GOVERNMENT OF MALAYSIA

THE FEASIBILITY STUDY ON
TRANSPORTATION FACILITIES PROJECTS
IN KLANG VALLEY

FINAL REPORT

TRAFFIC CONTROL AND SURVEILLANCE SYSTEM PROJECT

TEXT

JUNE 1989

JAPAN INTERNATIONAL COOPERATION AGENCY

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CHAPTER 1 : INTRODUCTION

1.1 Background

The Klang Valley Transportation Study (hereinafter referred to as "KVTS") conducted jointly by Japan International Cooperation Agency (hereinafter referred to as "JICA") with the Government of Malaysia from December 1985 to May 1987, has proposed a list of priority transportation facility development projects and among which is the Traffic Control and Surveillance System project.

Subsequent to the acceptance of these proposals by the Government of Malaysia, The Feasibility Study on Transportation Facilities Projects in Klang Valley which includes Traffic Control and Surveillance System Project (hereinafter referred to as "the Study") was conducted from October 1987 to September 1988 by JICA in cooperation with the Government of Malaysia.

Prior to this report, the Progress Report I, Interim Report and the Draft Final Report had been submitted to the Government of Malaysia in February 1988, September 1988 and March 1989 respectively. Specifically to the Traffic Control and Surveillance System Project, this report forms the TEXT of the Final Report to be submitted in July 1989.

1.2 Study Objective

This Study of the Traffic Control and Surveillance System project has the following objectives:-

(i) To examine the technical and economical feasibility of the Traffic Control and Surveillance System projects;

(ii) To prepare the preliminary engineering design for this project following the results of the technical analysis;

(iii) To prepare a suitable implementation programme for this project;

(iv) To transfer the necessary technical know-how and methodologies on the Feasibility Study to the Malaysian counterparts in the course of this Study.

1.3 Study Component

This study covers two specific systems in the field of traffic control and surveillance system, that is:-

(i) Area Traffic Control (ATC) System
(ii) Highway Traffic Surveillance (HTS) System

1.4 Study Approach

This Study is conducted in two phases and organised into five stages. The study on the Traffic Control and Surveillance System project component was completed at the Interim Stage in September 1989.

Figure 1.1 illustrates the flowchart of the study approach for the Traffic Control and Surveillance System project.

1.5 Structure of the Report

Chapter 1 of this main volume introduces the study background, objectives and approach as well as the structure of this report.

Chapter 2 presents the existing road and traffic conditions in the Klang Valley and the current status of traffic control system. Consequently, problems related to this study on traffic control and surveillance system are identified.

Chapter 3 discusses the necessity, objective and concept of the TCS System, alternative ATC System plans and finally the conceptual plan of the TCS System.

Chapter 4 explains the preliminary engineering design of the TCS System which comprises functional subsystems (including the proposed equipment), traffic engineering measures related to ATC System (including the design guideline for improvement of intersections), staging plan of the system and organisation of the control centres.

Chapter 5 describes the procedure for and cost estimates for the TCS System.

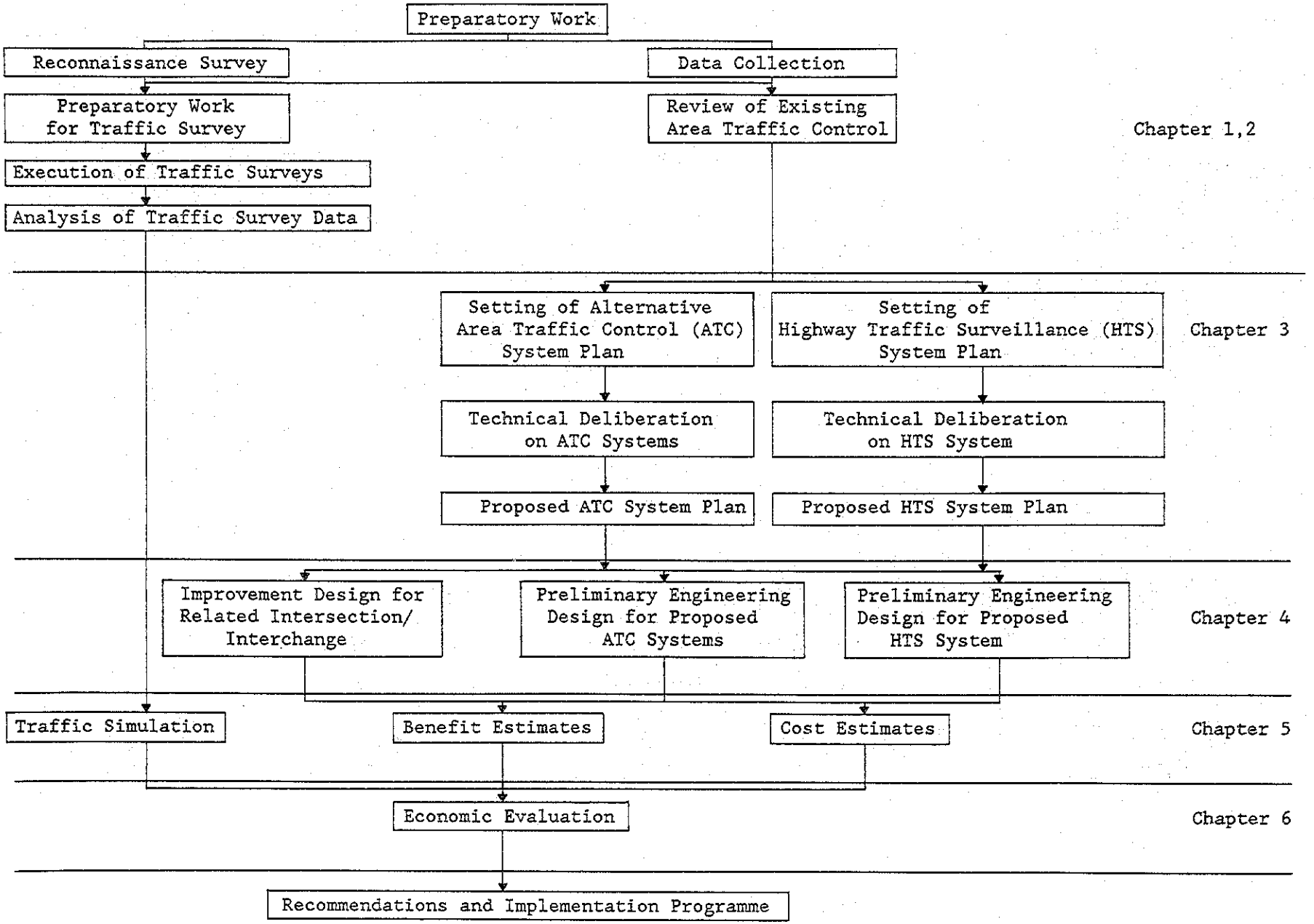


Figure 1.1: Flowchart of the Study Approach

Chapter 6 presents the economic evaluation including benefit estimates and sensitivity analysis.

Chapter 7 presents recommendation and the implementation programme for the TCS System.

CHAPTER 2 : EXISTING ROAD AND TRAFFIC CONDITIONS IN THE KLANG VALLEY

2.1 Road and Traffic Conditions

Road network configuration in Kuala Lumpur consists of partially developed ring and radial road network. The ring roads are Inner Ring Road and Middle Ring Road where the latter encompasses the Central Planning Area. Major radial roads are Jalan Kuching, Jalan Kepong, Jalan Ipoh, Jalan Pahang and Jalan Gombak in the north, Jalan Ampang in the east, Jalan Cheras and Jalan Loke Yew in the south and Jalan Kelang Lama and Jalan Damansara in the west.

Besides these, there are four (4) major highways radiating from Kuala Lumpur. Jalan Kuching and Jalan Ipoh in the north and KL-Seremban Expressway in the south form part of the Federal Route 1. KL-Karak Highway and Federal Highway form part of the Federal Route 2.

Petaling Jaya, divided into two sections by Federal Highway, consists of collectors and distributors of traffic.

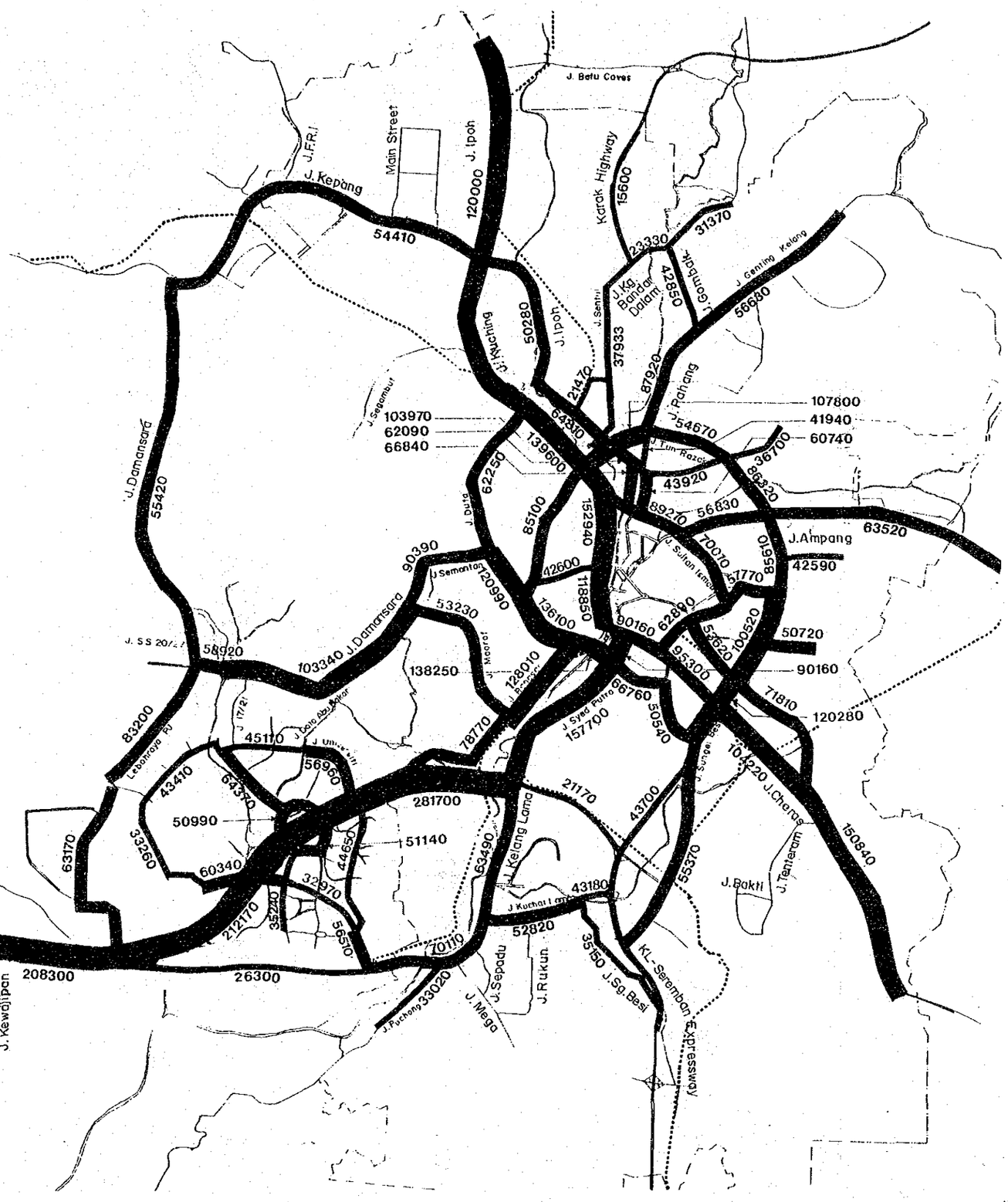
Within the existing road network in the Klang Valley, the heaviest traffic flow is observed on Federal Highway between Kuala Lumpur and Petaling Jaya which carries 281,700 PCU/day in both directions in 1987. Figure 2.1 illustrates the existing traffic volume in Kuala Lumpur Conurbation.

Congestion along on-ramps and off-ramps of Federal Highway interchanges in Petaling Jaya are so severe that long queues extending onto the surface streets and through lane of the highway are not uncommon during morning and evening peak hours respectively. Besides, Jalan Kepong, Jalan Ipoh, Jalan Ampang and Jalan Cheras are major commuting corridors in the Kuala Lumpur Conurbation. These roads are heavily congested especially during morning and evening peak hours.

Apart from these road segments, recurrent congestion sites are low-capacity intersections, for instance, Edinburgh Circle, Pahang Roundabout, 5.5 km and 8.0 km Cheras Roundabout. Queue length of more than 1 km has become a daily phenomenon during peak hours at the Pahang Roundabout, Cheras Roundabout and the Edinburgh Circle.

THE FEASIBILITY STUDY ON TRANSPORTATION FACILITIES PROJECTS IN KLANG VALLEY

Figure 2.1 :
Existing Traffic Volume
in Kuala Lumpur Conurbation



LEGEND :

Traffic Volume In Passenger Car Unit (PCU)

- 30,000 - 50,000
- 50,000 - 100,000
- 100,000 - 200,000
- Over 200,000

(24 - Hour Traffic Volume)

SCALE :

0 1 2 3 4 km

N

2.2 Current Status of Traffic Control System

(1) Urban Street

The coverage area of existing KL ATC System is confined within the Central Planning Area and Jalan Bangsar. At present, there are seventy-four (74) signal controllers connected to the KL ATC Control Centre. Figure 2.2 illustrates the coverage area of the existing ATC system. The rest of the signal controllers, eighty-five (85) of them in KL, operate in isolation.

In Petaling Jaya, all the thirty-one (31) controllers operate in an isolated mode.

System configuration of the existing KL ATC System is shown in Figure 2.3. The Kuala Lumpur Control Centre has a main computer with modem provided for data communication with local signal controllers. Besides, a wall map, two video display units and four console typewriters are connected to the main computer as man-machine interface.

The terminal equipment include local controllers, vehicle detectors and CCTV cameras. Some local controllers perform actuated signal timing control in conjunction with the data obtained from vehicle detector installed at intersections. Inductive loop type vehicle detector is used in the existing system to collect traffic information. However, detector data are not fully utilized in the signal control due mainly to malfunctioned detectors. At present, six (6) CCTV cameras are installed at strategic locations for monitoring traffic situation. In addition, two-way radios are provided for communication with police and City Hall Enforcement Officer.

The existing ATC System functions as fixed-time signal control, that is, according to time-of-day, which is incapable of responding to real time traffic situation.

(2) Highway

At present, there is no proper traffic management on the highways in the Klang Valley. Administration of first aid countermeasures is on an impromptu basis as there is no organization which appears to be entrusted with the task.

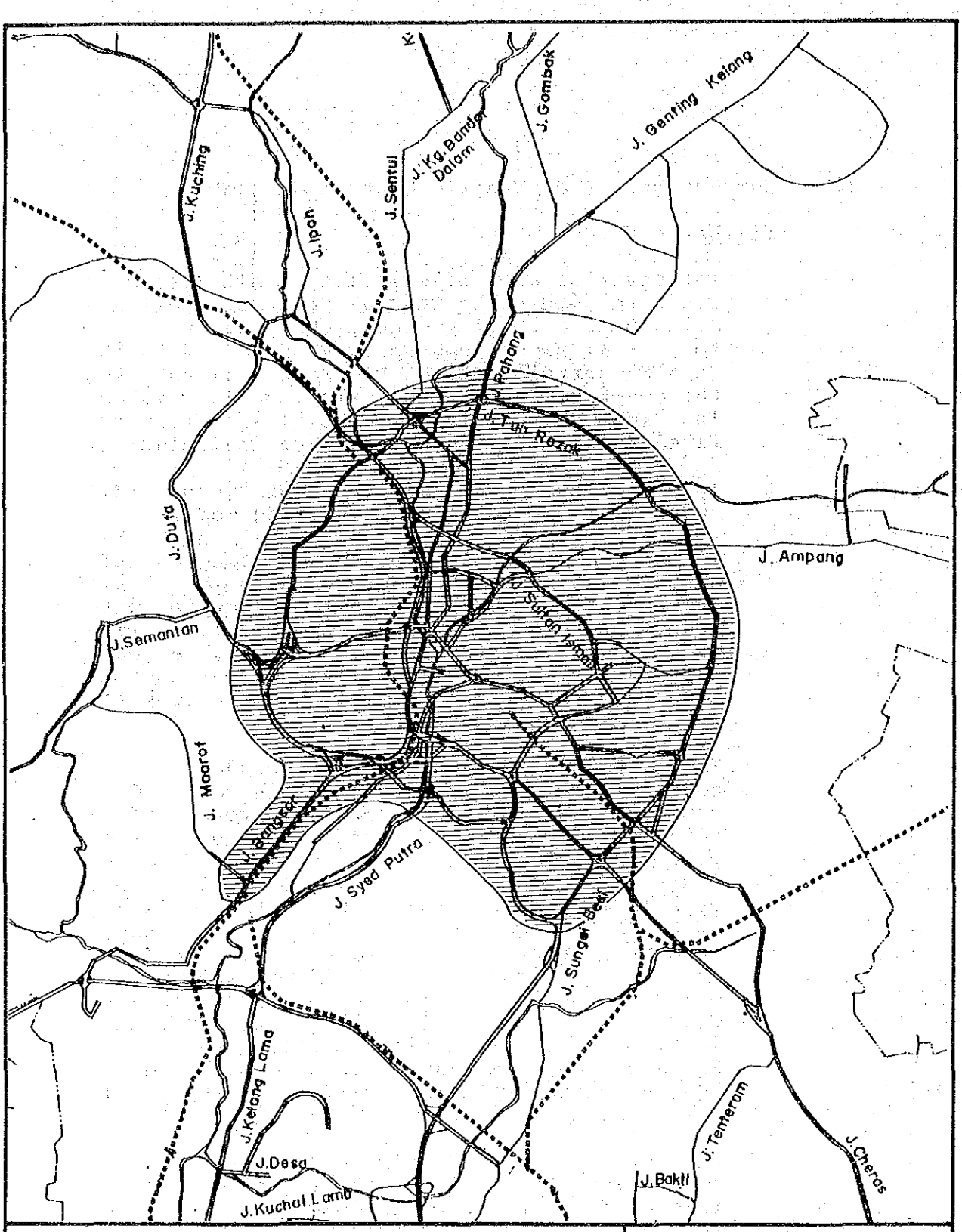


Figure 2.2 : Coverage Area of Existing KL ATC System

LEGEND :

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SCALE :

