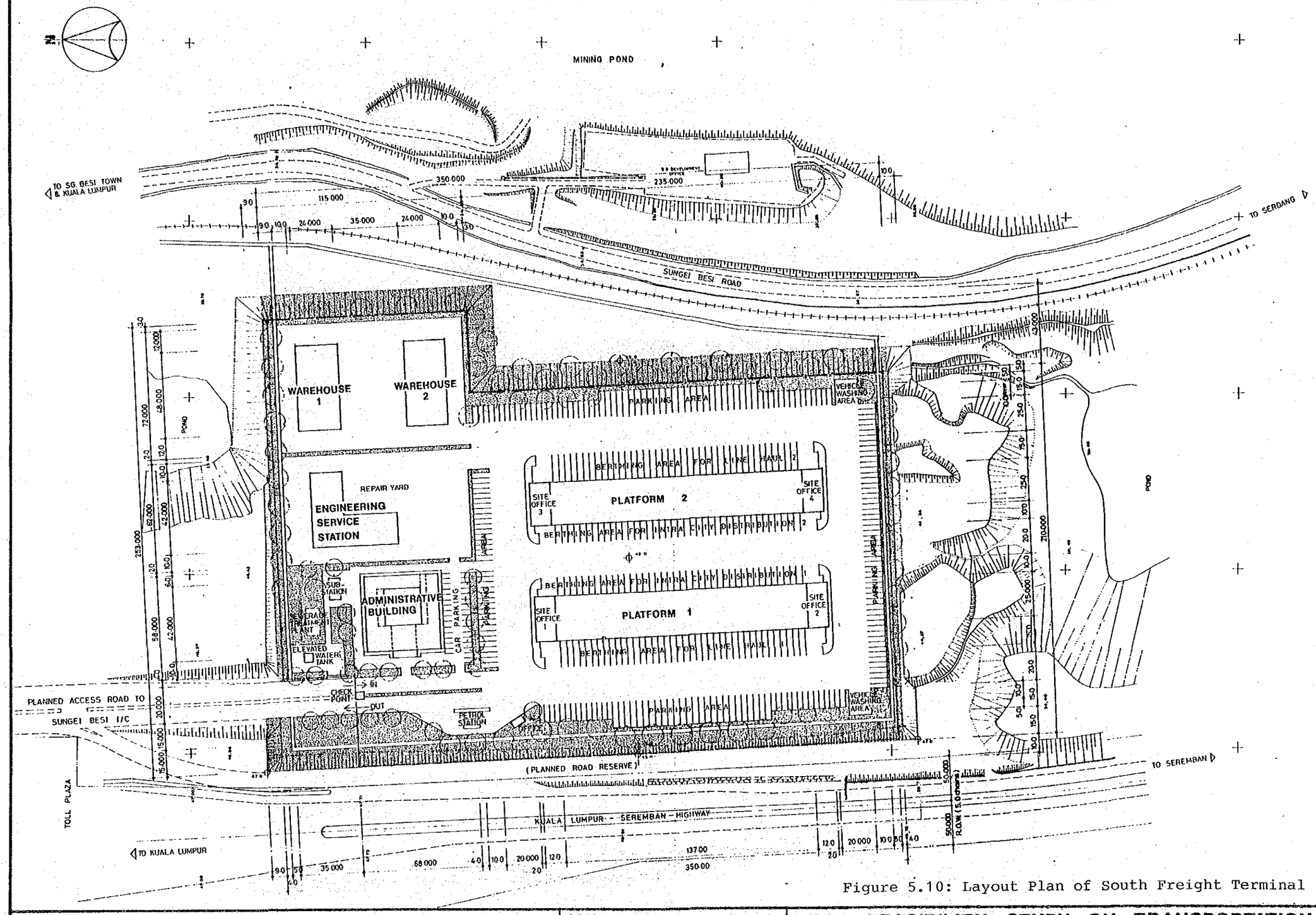


Figure 5.10: Layout Plan of South Freight Terminal

FREIGHT TERMINAL PROJECT		SCALE : 1:2000		THE FEASIBILITY STUDY ON TRANSPORTATION FACILITIES PROJECTS IN KLANG VALLEY
SOUTH TERMINAL	SITE PLAN	DRAWING NO : S - 1	DATE : JULY 1988	JAPAN INTERNATIONAL COOPERATION AGENCY

5.4 Preliminary Engineering Design for the Multi-modal Freight Terminal

5.4.1 Site Planning

The major consideration for planning the terminal facility at the Multi-modal Freight Terminal is to take into account the relation of the terminal with the existing container transhipment facility, its future expansion plan, access from the existing road and the possibility of incorporating rail-cargo transport in future.