0 1 2 km

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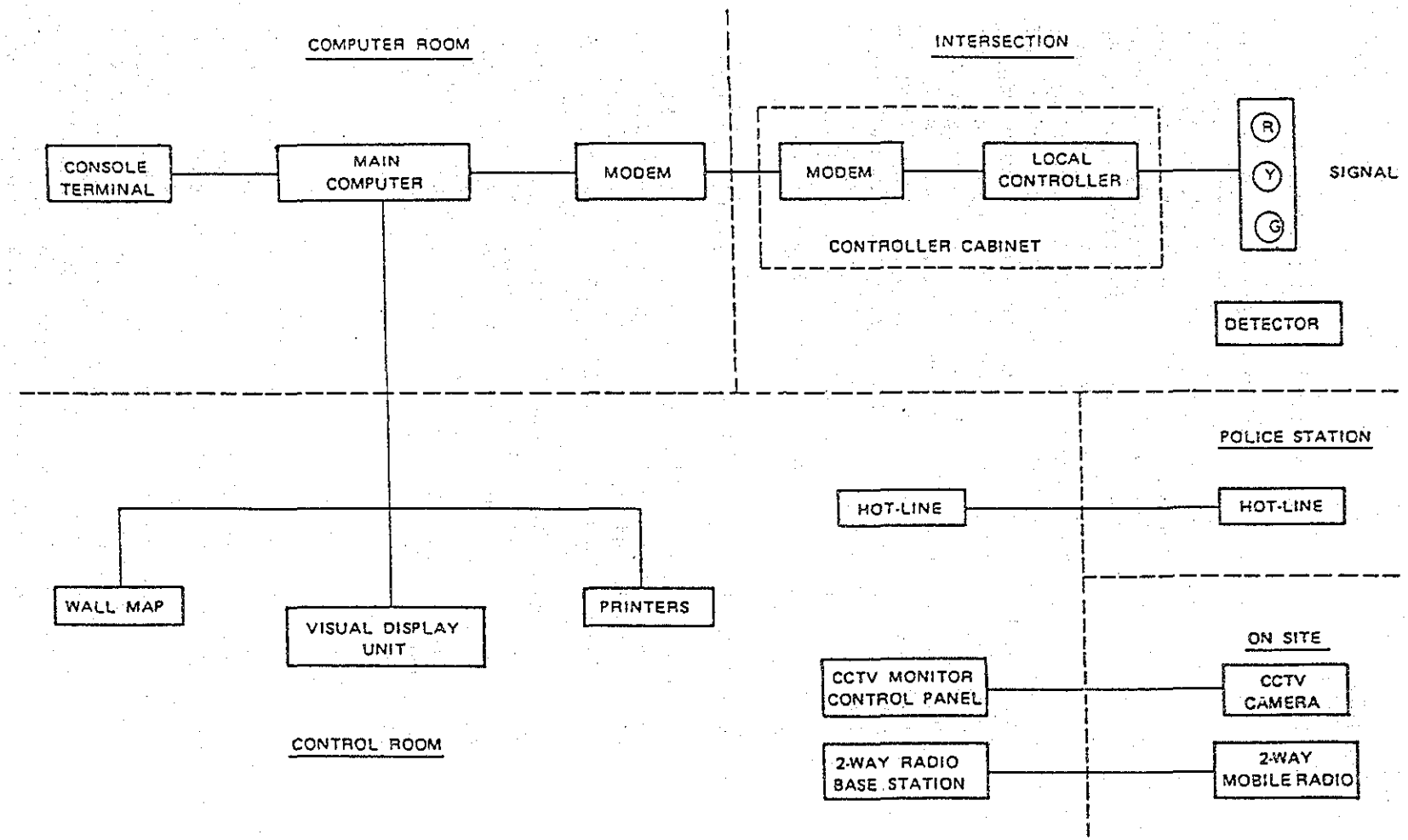

Figure 2.3 : System Configuration of Existing KL ATC System

2.3 Problems

(1) Limitation of Existing KL ATC System

Foremost, the existing ATC System is incapable of controlling the conurbation traffic in view of its limited coverage area. Lack of traffic responsive control function makes the existing ATC System incapable of responding to real time traffic conditions. Traffic information is vital for effective traffic management. However, the existing system is lacking in this aspect especially with the existence of malfunctioned vehicle detectors. Furthermore, the existing system configuration has no provision of mass storage media like magnetic tape for the CPU System, thus no data is recorded in a form suitable for future statistical or analytical usage. In addition, there is a shortage of traffic engineers in the KL ATC Control Centre. This hinders the maximum optimization of the system capacity.

(2) Limitation of Isolated Traffic Signal Control

Besides the limitation of the existing KL ATC System, there are also various limitations facing the signals which operate in isolation in Kuala Lumpur Conurbation. These signals are of pre-timed and vehicle-actuated types. The former is backdated whereas the latter befits the same function as a pre-timed signal control under heavy traffic flow conditions. Other major limitations are uncoordinated signal control and difficulties in maintaining optimum control timing.

(3) Traffic Problems

In addition to the limitation of the existing traffic signal control, the major traffic problem facing Kuala Lumpur is the occurrence of heavy traffic congestion outside the Central Planning Area (CPA), particularly on radial roads leading to/from the CPA. Legendary traffic jam are usually observed along Jalan Kepong, Jalan Ipoh, Jalan Gombak, Jalan Sentul, Jalan Dato Keramat, Jalan Ampang and Jalan Cheras. Major causes of this congestion situation are inadequate road network, heavy traffic demand, low capacity road condition and intersections/roundabouts.

A large portion of the existing highways in the Klang Valley does not conform to highway/ expressway design standard. This supposedly highway network intermingles with the urban street network in Kuala Lumpur without full access control, thus mixing up through and internal traffic. This creates traffic bottlenecks at the gateway intersections and interchanges, thus forbid smooth and safe traffic flow.

Apart from these, traffic queue is usually observed during peak hours at on/off ramps and on through lanes on the highway network in the Klang Valley, particularly at Federal Highway interchanges.

(4) Lack of Traffic Information

At present, there is no proper traffic information pertaining to the existing highways for traffic management officials to administer prompt action to any incident on the highway and for policy making on the future highway network.

In addition, there is an inadequate traffic information for highway commuters. This is particularly important, for example, in the event of accidents on highway, in order to allow voluntary diversion or allay some of the driver's concern, irritation and discomforts.

(5) Lack of Traffic Management

Although the existing highways and urban streets are maintained by City Hall, JKR and/or LLM, these organizations do not undertake traffic management activities such as first aid countermeasures, incident detection, detour implementation and others.

CHAPTER 3 : CONCEPTUAL PLAN

The characteristics of traffic movement on urban streets and highways are different as the former is of intracity traffic while the latter intercity traffic. As such, the main control strategy on urban street is traffic signal control whereas on highway is traffic surveillance and conveying of traffic-related information to drivers. Furthermore, urban streets and highways are managed and operated by different traffic authorities.

Hence, two systems will be examined here, that is, Area Traffic Control (ATC) System and Highway Traffic Surveillance (HTS) System. Information exchange will be provided between the two systems to allow monitoring of each other system's operation.

3.1 Necessity

(1) Necessity for Area Traffic Control (ATC) System

In order to overcome the limitation of the existing KL ATC system, the needs to upgrade and expand the area traffic control system in Kuala Lumpur Conurbation are described below:-

(a) To expand the coverage area of existing ATC system in order to ensure an effective control of all traffic in the conurbation area;

(b) To introduce traffic responsive signal control, capable of responding to changing traffic conditions in real time, so as to alleviate traffic congestion;

(c) To reinforce the traffic surveillance function of collecting updated traffic-related information;

(d) To enhance driver information function in conveying accurate and up-to-date traffic-related information to driver;

(e) To introduce statistical data collection function to facilitate traffic management activities and traffic improvement programmes.

In short, the existing ATC system is in need of expansion and upgrading to cope with the ever changing and demanding traffic conditions in Kuala Lumpur Conurbation.

(2) Necessity for Highway Traffic Surveillance (HTS) System

The need for a highway traffic surveillance system in the Klang Valley are as follows:-

(a) To introduce traffic surveillance function of collecting and processing traffic-related information collectively in a manner that traffic management officials can administer the necessary first aid countermeasures.

(b) To introduce driver information function of conveying up-to-date traffic-related information, for instance, incident locations to drivers so that congestion can be mitigated to a minimum.

(c) To introduce traffic management activities such as detour implementation through monitoring the traffic situation in a centre. Besides, traffic improvement programmes may be initiated at this centre.

3.2 Objectives

(1) Objectives of ATC System

One of the principal objectives of the ATC System is expanding the existing coverage area to include Kuala Lumpur and its surrounding areas of Kepong, Selayang, Ampang and Petaling Jaya. With this expansion, the Kuala Lumpur Conurbation traffic can be effectively coordinated and controlled.

The other objective of the ATC System is to establish a comprehensive ATC System with traffic responsive signal control, traffic surveillance, driver information and other functions which enable the implementation of comprehensive traffic management activities. This comprehensive ATC System serves not only to mitigate traffic congestions and accidents but also to facilitate traffic management officials in administering the first aid countermeasures and preparing the traffic improvement programmes.

(2) Objectives of HTS System

The objectives of the Highway Traffic Surveillance (HTS) System are described as follows:-

(i) Traffic Surveillance

To detect automatically up-to-date traffic information such as volume, speed and congestion degree on expressways or highways and processing the data collectively in a manner that traffic management officials can continuously monitor the traffic situation for prompt management of the necessary first aid countermeasures.

(ii) Conveying Traffic Information to Public

To provide traffic information to public, devices such as broadcasting, changeable message sign, etc. could be made available so that adverse effects caused by incident and congestion can be mitigated to a minimum resulting in a balanced and more effective traffic flow.

(iii) Traffic Management Activities

To establish a centre where traffic management activities such as incident detection, detour implementation, special enforcement, etc. are activated through monitoring the traffic situations. This centre will also take the initiative to prepare the traffic improvement programme.

3.3 Concept

(1) System Concept

(a) Concept of ATC System

ATC System is an area-wide coordinated signal control system placed under the control of a central computer. There are many forms of ATC system having different combination of functional usage and various level of traffic adaptability. In whatever form, an ATC system aims at improving traffic operation.

Figure 3.1 illustrates an overview concept of the ATC System.

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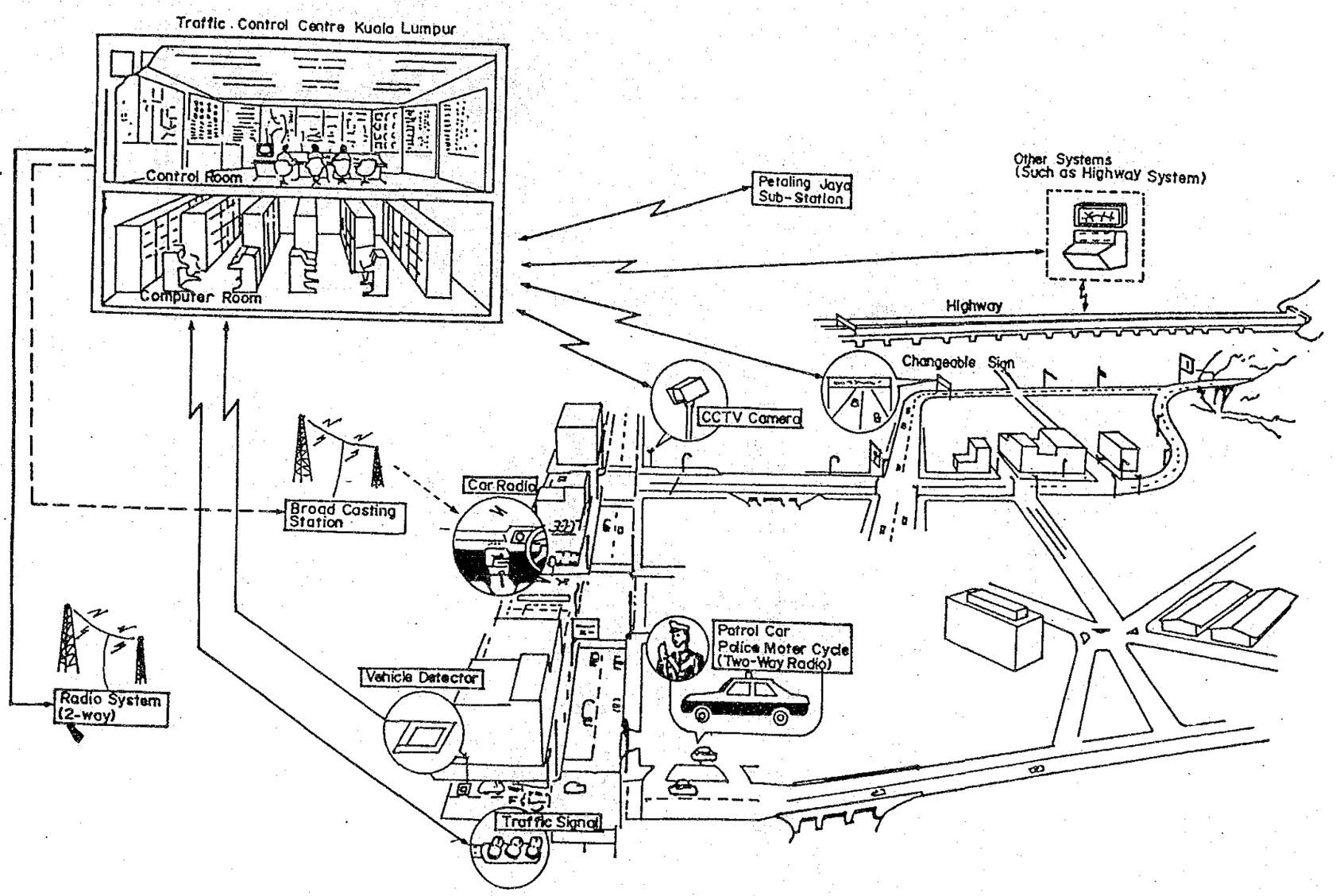


Figure 3.1 :
An Overview Concept of
ATC System

LEGEND :

SCALE :

N

The traffic control centre is set up with central equipment such as central computer, control desk, wall map, etc. At sites, various terminal equipment such as vehicle detectors, CCTV cameras, traffic signal controllers and changeable message signs are linked to the control centre with communication cable. Besides, radio broadcasting station can be provided in the centre for broadcasting traffic-related information periodically through the control centre.

In addition, information exchange function can be incorporated in the control centre for links with other system such as sub centre and highway traffic surveillance system.

(b) Concept of HTS System

HTS System aims at ensuring traffic flow on highway safer and smoother by collecting and analyzing factual data on the highway network, conveying advisory and mandatory information to drivers and activating traffic management activities.

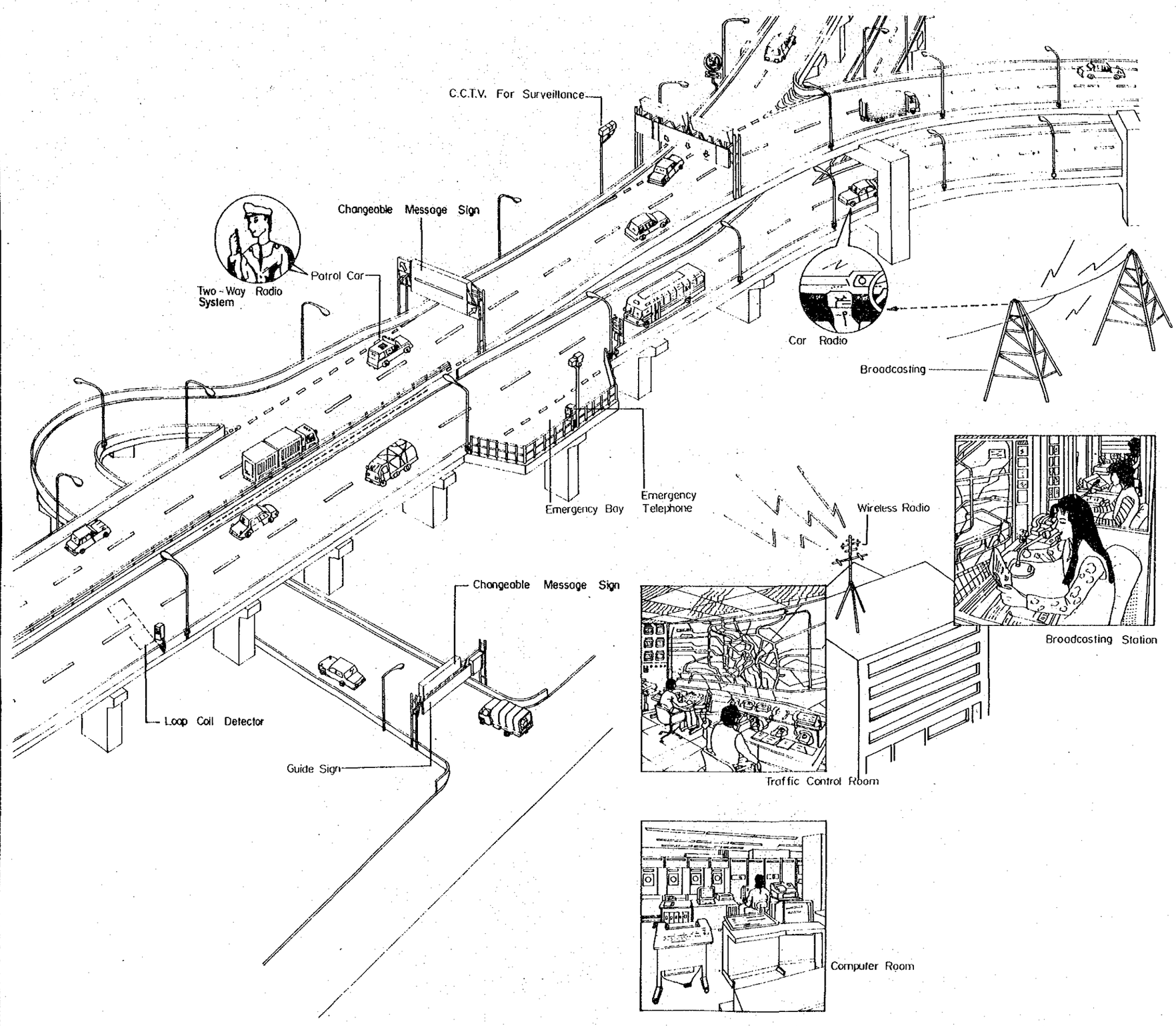
In the control centre, control room, machine room and broadcasting station are set up. Wall map, control desk, emergency telephone desk, etc. are installed in the control room whereas the machine room houses the computers and peripheral equipment. Terminal equipment such as vehicle detectors, CCTV cameras, changeable message signs and emergency telephones are connected to the computer in the control centre by communication cable.

Similarly, information exchange function can be incorporated in the centre for linkage with other systems.

Figure 3.2 illustrates an overview concept of the HTS System.

THE FEASIBILITY STUDY ON TRANSPORTATION FACILITIES PROJECTS IN KLANG VALLEY

Figure 3.2 :
An Overview Concept of
HTS System



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(2) Operational Concept

The Study covers two types of traffic control system, area traffic control system whose main purpose is to control traffic signals at intersections on urban street network and highway traffic surveillance system which aims at ensuring smooth and safe traffic on highways by monitoring highway traffic and taking necessary countermeasures when an incident occurs.

The ATC System will cover Kuala Lumpur and Petaling Jaya, which are under two different jurisdictions, Kuala Lumpur City Hall (DBKL) and Municipal Council of Petaling Jaya (MPPJ), respectively. The highway routes on which the HTS System cover are the Federal Highway (from North Klang Straits Bypass to the boundary of Kuala Lumpur) and Airport Highway.