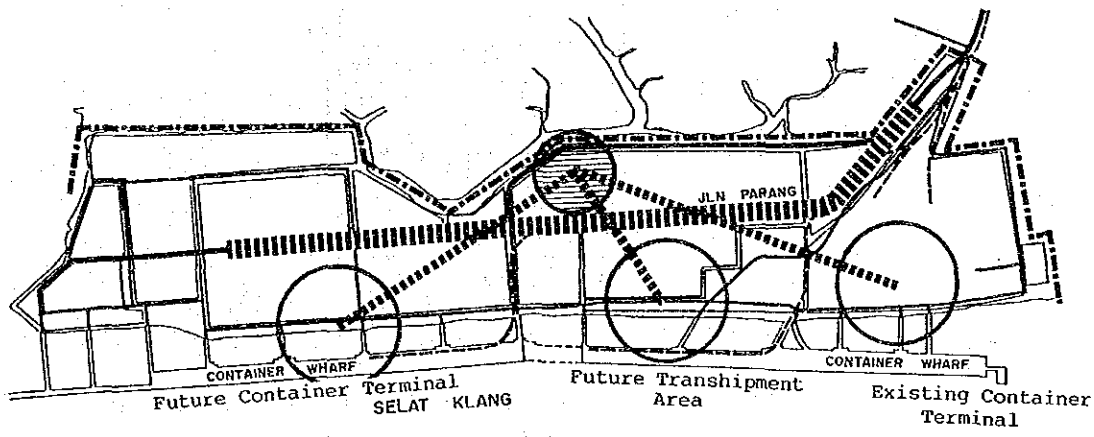


Figure 5.11: Relationship of Multi-modal Freight Terminal Vis-a-vis North Port Facilities

5.4.2 Functioning Zoning

The Multi-modal Freight Terminal is designed to serve as a transfer point between land and sea transportation or vice versa.

The concept shown in the figure below reflects very clearly the relationship of the freight terminal as one of the elements of the overall port facilities.

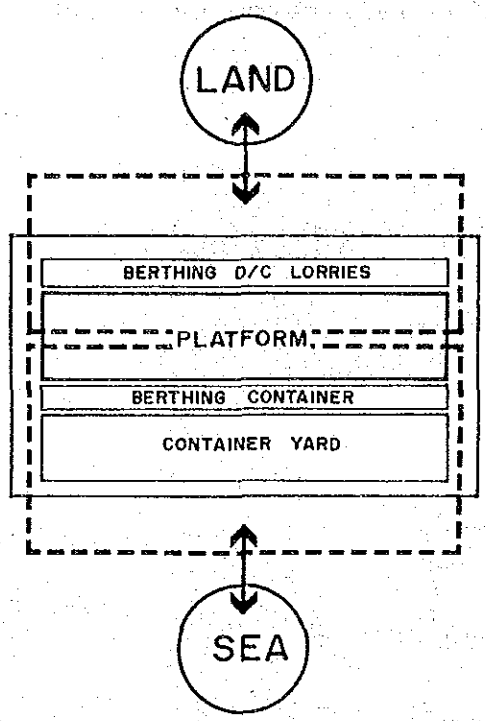


Figure 5.12: Concept of Multi-modal Freight Terminal as a Transfer Point

A zoning plan is prepared by grouping the facilities constituting the terminal by their functions and also taking into consideration the terminal administration and operation.

Similar to the North and South Terminals, a functional zoning that separates vehicular and human movement is applied. The functional zoning can be seen in Figure 5.13.

Zone 1 : Cargo Handling Zone
Zone 2 : Administration and Supporting Services Zone
Zone 3 : Parking Zone
Zone 4 : Container Yard Zone

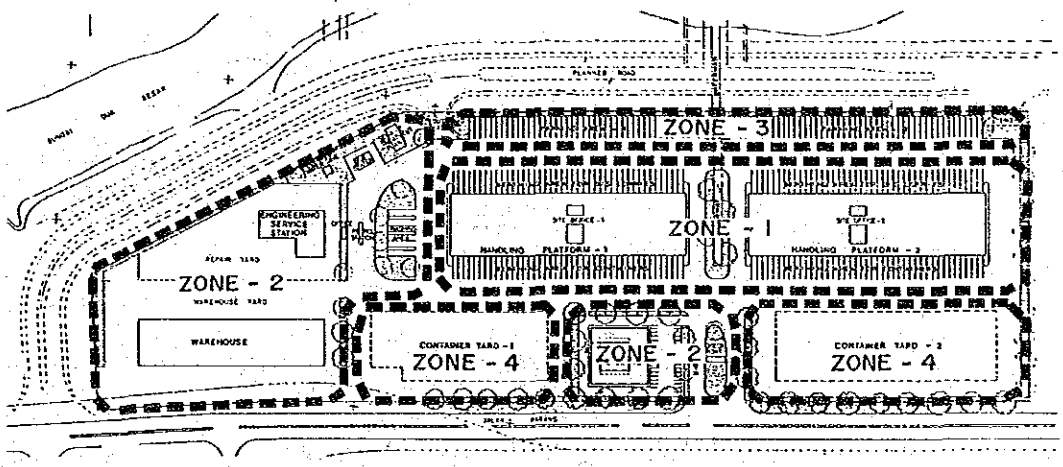


Figure 5.13: Zoning Plan for Multi-modal Freight Terminal