With regard to the operational body of these two ATC Systems and the HTS System, several alternatives are considered from one that has a single integrated centre to that of three independent centres formation.

(a) One centre formation

The simplest formation is to establish one integrated control centre which controls all the signals and at the same time undertakes highway surveillance. Advantage of this formation is saving of equipment cost at the centre and fewer number of staff needed to operate the system.

But different objectives, operational procedure, equipment configuration of the ATC System and HTS System make the system complicated and difficult to manage. In addition, this formation requires substantial changes in the present organisation involved in the traffic management. From the technical viewpoint, the formation is not advantageous as communication cable length will be longer than other formation resulting in higher installation and operation costs.

(b) Three Centre Formation

Under this formation, three separate centres will be established; one for KL ATC System, one for PJ ATC System and one for JKR HTS System. Each centre will have a simple equipment configuration and its operational objectives will be straight forward. Similar HTS system is being planned for the existing and proposed North-South Toll Expressways and if such system is constructed, the HTS system should maintain close rapport with it. This can be easily achieved if the HTS system here is independent from the ATC systems.

As the traffic conditions in Kuala Lumpur and Petaling Jaya are not closely related except locations where signals are installed along the road crossing the city boundary, two independent ATC centres will not present any problem in signal operation. If necessary, synchronization of signal control system of Kuala Lumpur and that of Petaling Jaya can be effected through a centre to centre connection cable. The five (5) signals along Federal Highway in Petaling Jaya will be controlled by HTS centre rather than by PJ ATC centre for reasons which will be presented later. No organisational change is required by this formation.

(c) Centre-subcentre Formation

Another possible formation is a centre-subcentre configuration in which two centres will be established for KL ATC System and JKR HTS System and a subcentre for PJ ATC system.

The PJ subcentre, which could be unmanned, will be placed under either KL ATC centre or JKR HTS centre. No advantage is expected if the subcentre is placed under KL ATC system except marginal saving of central equipment cost. If PJ ATC System is placed under HTS system, control of five (5) signals along Federal Highway would be more coordinated with other signals in Petaling Jaya. However the different nature of ATC system and HTS system would likely present problems in operation and management. This formation also entails changes in the organisation and jurisdiction so that implementation would not be easy.

Based on the discussion presented above, three centre formation is recommended as the configuration of the TCS System and its operation are simple and no organisational change is required.

Technically the five (5) signals along Federal Highway in Petaling Jaya can be connected to either PJ ATC system or JKR HTS system. If connected to PJ ATC system, its hardware and software configurations will be simpler enabling easier coordination of these signals with other signals in Petaling Jaya. From the viewpoint of highway traffic management, however, effective and timely ramp control will not be possible as the HTS system has no means to control these signals. Thus only limited improvement of queue problem can be expected under this arrangement.

On the other hand, if the five signals along the Federal Highway are brought under JKR HTS system, ramp control can be easily implemented. The total cost however will be slightly higher as additional signal control devices are required at the control centre for the HTS system. Considering that operation of these signals has critical impact on the highway traffic, they are recommended to be connected to the JKR HTS system.

3.4 Alternative Plans of ATC System

(1) Alternative Plans

In defining the system that is best suited for Kuala Lumpur Conurbation, three alternative plans for the Kuala Lumpur ATC System were proposed from the viewpoints of coverage area and functional subsystem.

Table 3.1 depicts the features of each alternative plan for the ATC system.

Table 3.1 : Features of Each Alternative Plan for ATC System in Kuala Lumpur Conurbation

	Existing ATC System	Alternative Plan		
		I	II	III
Coverage Area	Within Central Planning Area	Kuala Lumpur and its Conurbation areas of Cheras, Kepong, Selayang and Ampang		
Functions				
Non-Traffic Responsive Signal Control	***			
Traffic Responsive Signal Control		***	***	***
Traffic Surveillance		*	***	***
Driver Information			*	***
Statistical Data Collection			*	**
Information Exchange				**

Note: *** - Essential
** - Complement
* - Optional

Alternative I is basically a traffic responsive signal control system which aims mainly at upgrading and expanding the existing ATC system. Traffic responsive signal control forms the backbone of the ATC system. It serves to seek an optimum signal control timing parameter based on the traffic information obtained by the vehicle detectors. All three alternative plans cover the entire city of Kuala Lumpur and its surrounding areas of Cheras, Kepong, Selayang and Ampang.

Alternative II is an expanded system of Alternative I with traffic surveillance function. Traffic surveillance function collects, processes and interprets traffic-related information in a manner that traffic management officials can use it to administer the necessary first aid countermeasures.

Alternative III is a comprehensive multi-functional ATC system incorporating all features of Alternative II as well as driver information function. In addition, it is functionally complemented by statistical data collection and information exchange. Driver information function is conveying traffic-related information to driver who can then decide his actions by himself. Statistical data collection provides relevant statistical data to traffic management officials for adjusting existing control parameters and formulation of future traffic control policy. The information exchange with HTS system ensures an effective implementation of traffic management activities in the Kuala Lumpur Conurbation.

(2) Evaluation of Alternative Plans

The three alternative plans of the Kuala Lumpur ATC System are being evaluated from the technical, social and economic viewpoints.

It is noted that Alternative II includes Alternative I as its component and likewise Alternative III covers Alternative II. Alternative Plans I and II therefore can also be regarded as stages of implementation in achieving the final and comprehensive ATC System as in Alternative Plan III.

Technically, the three alternatives are similar except for their differences in scale.

From the social viewpoint, Alternatives II and III are more advanced forms of system with more users-oriented features than their respective predecessors. The need for such systems is becoming more urgent as the signal control system alone cannot solve the problem of deteriorating traffic situation.

Economically, construction cost of Alternatives II and III is 20% and 45% higher than that of Alternative I respectively.

Considering that the system will be implemented, at the earliest, in two or three years from now when the traffic demand and car ownership would have increased, Alternative III is recommended.

3.5 Conceptual Plan

As explained in Section 4.8 of this Text Volume, all the proposed systems will be constructed in three stages.

(1) Kuala Lumpur Area Traffic Control (ATC) System - Upgrading and Expansion of Existing ATC System

(a) Coverage Area

Kuala Lumpur and its Conurbation areas of Cheras, Kepong, Selayang and Ampang.

Regarding the timing in expanding the coverage area, higher priority is to be given to traffic congested area. Thus the proposed system will cover the city centre and heavily trafficked roads in Stage 1 and the outer areas in Stages 2 and 3.

(b) Main Functions

* Traffic Responsive Signal Control
* Traffic Surveillance
* Driver Information
* Statistical Data Collection
* Information Exchange

Traffic responsive signal control function will be introduced in Stage 1 and traffic surveillance function in Stage 2. For driver information function, it will be introduced initially in Stage 2 but mainly in Stage 3.

(c) Features

This is an integrated system consisting of wide-area traffic responsive signal control system as well as traffic surveillance system which covers Federal Route 1 and 2 and the surface road network.

(d) Executing Agency

Kuala Lumpur City Hall (DBKL)

(e) Control Centre

Kuala Lumpur City Hall

(2) Petaling Jaya Area Traffic Control (ATC) System

(a) Coverage Area

Petaling Jaya

The system will cover the city centre in Stage 1 and the outer areas in Stages 2 and 3.

(b) Main Functions

* Traffic Responsive Signal Control
* Traffic Surveillance
* Information Exchange

Traffic responsive signal control function will be introduced in Stage 1 and traffic surveillance function in Stage 2.

(c) Features

This area-wide traffic responsive signal control must be compatible with the Kuala Lumpur ATC System and ramp signal control of HTS System. Thus, information exchange function is essential.

(d) Executing Agency

Petaling Jaya Municipal Council (MPPJ)

(e) Control Centre

Menara MPPJ

(3) Public Works Department (JKR) Highway Traffic Surveillance (HTS) System

(a) Coverage Route

* Federal Highway : From North Klang Straits Bypass to Kuala Lumpur boundary.

* Airport Highway (Jalan Subang)

The system will cover the interchange ramps in PJ in Stage 1, the section of Federal Highway from Kuala Lumpur boundary to Airport Highway and the Airport Highway itself in Stage 2 and the section of Federal Highway from Airport Highway to North Klang Straits Bypass in Stage 3.

(b) Main Functions

* Traffic Surveillance
  - Automatic Detection of Traffic Condition by Vehicle Detectors
  - CCTV
  - Emergency Telephone
* Driver Information
* Statistical Data Collection
* Ramp Signal Control
* Information Exchange

Ramp signal control function will be introduced in Stage 1 and traffic surveillance function in Stage 2. For the driver information function, it will be introduced initially in Stage 2 but mainly in Stage 3.

(c) Features

This system is an advanced type of real-time traffic surveillance and control system which is applicable to urban expressway. Traffic responsive signal control at the interchange ramps in Petaling Jaya is included.

(d) Executing Agency

Federal Public Works Department (JKR).

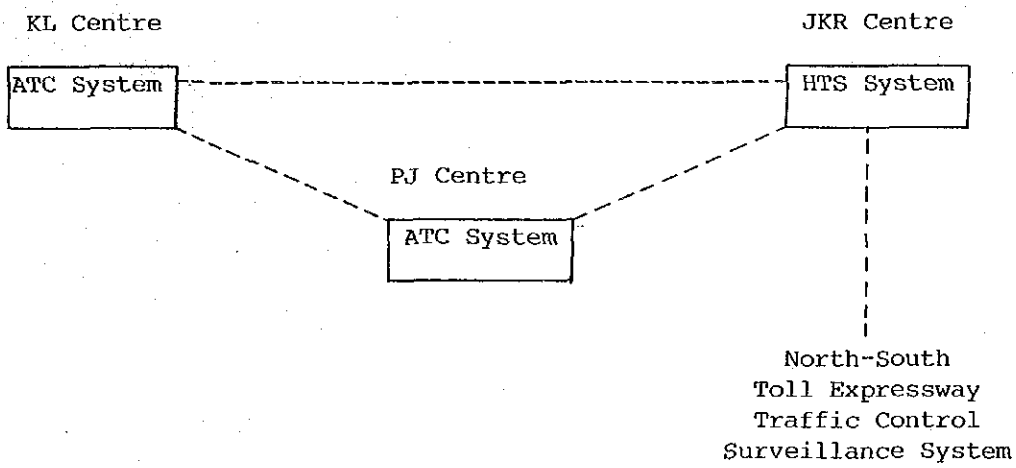
(e) Control Centre

Selangor State Public Works Department (JKR) in Bangunan Sultan Salahuddin, Shah Alam.

This control centre is selected in view of its central location within the coverage area, thereby ensuring an efficient and convenient operation. Furthermore, the Federal JKR may delegate this management responsibility to the State JKR.

The main features of the TCS System projects are shown in Table 3.2 and Figure 3.3.

Table 3.2 : Main Features of TCS System Project

	Kuala Lumpur ATC System	Petaling Jaya ATC System	JKR HTS System
Coverage Area/Route	* All signalised intersections within Kuala Lumpur and surrounding areas of Kepong, Selayang and Ampang * Federal Route 1 and 2 within Kuala Lumpur	* All signalised intersections in Petaling Jaya	* Federal Highway * Airport Highway * Signalised Ramp along Federal Highway in PJ
Main Functions	* Traffic Responsive Signal Control * Traffic Surveillance on the surface road and Federal Route 1 and 2 * Driver Information * Statistical Data Collection * Information Exchange	* Traffic Responsive Signal Control * Traffic Surveillance * Information Exchange	* Traffic Surveillance * Driver Information * Statistical Data Collection * Ramp Signal Control in Petaling Jaya * Information Exchange
System Configuration			

Note : --------- Information Exchange

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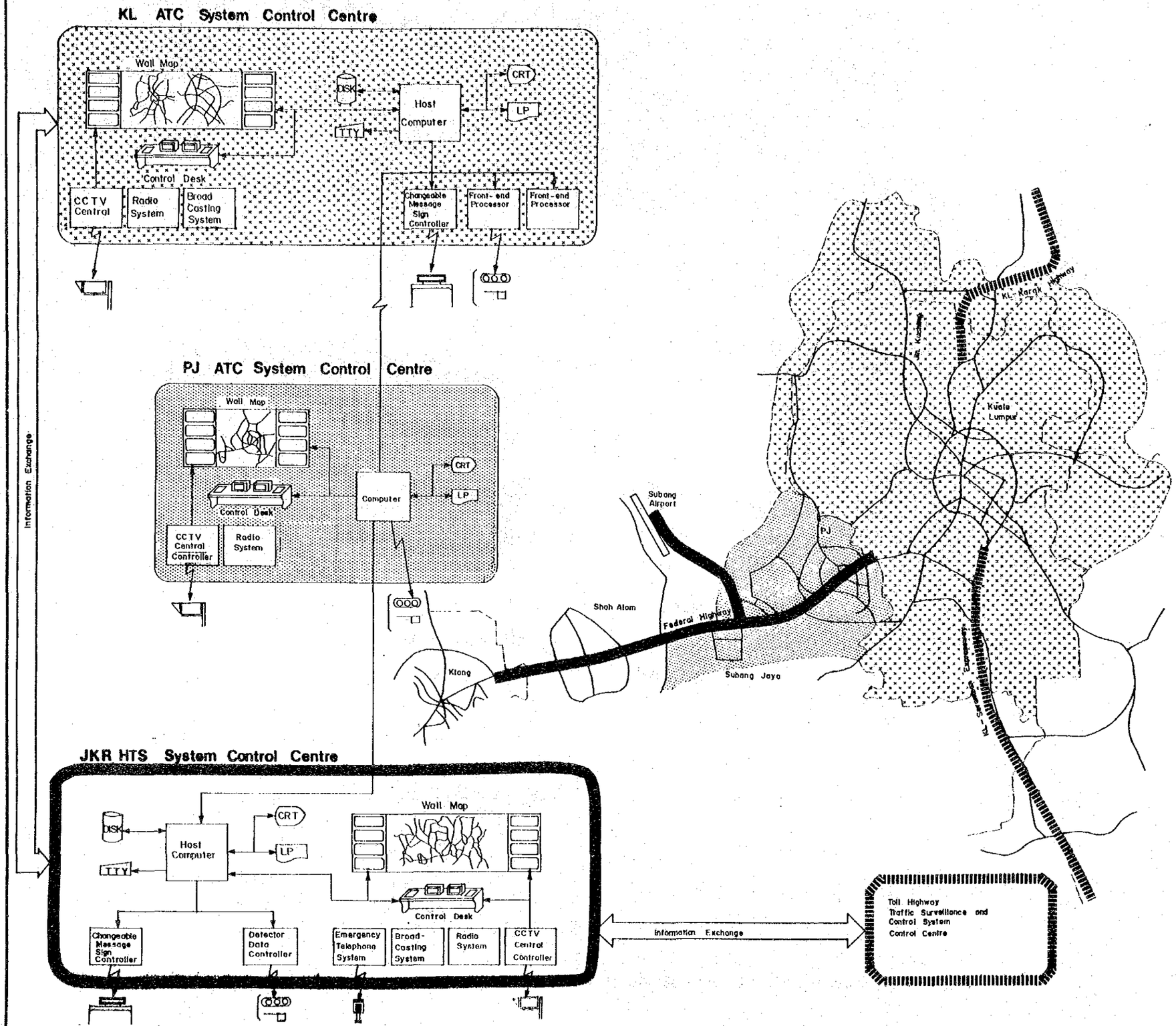
Figure 3.3 :
Main Features of
TCS System



LEGEND :

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CHAPTER 4 : PRELIMINARY ENGINEERING DESIGN

4.1 Traffic Signal Control System

Traffic responsive signal control forms the backbone of the ATC System. Primarily, it centralizes the operation of traffic signal controllers and seek an optimum control timing parameter based on the traffic responsive function.

(1) Traffic Signal Control Method

Traffic signal control methods may be classified as fixed-time control and traffic responsive control.

Fixed-time control relies on historical data to prepare timing plans for a signalized area. Three to four plans, representing the morning peak, evening peak and off-peak conditions are commonly used. A particular plan is switched into operation according to the time-of-day. Traffic signals under the existing KL ATC System are fixed-time control signals but with more patterns.

On the other hand, traffic responsive control calculates control parameters and adjusts the timing plans according to the traffic information from vehicle detectors. It is difficult to give a precise definition of what a traffic responsive control method is as there are many forms of implementation having various levels of traffic adaptability. Nevertheless, this method can be broadly subdivided into two types. In the first type of programme/plan formation, the level of traffic adaptability is high and the control parameters are calculated on-line but demands highly reliable detectors. Currently, its usage is limited and it is still the subject of research. In the second type of plan selection, the control is by adjusting to the traffic situations using pre-prepared timing plans. Plan selection, the most recently used type, is proposed as the traffic responsive signal control method in the ATC System.

(2) Traffic Signal Controller

In principle, traffic signal controller controls the signal lights in accordance with the commands from a central computer in the control centre. At the same time, the status of the signal controller is monitored by the computer. In case of malfunction, the signal controller falls automatically into local mode operation.

Recent development in micro-electronics has lead to the creation of microprocessor based signal controller, which has more flexibility and functions than the conventional one. The traffic signal controller proposed here employs such state-of-the-art features. But as the development of technology is so rapid, details of the signal controller specifications will be decided during the detailed design stage.

Same type of signal controller will be adopted for ATC System and ramp signal controller under HTS System.

(3) Traffic Signal Location Plan

In principle, all existing and proposed signalised intersections in the future should be computerized as to achieve a well-coordinated signal control system.

The proposed traffic signal location inclusive of existing and proposed signalised intersections are shown in Figure 4.1 whereas Table 4.1 tabulates the numbers of signal controllers under each system. One hundred and seventy (170) signal controllers in Kuala Lumpur, forty-three (43) in Petaling Jaya and five (5) at the interchanges along the Federal Highway will be computerized with the completion of the proposed plan.

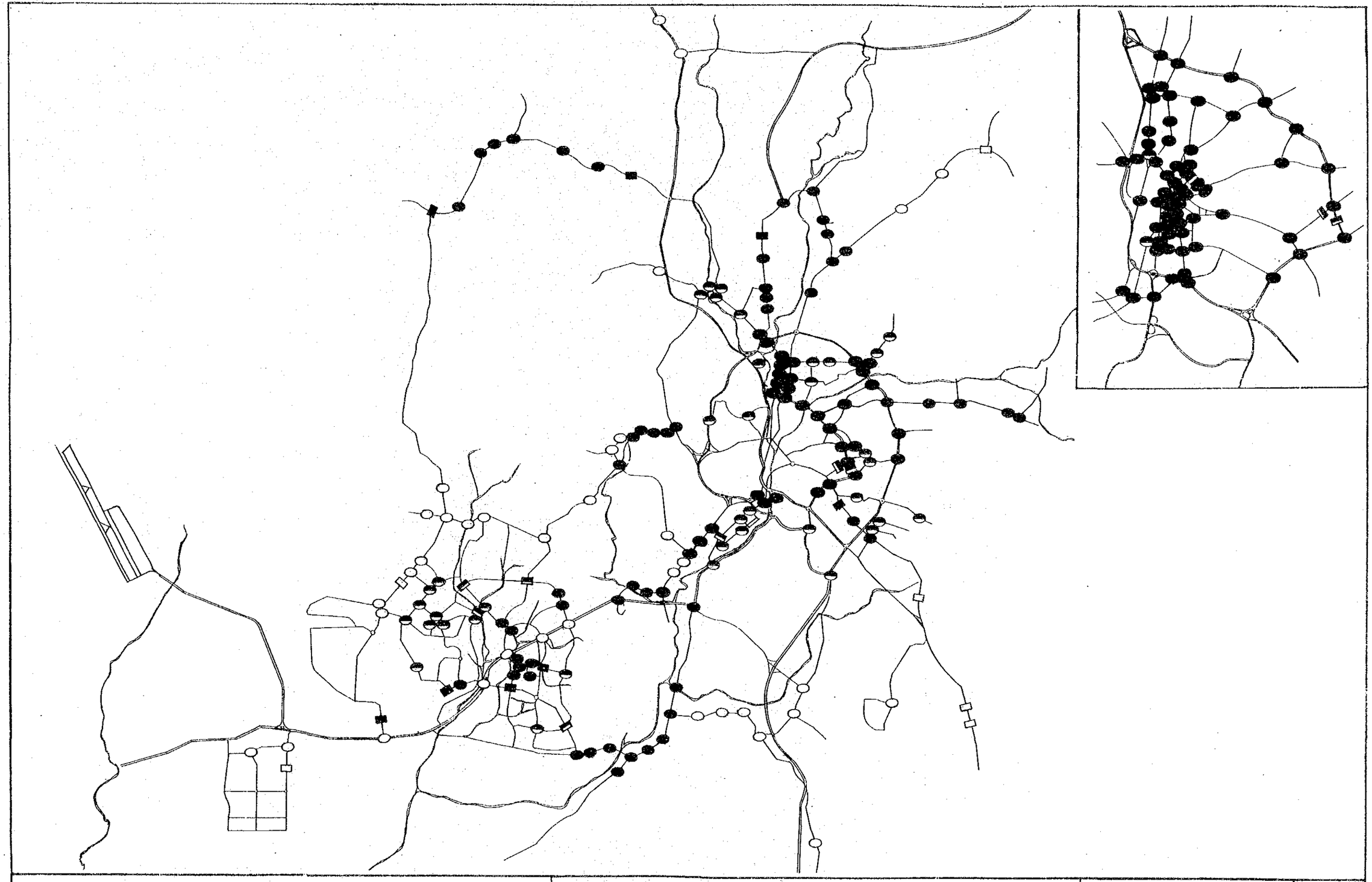

Figure 4.1 : Proposed Traffic Signal Location

THE FEASIBILITY STUDY ON TRANSPORTATION FACILITIES PROJECTS IN KLANG VALLEY

LEGEND :

- EXISTING TRAFFIC SIGNAL TO BE UPGRADED AND COMPUTERISED IN STAGE 1
- PROPOSED TRAFFIC SIGNAL TO BE COMPUTERISED IN STAGE 1
- EXISTING TRAFFIC SIGNAL TO BE COMPUTERISED IN STAGE 2
- PROPOSED TRAFFIC SIGNAL TO BE COMPUTERISED IN STAGE 2
- EXISTING TRAFFIC SIGNAL TO BE COMPUTERISED IN STAGE 3
- PROPOSED TRAFFIC SIGNAL TO BE COMPUTERISED IN STAGE 3

SCALE : 0 1 2 3 4 5 Km

N

Table 4.1 : Proposed Number of Signal Controllers

	ATC				HTS	
	KL		PJ		JKR	
	Existing	Proposed	Existing	Proposed	Existing	Proposed
Stage 1	112 *	4	12	4	5	-
Stage 2	26	4	12	4	-	-
Stage 3	20	4	9	2		
Total	158 *	12	33	10	5	0

Note: * including seventy-four (74) signal controllers under existing KL ATC System

4.2 Traffic Surveillance System

Recently, traffic surveillance function plays an important role in traffic control and surveillance system. Functionally, traffic surveillance involves the collection of traffic information by various means, for instance, vehicle detectors, CCTV and emergency telephones. The collected traffic-related information are required for other functional subsystems such as traffic responsive signal control system, driver information system and statistical data collection system.

(1) Vehicle Detector

Vehicle detector is the most important detecting device as it can automatically measure the fundamental parameters of the traffic flow such as volume and speed.

There are two types of vehicle detectors being used widely, that is, loop coil and ultrasonic detectors. In the TCS System, loop coil detector will be normally adopted. However, the ultrasonic vehicle detector is used in places where the loop coil installation is difficult or inappropriate because of unpaved road surface or the influence of an iron structure.

The vehicle detectors to be adopted in this TCS System and their standard location are as follows:-

(a) ATC System

(i) Signal system detector for traffic responsive signal control
- at 150 meters or further upstream from the stop line of the critical intersection.

(ii) Actuation detector
- especially on the right turning lane, at about 40 meters upstream from the stop line.

(iii) Detector for Queue Detection
- at 250 meters, 500 meters and 750 meters upstream from the stop line of bottleneck intersection.

(iv) Statistics gathering detector
- on all the lanes of the roadway at 150 meters or further upstream from the stop line.

(b) HTS System

(i) Through Lane Detector
- on all the through lanes at regular interval of about 1000 meters longitudinally. Besides, an additional detector is installed a few meters, usually 5-6 meters apart serially in the specific lane for measuring traffic speed.

(ii) On/Off Ramp Detector
- on the lanes of on/off ramps.

(iii) Ramp Signal Control Detector
- the standard location is the same as that of signal system and actuation detectors as described above.

The proposed number of vehicle detectors in each stage is depicted in Table 4.2.

Table 4.2 : Proposed Number of Vehicle Detectors

	ATC		HTS
	KL	PJ	JKR
Stage 1	124	52	26
Stage 2	109	47	154
Stage 3	133	23	109
Total	366	122	289

(2) Closed Circuit Television (CCTV) Camera

The most significant role of CCTV in the proposed TCS system is to transmit on-the-spot visual information to control centre, thereby enabling operators to identify traffic incidents and subsequently initiate appropriate countermeasures.

The proposed CCTV cameras are located based on the following criteria.

(i) Prominent congested intersections along or within the Middle Ring Road and its periphery in Kuala Lumpur.

The existing six (6) cameras located in the CPA will be retained besides newly installed ones as described above.

(ii) Top of Menara MPPJ and recurrent congestion sites in PJ.

(iii) Through lane on Federal Highway especially on the roadway section in Petaling Jaya where traffic demand possibly exceeds the capacity.

(iv) The interchanges along the Federal Highway and Airport Highway where congestion is prone to occur.

Table 4.3 presents the number of CCTV camera required in each stage and their location is shown in Figure 4.2.

Table 4.3 : Proposed Number of CCTV Camera

	ATC		HTS
	KL	PJ	JKR
Stage 1	6*	-	-
Stage 2	11	3	8
Stage 3	-	1	4
Total	17*	4	12

Note : * including six (6) CCTV camera under existing KL ATC System.

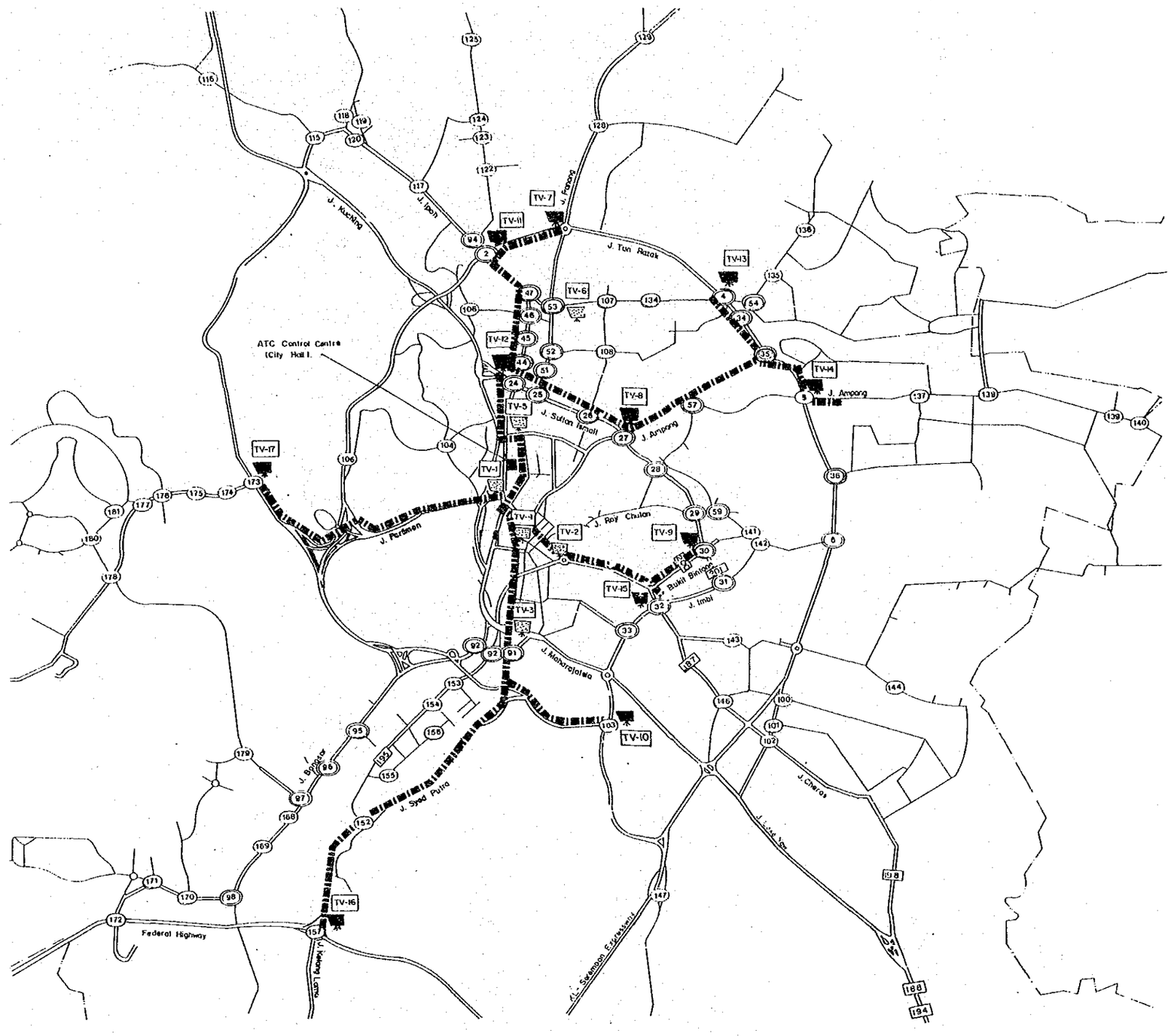

Figure 4.2(1) : Proposed CCTV Location - KL ATC System

THE FEASIBILITY STUDY ON TRANSPORTATION FACILITIES PROJECTS IN KLANG VALLEY

LEGEND :

- CCTV CAMERA (EXISTING)
- CCTV CAMERA (STAGE 2)
- OPTICAL FIBRE CABLE (STAGE 2)

SCALE : 0 0.5 1.0 km

N

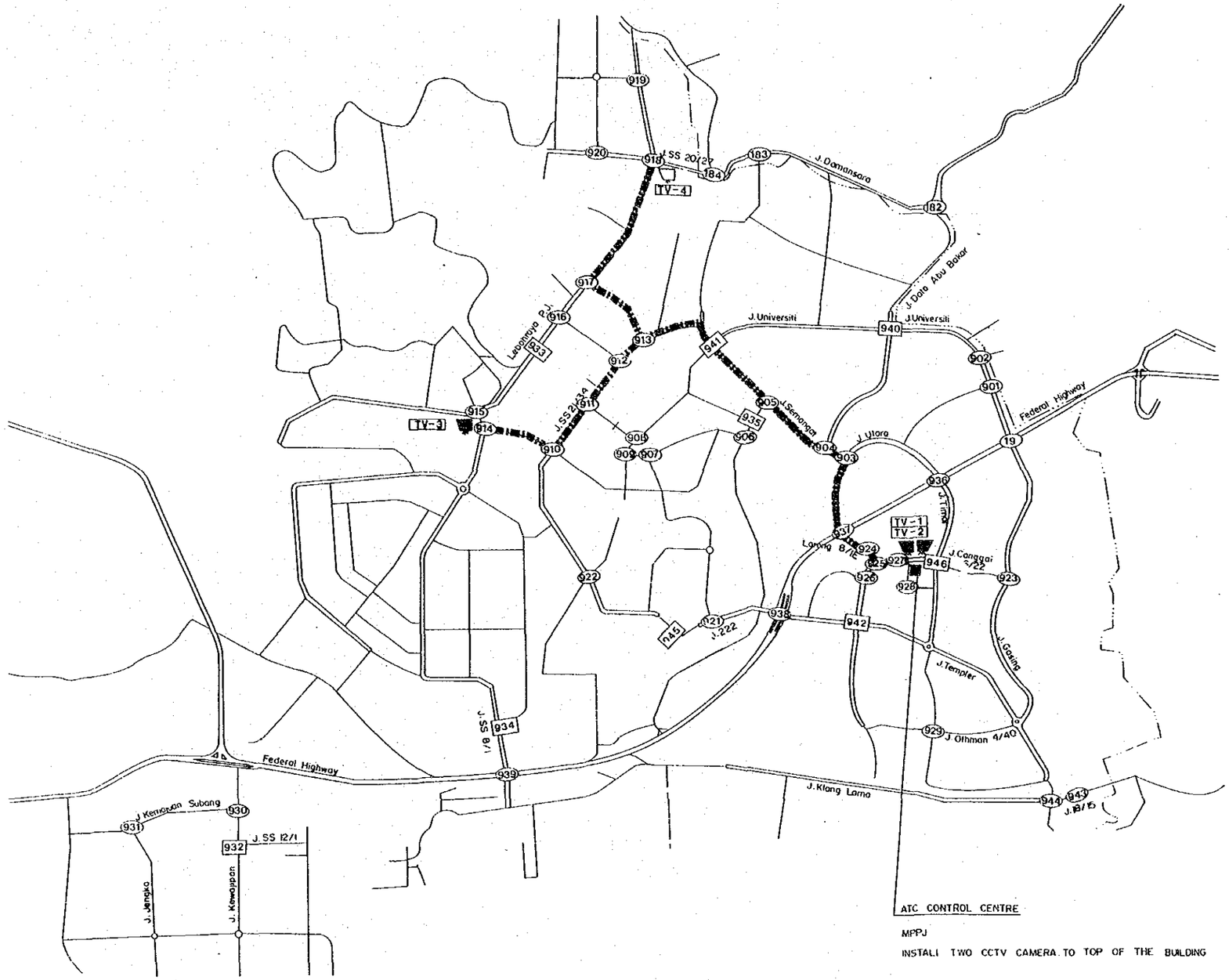

Figure 4.2(2) : Proposed CCTV Location - PJ ATC System

THE FEASIBILITY STUDY ON TRANSPORTATION FACILITIES PROJECTS IN KLANG VALLEY

LEGEND :

- CCTV CAMERA (STAGE 2)
- CCTV CAMERA (STAGE 3)
- OPTICAL FIBRE CABLE (STAGE 2)

SCALE : 0 0.5 1.0 km

N

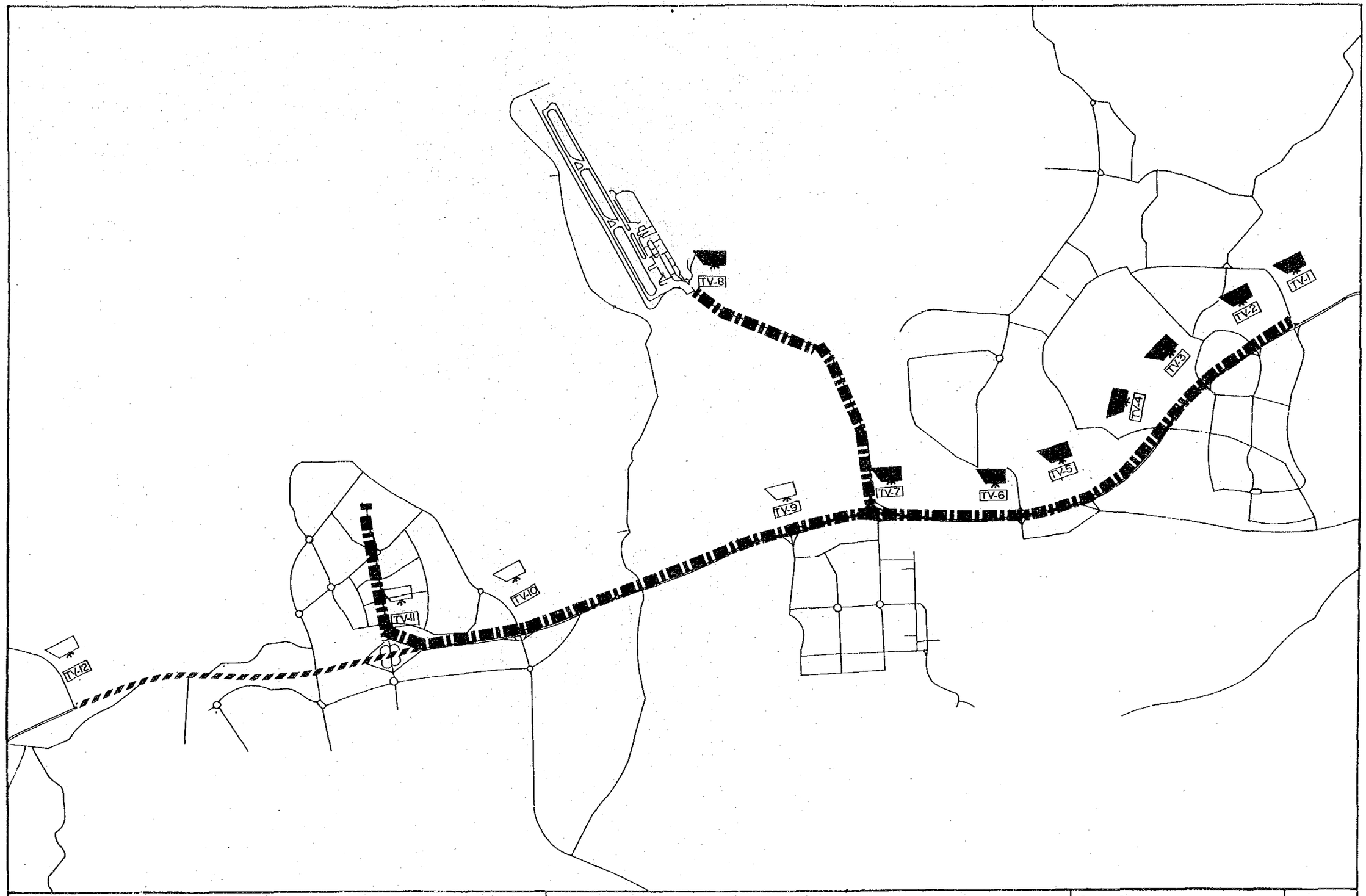

Figure 4.2(3) : Proposed CCTV Location - JKR HTS System

THE FEASIBILITY STUDY ON TRANSPORTATION FACILITIES PROJECTS IN KLANG VALLEY

LEGEND:

- CCTV CAMERA (STAGE 2)
- CCTV CAMERA (STAGE 3)
- OPTICAL FIBRE CABLE (STAGE 2)
- OPTICAL FIBRE CABLE (STAGE 3)

SCALE : 0 0.5 1 1.5 km

N

(3) Emergency Telephone for HTS System

Emergency telephones are very useful and keenly needed by drivers travelling on highways in two main types of situation; accidents, where urgent traffic regulation and medical assistance are required and breakdowns which are generally of lower priority. In both situations, the drivers can inform the operators in the control centre to ask for necessary assistance.

The telephones are placed along both sides of the highway at every 1,000 meters. A total of fifty-four (54) emergency telephones will be installed in the HTS System.

Figure 4.3 illustrates the proposed emergency telephone locations.

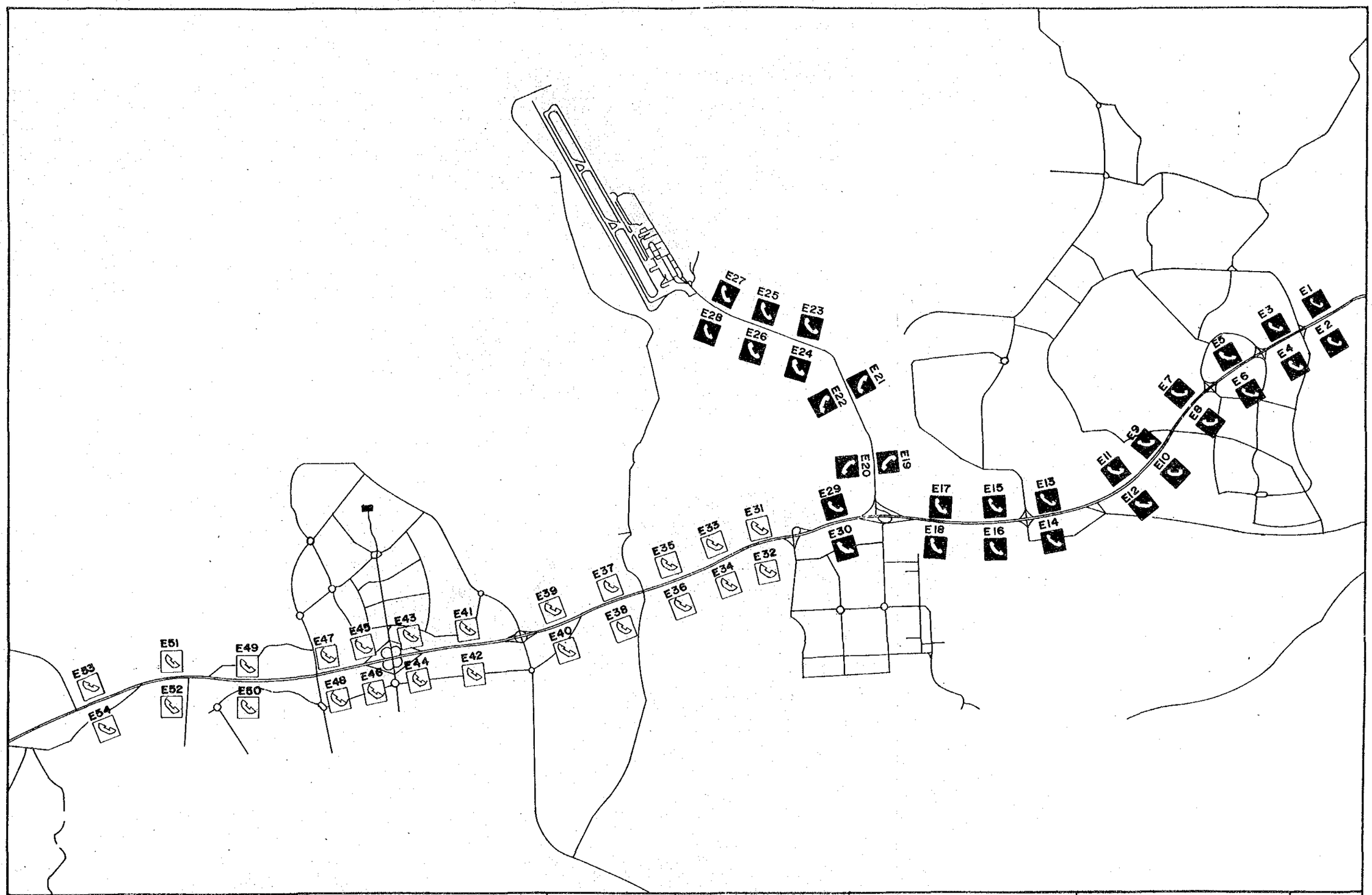

Figure 4.3 : Proposed Emergency Telephone Location

THE FEASIBILITY STUDY ON TRANSPORTATION FACILITIES PROJECTS IN KLANG VALLEY

LEGEND :

- EMERGENCY TELEPHONE (STAGE 2)
- EMERGENCY TELEPHONE (STAGE 3)

SCALE : 0 0.5 1 1.5 km

N

4.3 Driver Information System

In simple terms, driver information function is the act of conveying traffic-related information to drivers on the road.

Changeable message sign and commercial radio are the selected media for this function in the TCS System.

(1) Changeable Message Sign

Changeable message signs are equipped with functions that can display any message, for instance, congestion warning, route guidance, etc. set in advance as well as message instructed by an operator through message input device in the control centre.

The signboard has a display surface sufficient for about 40 alphabet characters arranged in two rows, each having about 20 character display surface.

The signboard will be installed mainly at the following places and used to inform drivers of the fact described below:-

* On the major radial road outside the Middle Ring Road in Kuala Lumpur to inform drivers travelling towards the central area of information related to central area congestion or detour routes.

* On the through lane leading to the off-ramp of Federal Highway to inform drivers of information related to downstream section of highway or surface street near the interchanges.

* On the surface streets leading to the on-ramp of Federal Highway in Petaling Jaya to inform drivers of highway conditions.

The proposed number of changeable message sign is shown in Table 4.4 and their location is illustrated in Figure 4.4.

Table 4.4 : Proposed Number of Changeable Message Sign

	ATC		HTS
	KL	PJ	JKR
Stage 1	-	-	-
Stage 2	2	-	2
Stage 3	10	-	8
Total	12	0	10

(2) Commercial Radio

Radio broadcasting station, which is sound proof, is provided in the control centre. Announcers at the control centre obtain traffic-related information through the wall map, CCTV monitor, etc. and broadcasts timely and accurate information periodically. The drivers can receive this audio information through car radio which acts as a driver information tool.

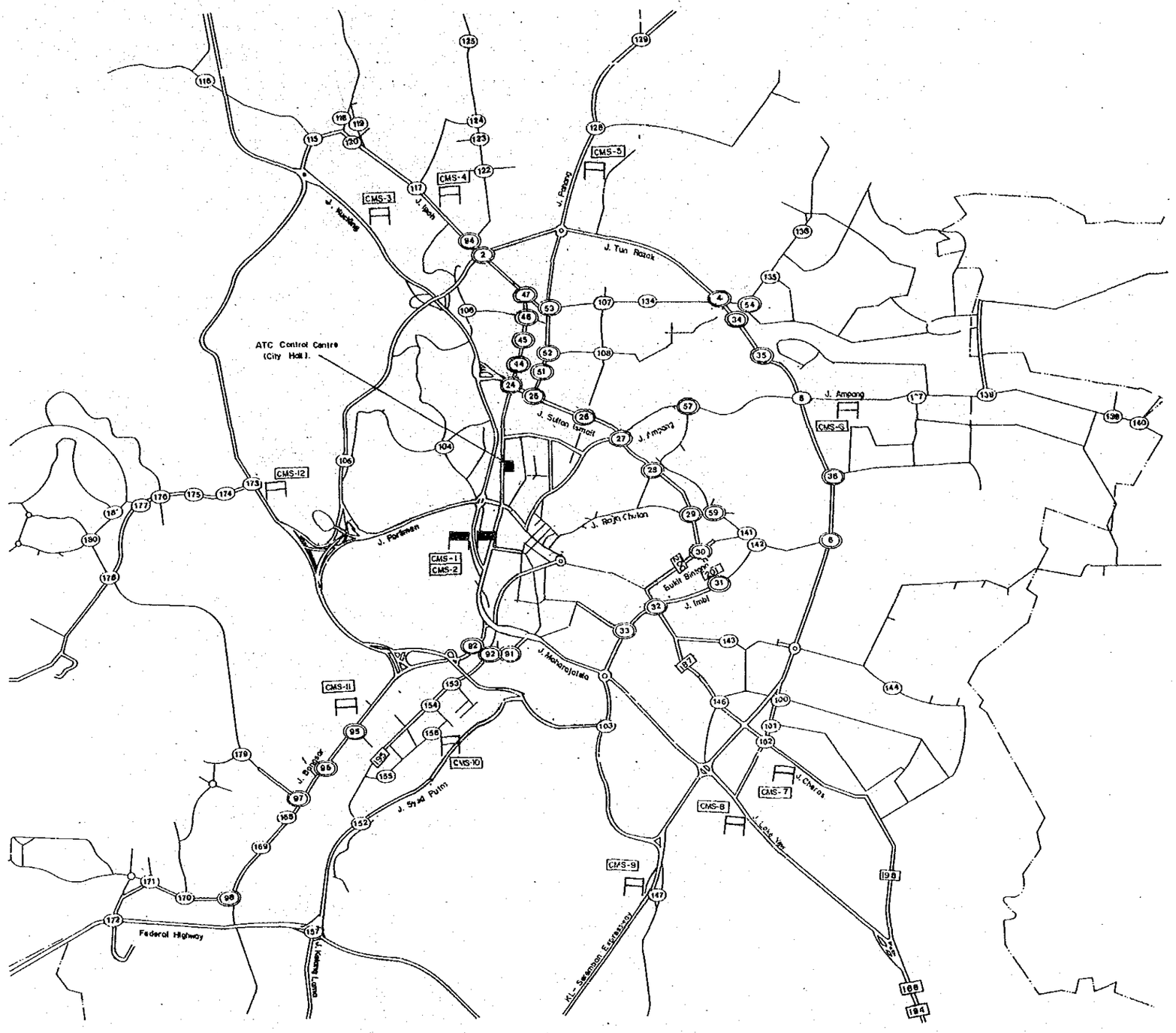

Figure 4.4(1) : Proposed CMS Location - KL ATC System

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LEGEND :

- CMS (STAGE 2)
- CMS (STAGE 3)

SCALE : 0 0.5 1.0 km

N

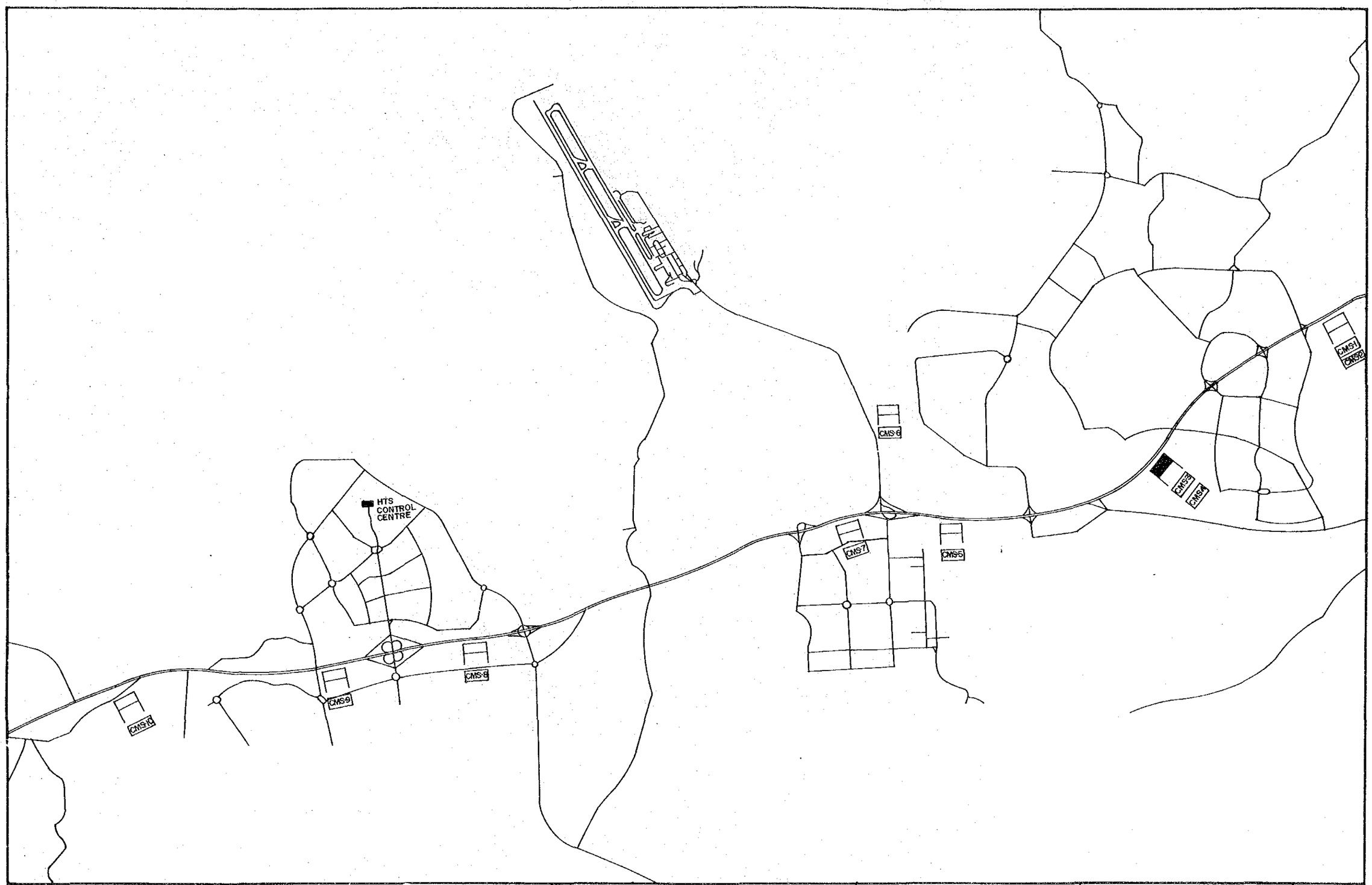


Figure 4.4(2) : Proposed CMS Location - JKR HTS System -

THE FEASIBILITY STUDY ON TRANSPORTATION FACILITIES PROJECTS IN KLANG VALLEY

LEGEND :

- CMS (STAGE 2)
- CMS (STAGE 3)

SCALE : 0 0.5 1 1.5 km

N

4.4 Statistical Data Collection System

The statistical data collection system provides pertinent statistical data for adjustment of control parameters, formulation of future traffic control policy and traffic research.

The statistical data to be provided are:-

(a) Traffic Flow Data

Traffic volume at the strategical location for traffic management, queue length displayed on the wall map, etc.

(b) Operation Data

Commanded timing parameters in signal control, displayed message in changeable message sign, etc.

(c) Error List

Site equipment error, communication error, computer system error, etc.

The reports of traffic flow data and operation data are produced periodically, for example, once a day while error lists are printed out whenever an error occurs.

4.5 Control Centre System

In each control centre of the TCS System, various central equipment are provided as below:-

(i) Computer System
(ii) Traffic-related Information Display
(iii) Man-machine Interface
(iv) Associated Facilities in the Centre
(v) Radio Broadcasting

The abovementioned equipment culminates in the system configuration. The hardware configuration of the KL ATC, PJ ATC and JKR HTS Systems are shown in Figure 4.5 whereas the configuration of application programmes is depicted in Figure 4.6.

The main criterion in the layout design of the control centre is the provision of adequate space for the computer hardware that will be introduced to coincide with the functional subsystems.

The requirements of the control centres are presented in Table 4.5.

Figure 4.7 illustrates the control centre layout for KL ATC, PJ ATC and JKR HTS systems.

Table 4.5 : Space Requirement of Control Centre

System		KL ATC	JKR HTS	PJ ATC
Control Centre Location		KL City Hall	Selangor State JKR, Bgn. Sultan Salahuddin, Shah Alam	Menara MPPJ
Room Space *1	Control and Machine Room	184 sq.m *2	184 sq.m	54 sq.m
	Room for Power Generator, etc.	55 sq.m	55 sq.m	-
	Total	239 sq.m	239 sq.m	54 sq.m
Ceiling height in the control room		More than 3 m	More than 3 m	More than 2.5 m
Control and Machine Room	Floor design	* raised floor	* raised floor	* raised floor
	Services	* Air-conditioned	* Air-conditioned	* Air-conditioned

Note:
*1 : Office space for staff is excluded
*2 : Same size as the control and machine rooms in the existing KL control centre

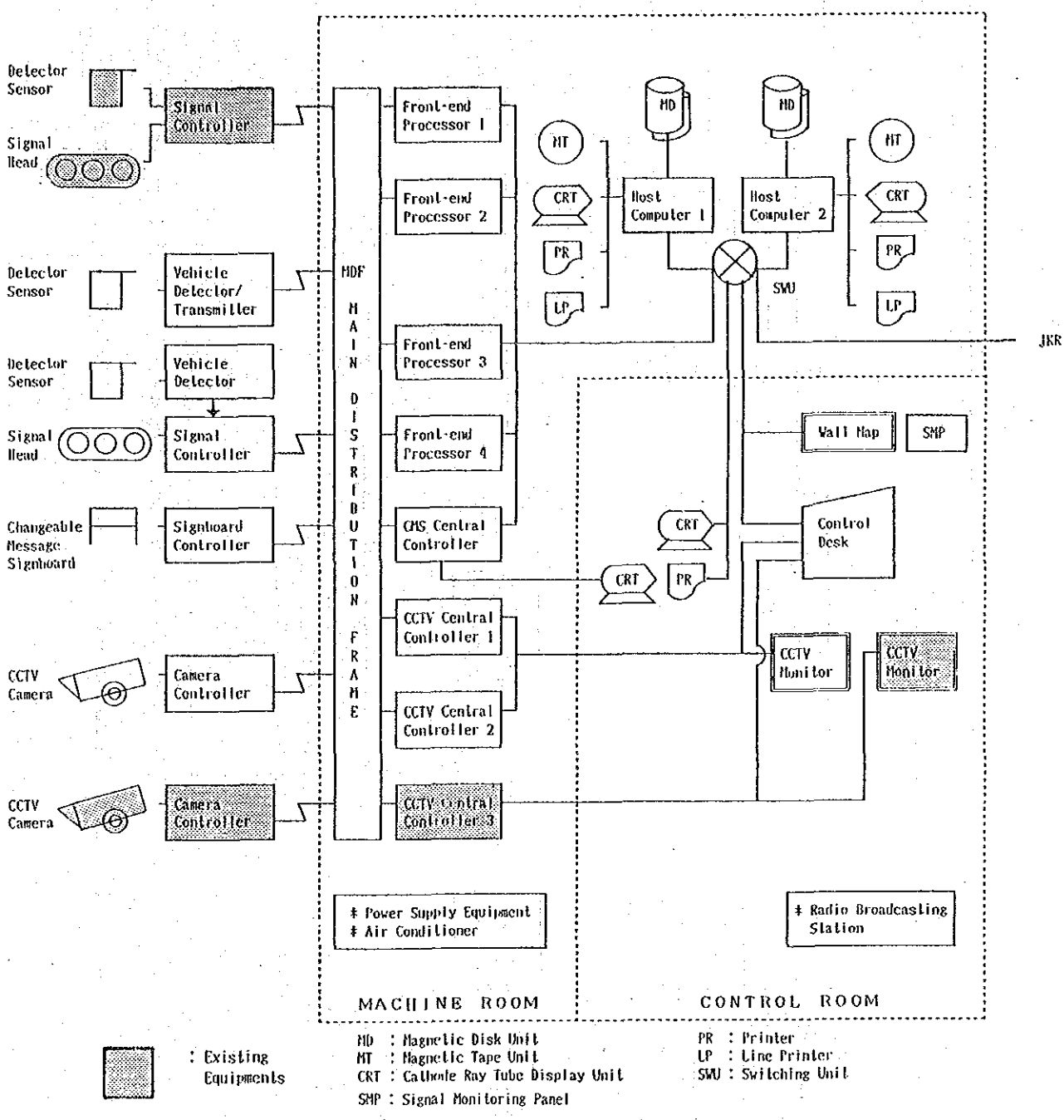


Figure 4.5(a) : Hardware Configuration - KL ATC System

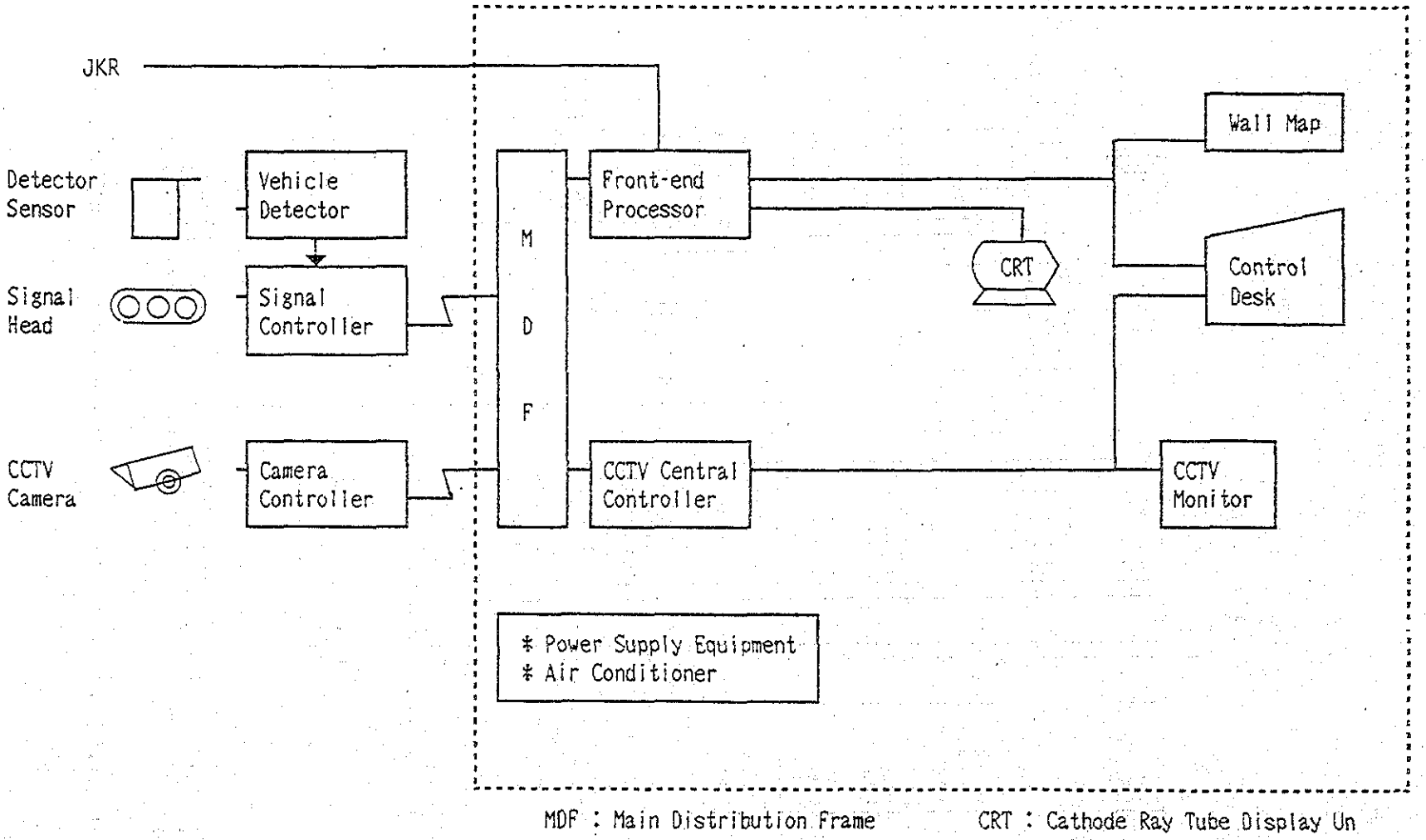


Figure 4.5(b) : Hardware Configuration - PJ ATC System

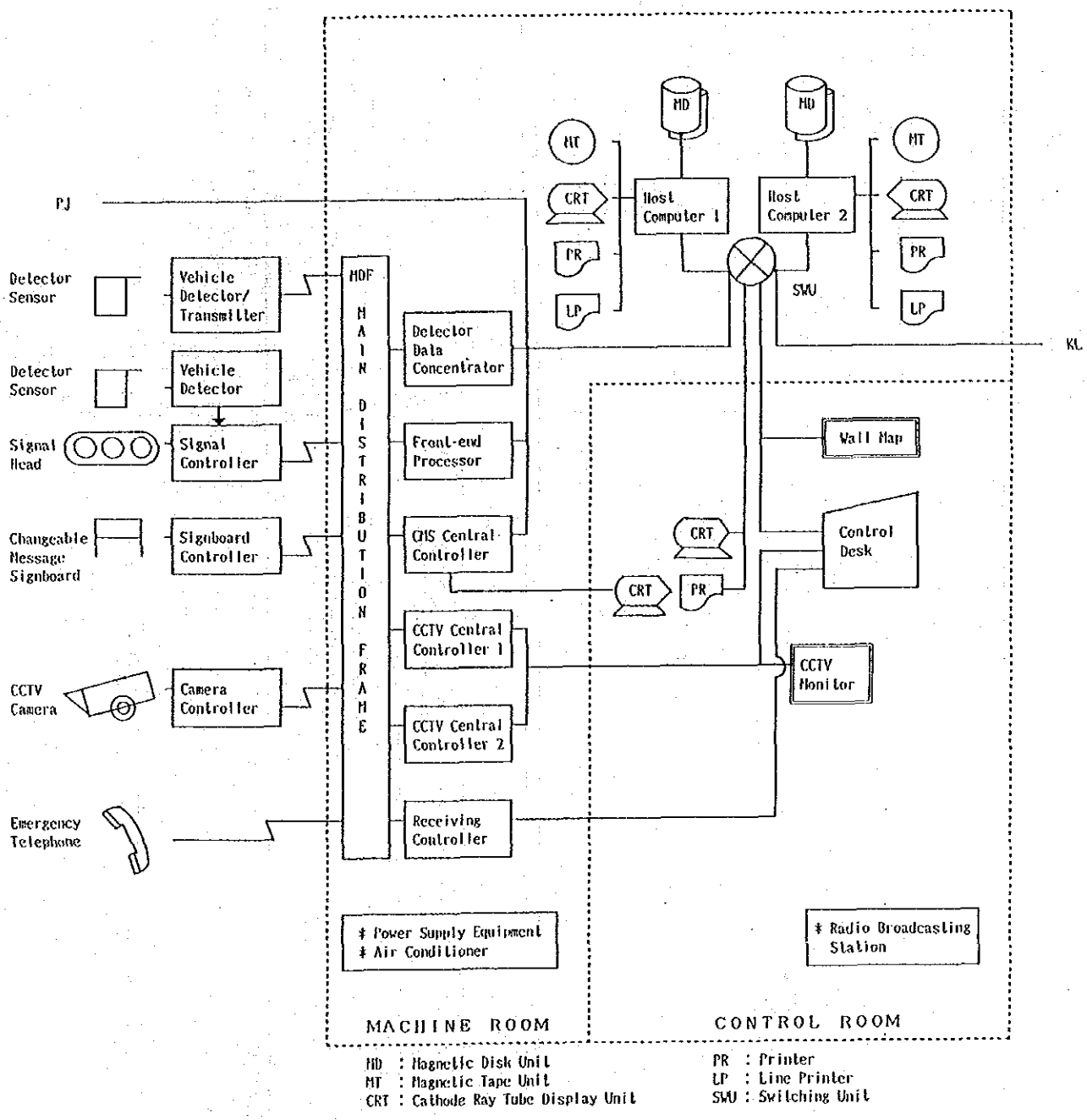


Figure 4.5(c) : Hardware Configuration - JKR HTS System

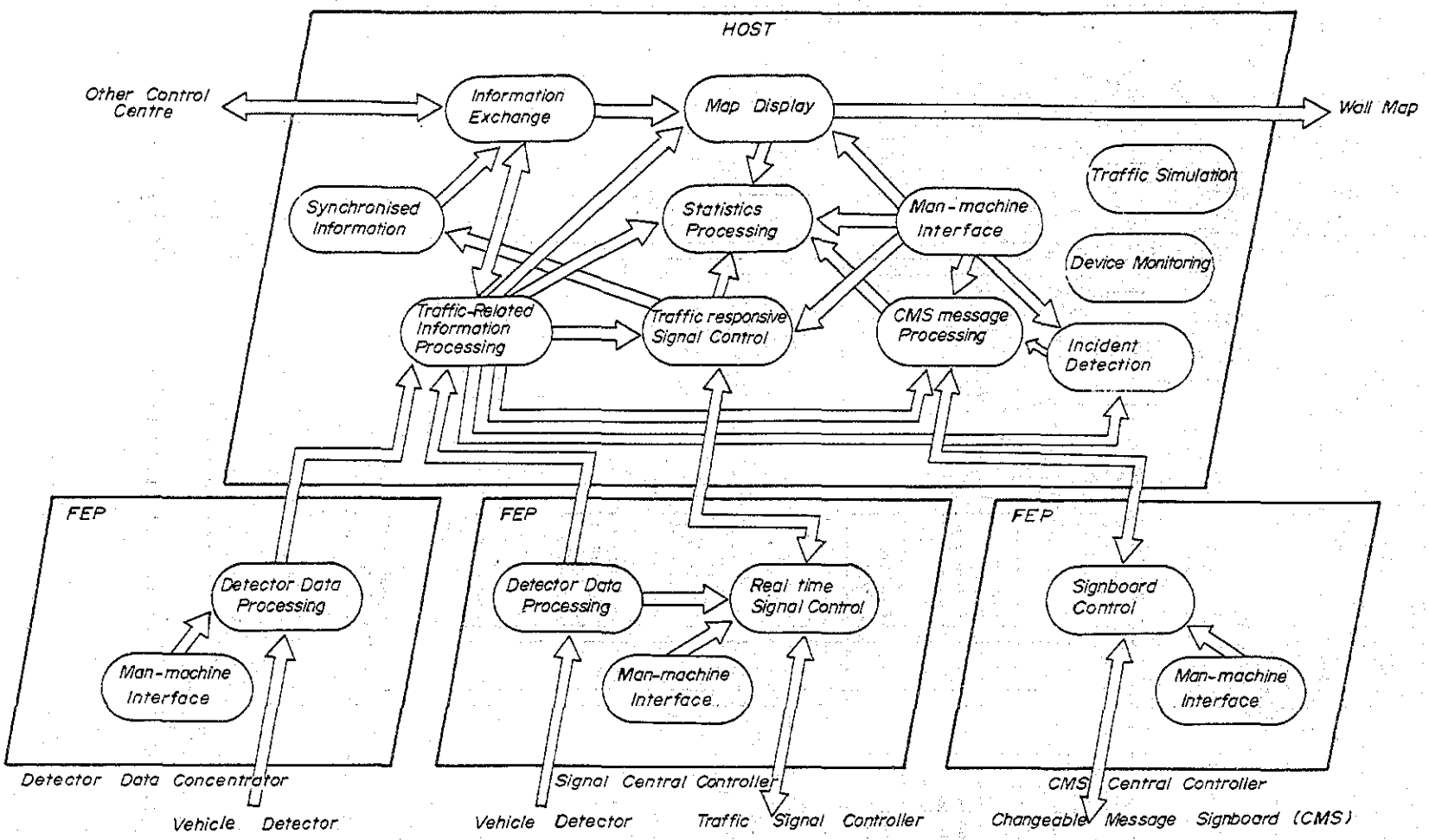
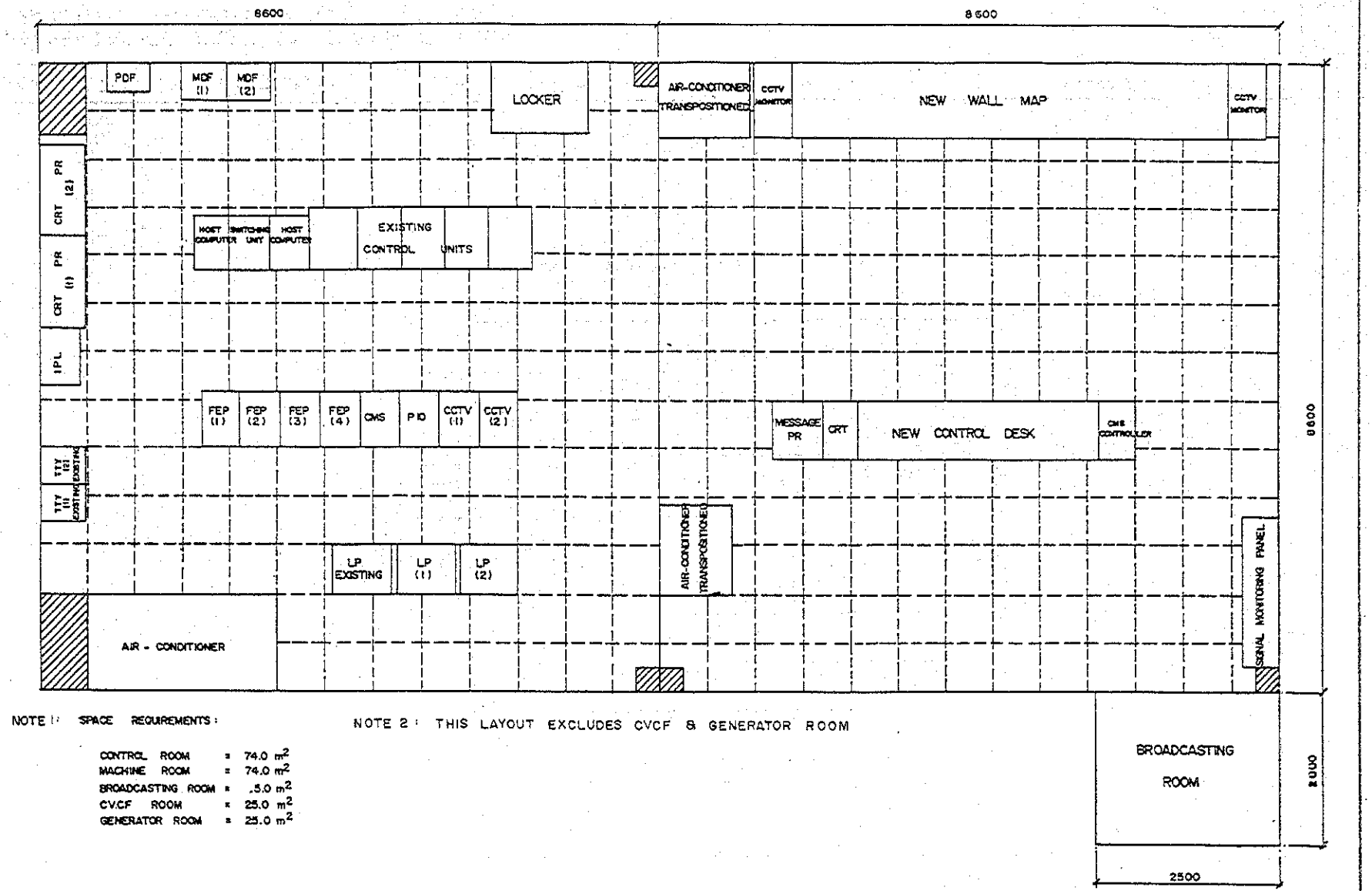


Figure 4.6: Configuration of Application Programmes



NOTE 1: SPACE REQUIREMENTS:

CONTROL ROOM	=	74.0 m^2
MACHINE ROOM	=	74.0 m^2
BROADCASTING ROOM	=	,5.0 m^2
CVCF ROOM	=	25.0 m^2
GENERATOR ROOM	=	25.0 m^2

NOTE 2: THIS LAYOUT EXCLUDES CVCF & GENERATOR ROOM

Figure 4.7(a) : KL ATC Control Centre Layout

LEGEND:

SCALE:

N

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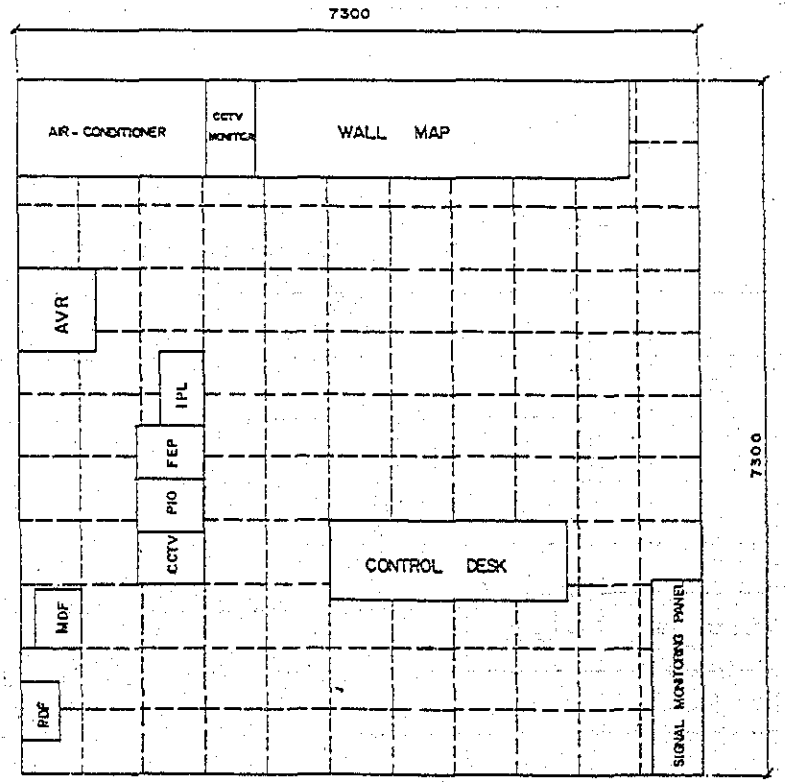

SPACE REQUIREMENT : 53.3 m^2

Figure 4.7(b) : PJ ATC Control Centre Layout

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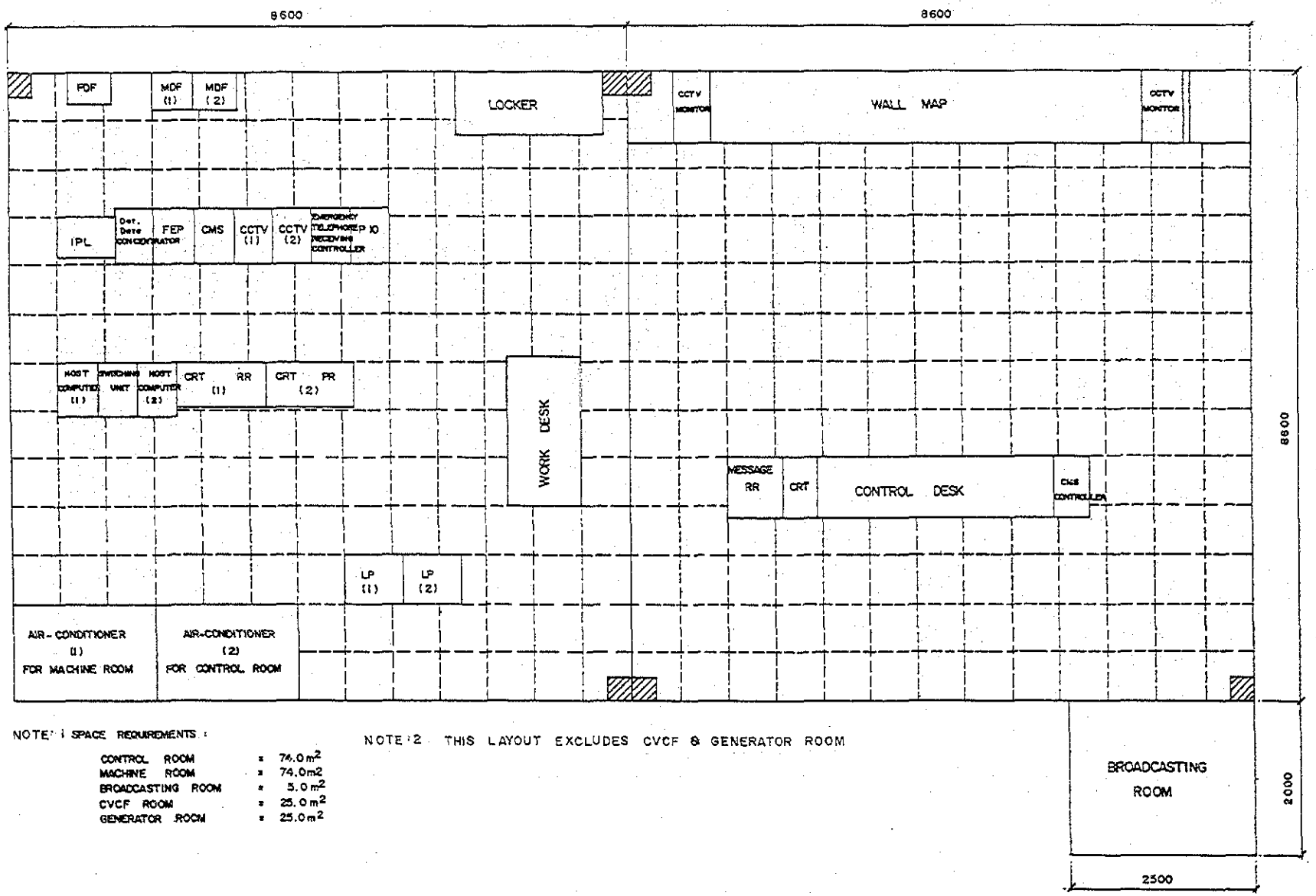
LEGEND:

SCALE :

N



NOTE : 1 SPACE REQUIREMENTS :

CONTROL ROOM	=	74.0 m^2
MACHINE ROOM	=	74.0m2
BROADCASTING ROOM	=	5.0 m^2
CVCF ROOM	=	25.0 m^2
GENERATOR ROOM	=	25.0 m^2

NOTE : 2 THIS LAYOUT EXCLUDES CVCF & GENERATOR ROOM

Figure 4.7(c) : JKR HTS Control Centre Layout

LEGEND:

SCALE:

N

THE FEASIBILITY STUDY ON TRANSPORTATION FACILITIES PROJECTS IN KLANG VALLEY

4.6 Communication Cable Network

The communication cable network to link site equipment to control centre are categorized into three types:-

(i) Leased telephone lines from Syarikat Telekom Malaysia Berhad (STMB)
(ii) Owned metallic cables along Federal Highway and Airport Highway
(iii) Optical fibre for CCTV.

(1) Leased Telephone Lines

In the existing Kuala Lumpur ATC System, the cable itself is owned by City Hall but the duct which forms part of the circuits is leased from STMB. In case of Penang ATC System, the cables are leased from the same company and no major trouble has occurred with the circuits.

There are many advantages with leased telephone lines, for example, low initial cost for cable laying, etc. For these reasons, the leased telephone line from STMB can be used as dedicated cables for the proposed ATC System in Kuala Lumpur and Petaling Jaya.

(2) Owned Metallic Cable

In the HTS System, many field devices are located along the long stretches of highway and some of these (for example, vehicle detectors) are linked to the transmitter/receiver which transmits the data collected to the control centre.

For this reason, two (2) kinds of cable network are employed, one is the cables network for long distance linkages from the transmitter/receiver to the control centre and the other is for short distance linkages from each field device to the transmitter/receiver.

As the former cable network need to be laid along the whole stretch of the highway, the latter cable network can be laid simultaneously in the same conduit without any additional installation cost.

In the HTS System, owned cable network of the executing agency will be used as it is capable of utilising good quality and highly reliable communication lines and will be easy to provide supplementary communication lines for police and maintenance phones.

Low-loss, balanced-paired cable, for example, ccp-LAp-0.9 mm will be broadly used as communication cables. These cable are also widely used in other HTS System or its equivalent system.

(3) Optical Fibre for CCTV

Coaxial cable was widely used for CCTV, for example, in the existing ATC System in Kuala Lumpur and Penang. However, optical fibre cable has recently been used for video signal transmission because of its advantages such as wide frequency band, long-distance transmission without amplifiers, noise immunity and light weight. Unlike coaxial cables, precaution must be taken for laying of fibre cables and technique is required for splicing of core. However, the installation practice is being improved thereby enhancing the application of fibre cables in various field in the near future. Thus, in this TCS System, optical fibre cable will be used for the CCTV.

Table 4.6 shows the type of cable and number of circuit for each terminal equipment.

Table 4.6 : Type of Cable and Number of Circuits for Each Terminal Equpment

Terminal Equipment Linked to the Control Centre		Type of Cable		Number of Circuit
KL & PJ ATC	Signal Controller/ Detector	Telephone lines leased from Syarikat Telekom Malaysia Berhad		One pair per controller and maximum of eight (8) detectors
	Changeable Message Sign			One pair per signboard
	CCTV		Optical fibre	Two (2) cores or 1 core and 1 pair of metallic cable per CCTV camera
JKR HTS	Detector	Owned Cable	Metallic cable (CCp-LAp 0.9mm)	One pair per controller and maximum of ten (10) detectors
	Signal Controller			One pair per controller and maximum of eight (8) detectors
	Changeable Message Sign			One pair per signboard
	Emergency Telephone			Two pairs per maximum of ten (10) telephones
	CCTV		Optical fibre	Two (2) cores or 1 core and 1 pair of metallic cable per CCTV camera
Centre to centre for information exchange		Telephone line leased from Syarikat Telekom Malaysia Berhad		Two (2) pairs per linkage between centres

Note: Additional pair will be provided for maintenance pruposes

4.7 Traffic Engineering Measures Related to ATC System

It is essential to implement the following aspects of traffic engineering measures collectively with the ATC System to further enhance the goals and objectives of the system.

(1) Geometric Improvements and Standards

(i) Geometric Improvements

* Construction of simple or regular intersection shape
* Provision of additional lanes at intersection approaches
* Conversion of prominent roundabouts into grade-separated or at-grade signalised intersections
* Channelisation

(ii) Acceptable Geometric Standards and Guidelines

(2) Traffic Signal Control

(i) Number of phases should be held to a minimum
(ii) Signal display and placement must be clearly visible and easily understood

(3) Pavement Markings and Traffic Signs

(i) Pavement markings such as stop, lane and centre lines should be clearly marked on roadways
(ii) Traffic signs should be legible and easily recognised as well as commands attention

Intersection improvement considerations are based primarily on the ensuing aspects namely the existing intersection geometrics and the signal phase operations. As shown in Figure 4.8, sixteen (16) existing signalised intersections under Stage 1 of the Kuala Lumpur and Petaling Jaya ATC Systems necessitate some measures of improvement.

A total of twenty two (22) intersections will be signalised under the KL and PJ ATC System.

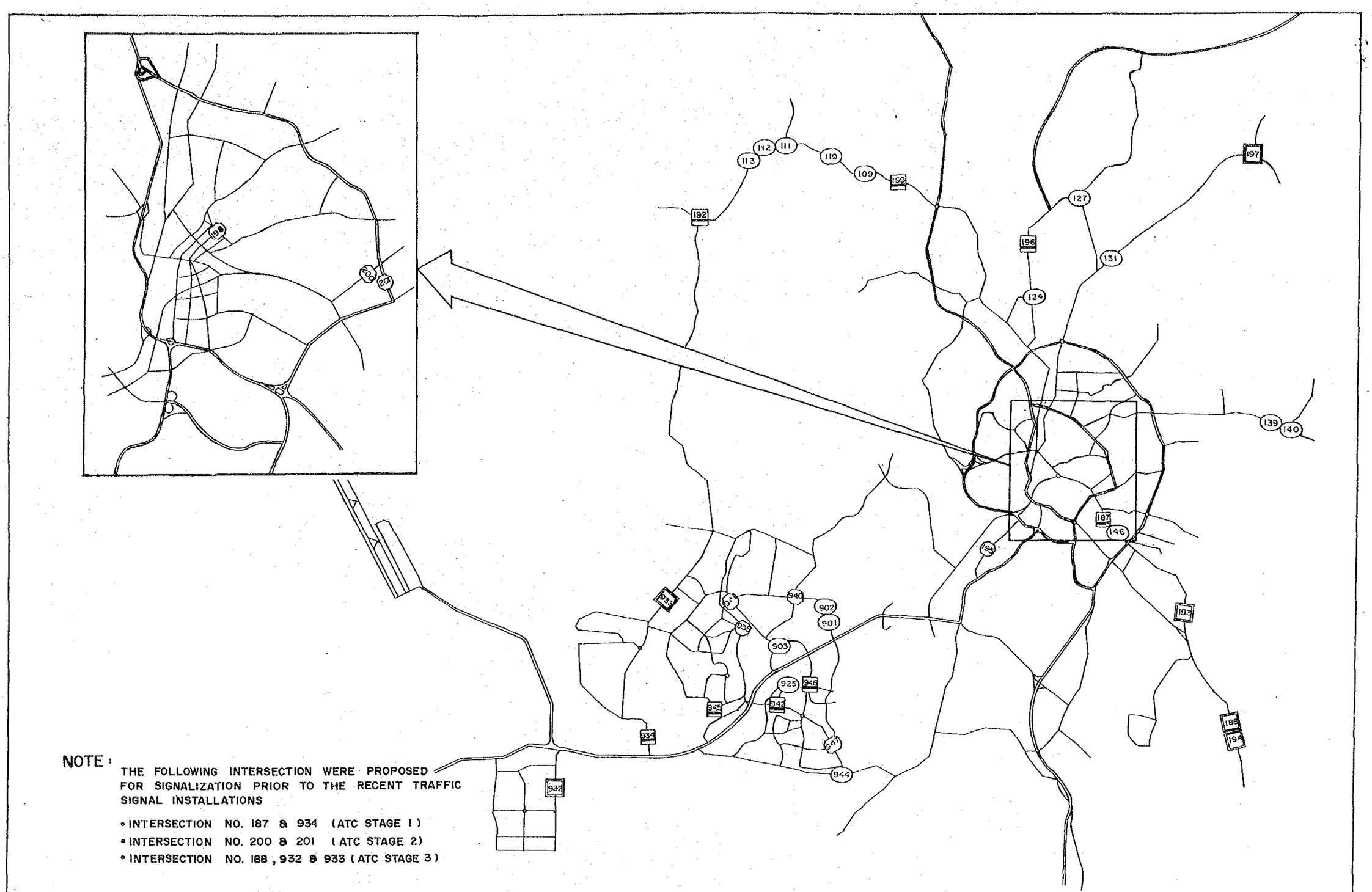


Figure 4.8 : Intersection Improvement Plan
- Stage 1 of ATC System

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4.8 Staging Plan

The ATC System which consists of KL ATC System and PJ ATC System will be implemented and managed by KL City Hall and Municipal Council of Petaling Jaya respectively whereas the HTS System will be implemented and managed by Public Works Department (JKR).

The staging plan that illustrates the timing of area covered and functional subsystems introduced is considered based on the following factors.

(1) Growth of Traffic Demand

It has been recognised that some existing signalised intersections on heavily congested roads need to be brought under the ATC System as soon as possible to mitigate the congestion situation. Besides, some intersections do not warrant signalisation at the prevailing conditions but as traffic demand increases in the future, they may need to be signalised and computerised too.

(2) Public Expectation

As society develops, public demand for upgraded and better services will naturally arise. As such, more sophisticated functions need to be introduced or reinforced stepwise to keep pace with the public expectation.

(3) Financial Burden

Any traffic control and surveillance system which involves substantial capital investment is, in most cases, a financial burden on the executing agency. Nevertheless, by staging the implementation programme, the financial burden is lessened and hence enhances its feasibility.

(4) Establishment of Organisation

The establishment of proper and compatible organisation is important in ensuring an effective functioning of any traffic control and surveillance system thereby reaping its optimum benefits. To induce the gradual set-up, it is but only advisable that the system be introduced in stages.

Figure 4.9 presents the basic guidelines of TCS System Staging plan.

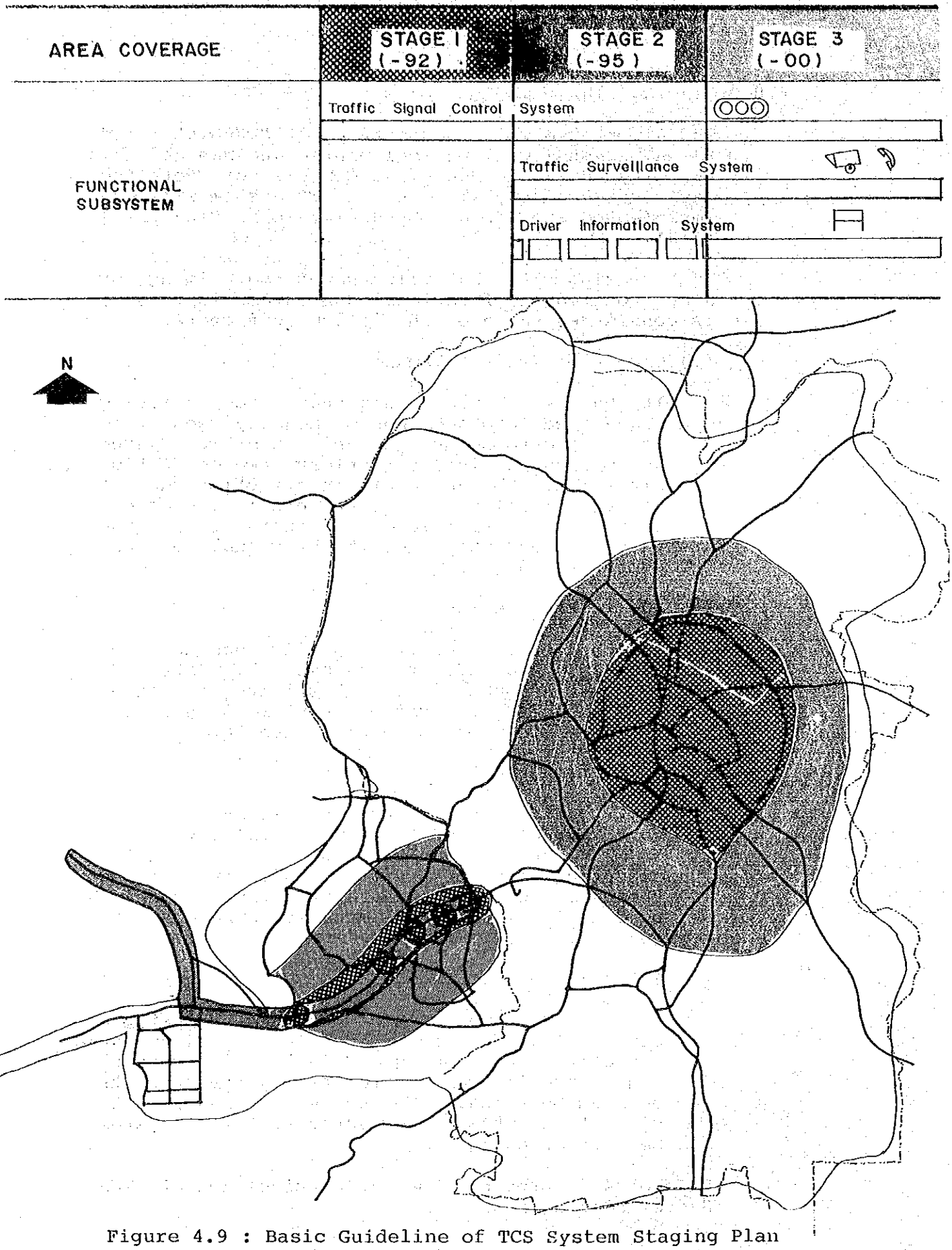

Figure 4.9 : Basic Guideline of TCS System Staging Plan

The proposed staging plan is as follows:-

(1) Kuala Lumpur ATC System - Upgrading and Expansion

Stage 1

* Upgrading of existing ATC System with traffic responsive signal control function within the Central Planning Area and its periphery

* Expansion of ATC System with traffic responsive signal control function on heavily trafficked radial roads

Stage 2

* Expansion of traffic responsive signal control function within the Central Planning Area and its periphery

* Introduction of traffic surveillance and driver information functions

Stage 3

* Expansion of traffic responsive signal control function in the outskirts of Kuala Lumpur

* Expansion of driver information function

(2) Petaling Jaya ATC System

Stage 1

* Introduction of traffic responsive signal control function in the vicinity areas along Federal Highway and Jalan Kelang Lama

Stage 2

* Expansion of traffic responsive signal control function in the other areas of Petaling Jaya

* Introduction of traffic surveillance function

Stage 3

* Expansion of traffic responsive signal control function to the entire Petaling Jaya Municipality

(3) JKR HTS System

Stage 1

* Introduction of ramp signal control function at the Federal Highway interchanges in Petaling Jaya

Stage 2

* Introduction of traffic surveillance and driver information functions on the highway from Kuala Lumpur boundary to Subang Airport

Stage 3

* Expansion of traffic surveillance and driver information function on the Federal Highway from junction of Airport Highway to North Klang Straits Bypass

The number of central and terminal equipment in each stage of the TCS System is summarized in Table 4.7.

Table 4.7 : TCS System Staging Plan - Main Equipment

Main Equipment		Stage 1 (~ 92)	Stage 2 (~ 95)	Stage 3 (~ 00)	On Completion of all Stages (~ 00)	Control Centre
KL ATC	Traffic Signal Controller	116*	30	24	170 *	KL Control Centre
	Vehicle Detector Sensor	124	109	133	366	
	CCTV Camera	6 Existing CCTV	11		17 **	
	CMS Board		2	10	12	
	Main Central Equipment	1 Host Computer System 2 FEP 1 Existing CCTV Central Controller 1 Wall Map 1 Control Desk	1 FEP 2 CCTV Central Controller 1 CMS Central Controller	1 FEP	1 Host Computer System 4 FEP 3 CCTV Central Controller *** 1 CMS Central Controller 1 Wall Map 1 Control Desk	
PJ ATC	Traffic Signal Controller	16	16	11	43	PJ Control Centre
	Vehicle Detector Sensor	52	47	23	122	
	CCTV Camera		3	1	4	
	Main Central Equipment	1 FEP 1 Wall Map 1 Control Desk	1 CCTV Central Controller		1 FEP 1 CCTV Central Controller 1 Wall Map 1 Control Desk	
JKR HTS	Ramp Signal Controller	5			5	Selangor State JKR Control Centre
	Vehicle Detector Sensor	26	154	109	289	
	Emergency Telephone		30	24	54	
	CCTV Camera		8	4	12	
	CMS Board		2	8	10	
	Main Central Equipment	1 Host Computer System 1 FEP	1 Detector Data Concentrator 2 CCTV Central Controller 1 Emergency Telephone Receiving Controller 1 CMS Central Controller 1 Wall Map 1 Control Desk		1 Host Computer System 1 FEP 1 Detector Data Concentrator 2 CCTV Central Controller 1 Emergency Telephone Receiving Controller 1 CMS Central Controller 1 Wall Map 1 Control Desk	

Note : * Including 74 signal controllers under existing KL ATC System
** Including 6 CCTV cameras under existing KL ATC System
*** Including 1 CCTV Central Controller under Existing KL ATC System

4.9 Organisation

(1) Operational Loop

To derive optimum benefits from any traffic control and surveillance system, operational and managerial supervision are essential besides installing just a combination of hardware and software.

Figure 4.10 depicts the three control loops in system operation which involves typical operational tasks. Loop 1 is a normal and automatic operation under a comprehensive traffic control system. During emergency and heavy congestion situations, or when maintenance problems arise, manual override by traffic engineer is necessary as illustrated in Loop 2. In the long term, Loop 3 involves an analysis and study of changing traffic conditions for improvement of the system.

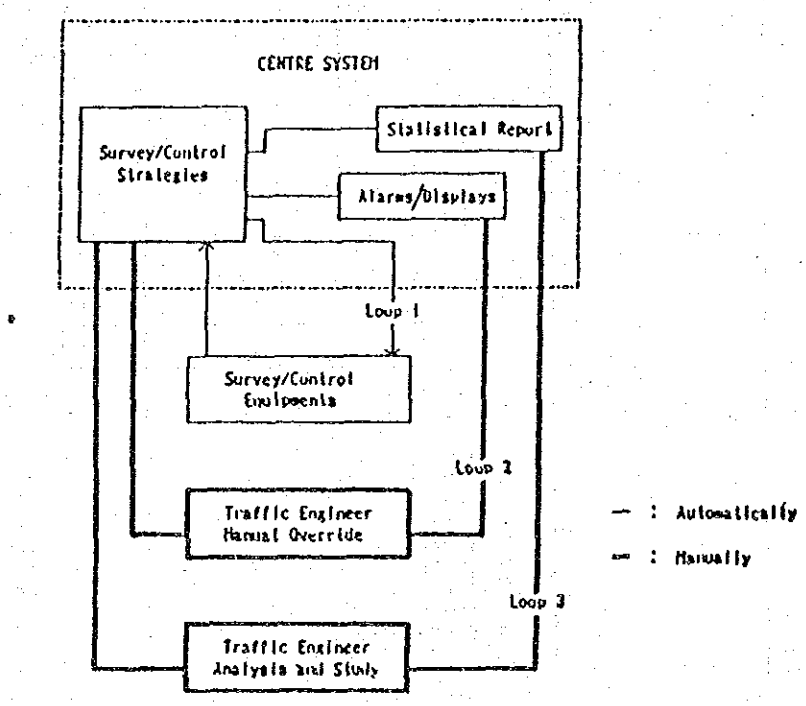

Figure 4.10 : Control Loops in System Operation

Among the three (3) loops, the latter two extend into the personnel area and to the basic organizational structure of the relevant department. With regard to the personnel requirement, two basic skills namely, knowledge in traffic flow principle/control concepts and computer/electronic technologies are needed. However, the latter skill could be provided through contacts with private firms. Thus, staff requirement and organization are necessary for successful introduction and implementation of advanced traffic control system.

(2) Requirement and Organisation of Staff

(a) KL ATC Control Centre

Similar to the existing KL ATC System, the proposed system will be under the jurisdiction of Public Works and Traffic Department of Kuala Lumpur City Hall.

The following qualified personnel will be required:

(i) Engineering Staff
* Senior Engineer (Manager)
* Traffic Engineer
* Electronics Engineer
* Operator

(ii) Broadcasting Staff

The existing hotline between the control centre and police department will be retained under the proposed KL ATC System.

At present, the KL control centre is managed and operated by one (1) engineer and eight (8) operators. With the proposed system, the number of staff will be increased to eleven (11) in Stage 1, fourteen (14) in Stage 2 and lastly, sixteen (16) in Stage 3. In Stage 3, a "Traffic Management and Control Unit" as an independent unit within the Public Works and Traffic Department, KL City Hall will be necessary for the efficient and effective operation of the control centre.

(b) PJ ATC Control Centre

The proposed PJ ATC System will be under the jurisdiction of Municipal Council of Petaling Jaya (MPPJ).

The following qualified personnel will be required:

(i) Senior Engineer
(ii) Traffic Engineer
(iii) Operator

For the management and operation of this centre, two (2) personnel will be required in Stage 1, three (3) in Stage 2 and four (4) in Stage 3.

(c) JKR HTS Control Centre

The JKR HTS System will be under the jurisdiction of Federal Public Works Department (JKR).

The following qualified personnel will be required:

(i) Engineering Staff
    * Senior Engineer
    * Traffic Engineeer
    * Operator

(ii) Broadcasting Staff

Besides these personnel, cooperation of police staff is necessary and the role of electronics engineer could be provided through contacts with private firms/contractors.

In Stage 1, the number of staff required to manage and operate the centre is three (3) which will be increased to seven (7) in Stage 2 and finally, nine (9) in Stage 3.

The staff requirement at each control centre is shown in Figure 4.11.

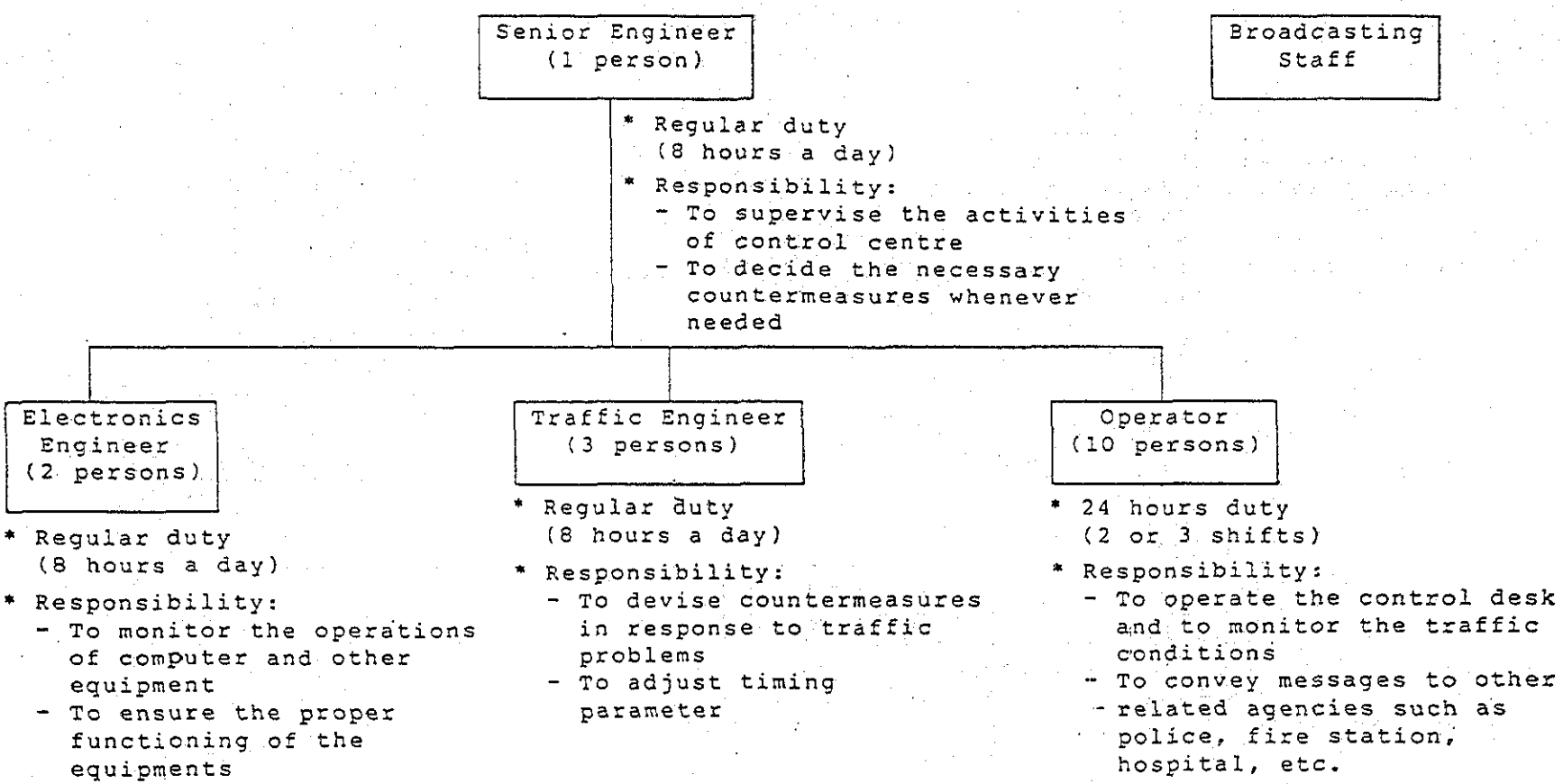

Figure 4.11(a) : Staff Requirement at the KL Control Centre

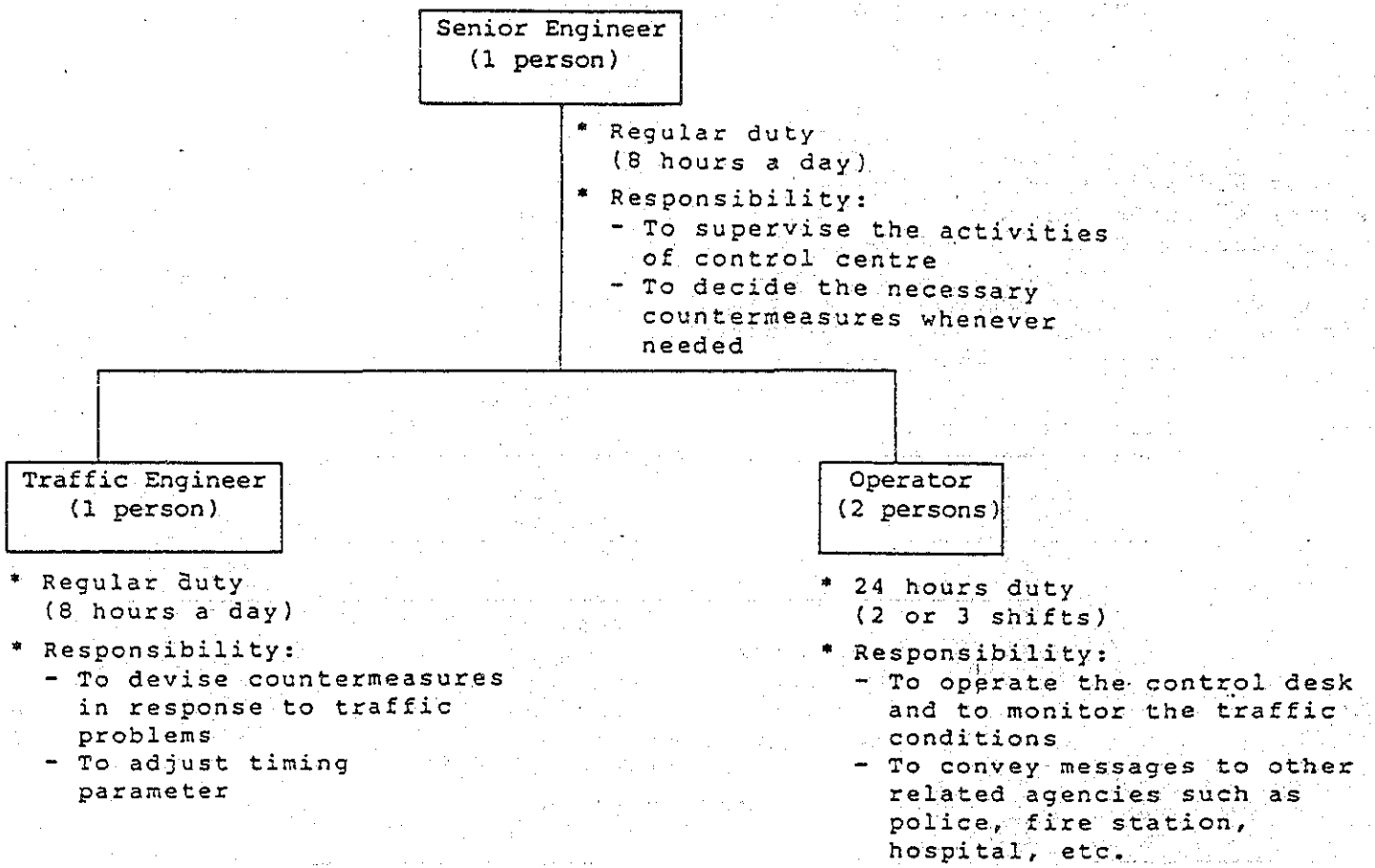

Figure 4.11(b) : Staff Requirement at the PJ Control Centre

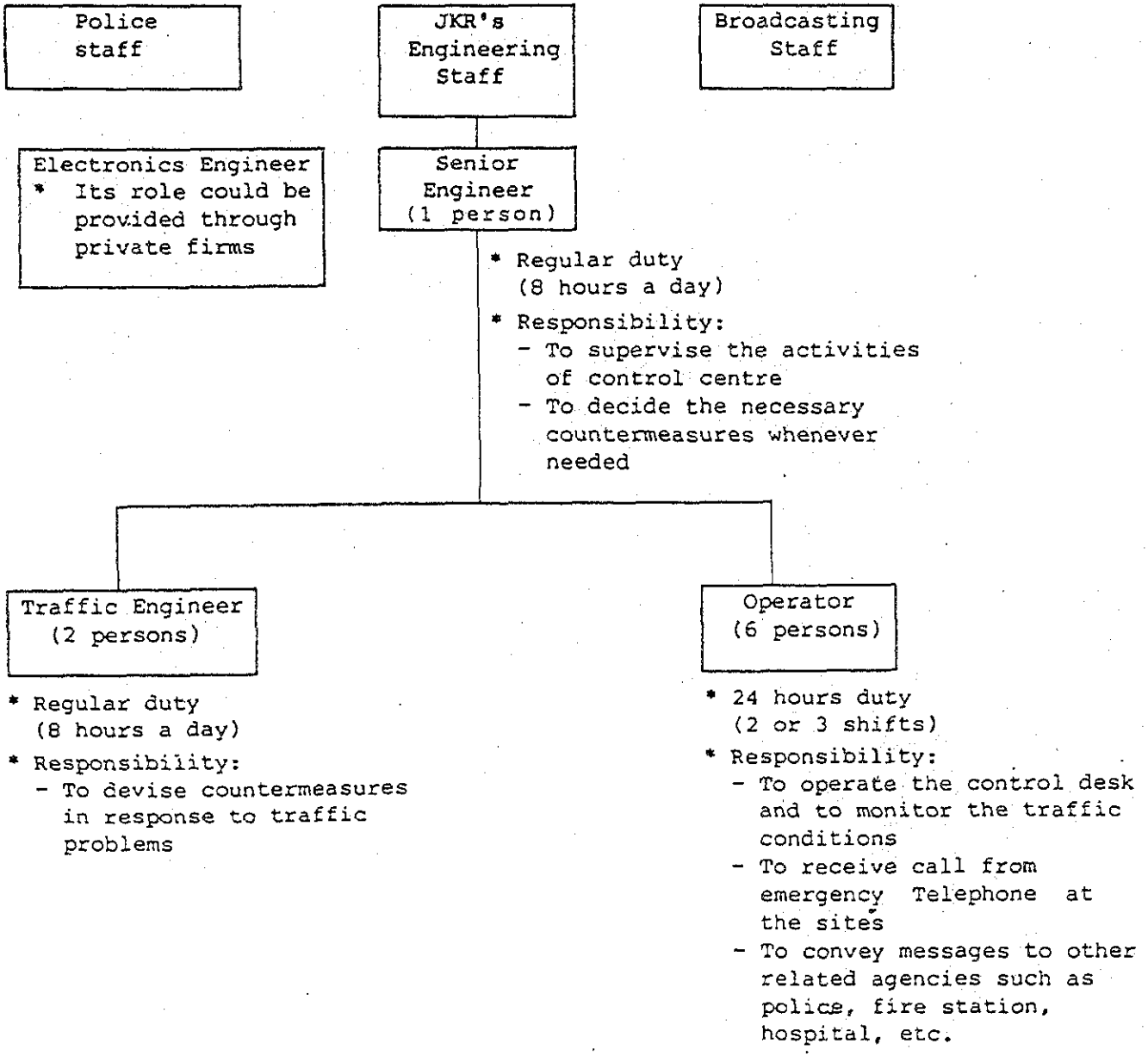

Figure 4.11(c) : Staff Requirement at the JKR Control Centre