SEMENANJUNG MALAYSIA

PIAWAIAN PERANCANGAN

GUIDELINES AND GEOMETRIC STANDARDS ON ROAD NETWORK SYSTEM

JABATAN PERANCANGAN BANDAR DAN DESA
SEMENANJUNG MALAYSIA

Kementerian Perumahan dan Kerajaan Tempatan Malaysia

SUMBER
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PIAWAIAN PERANCANGAN JPBD 1/97

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KATA ALU-ALUAN

Ketua Pengarah

Jabatan Perancangan Bandar dan Desa

Semenanjung Malaysia

Jalanraya telah menjadi satu kemudahan yang tidak dapat dipisahkan dalam setiap pembangunan. Masalah kesesakan jalanraya telah menjadi isu yang dihadapi oleh setiap penghuni kota setiap masa. Pengguna jalanraya kian bertambah. Pertambahan kenderaan di jalanraya bukan mengikut kadar pertambahan penduduk sahaja tetapi berlipat ganda bergantung kepada peningkatan tahap ekonomi dan keperluan permintaan berjalan (travel demand and mobility) masyarakat moden.

Hierarki jalanraya yang kurang menyusun atau tidak mengikut tahap juga boleh menyebabkan masalah kesesakan jalanraya. Oleh itu satu garis panduan yang menyeluruh adalah perlu untuk memberi panduan kepada semua pihak perlaksana atau perancangan jalanraya dan kegunaan tanah.

Garis Panduan ini menambah Garis Panduan dan Piawaian Kementerian Kerja Raya dan Garis Panduan National Highway Development Plan. Ianya mengandungi perkara-perkara yang berkaitan dengan perancangan dan bertujuan memberi maklumat serta panduan dalam menyelaras dan mengintegrasikan rangkaian jalan dengan perancangan kegunaan tanah. Dengan ini satu rangkaian jalan yang lebih teratur dapat diujudkan dalam perancangan pembangunan.

Akhir kata saya ingin merakamkan setinggi-tinggi penghargaan dan terima kasih kepada semua pihak yang terlibat terutamanya Unit Perancang Jalan di atas kerjasama yang diberikan kerana telah berjaya menghasilkan Garis Panduan ini.

DATO' PROF. ZAINUDDIN BIN MUHAMMAD
(D.P.M.T., J.S.M., S.M.T., K.M.N., A.S.K.)

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1.0 INTRODUCTION

The main purpose of this report is to supplement the standards and guidelines which are presented in Chapter 8 – 'Jalan' of Manual Piawaian Perancangan (Akhir) – 1988 prepared by Bahagian Perancangan Fizikal Nasional, Unit Penyelidikan, Jabatan Perancangan Bandar dan Desa, Semenanjung Malaysia. This report covers standards and guidelines on urban road network, highway development on environment, motorcycle lanes and service road, prepared by Public Works Department. (Jabatan Kerja Raya).

2.0 BACK GROUND

The standards and guidelines pertaining to road network sector complied in this report, are currently being adapted and used in the implementation of the work programmes at the Ministry of Work's level as well as by Public Works Department (Jabatan Kerja Raya) – throughout the country. The geometric standard that had been prepared by Public Works Department in 1986 were subsequently revised in 1988 (refer Table 1 and 2). Studies and researches on standards and road engineering aspects are being planned for example, the ongoing Traffic Study - Malaysia and Trip Generation Study (Pilot Study), and presently being co-ordinated by Highway Planning Unit (HPU). Guidelines on the national road network system are also being derived from the National Highway Network Development Plan (HNDP) prepared in 1993 and nearly completed Urban Transport Planning Manual, as a part of the bi-lateral aid programme form Japan and Asian Development Bank respectively.

Hence, with the incorporation and subsequent adoption of such standards and guidelines into the Town and Country Planning Department's 'Planning Standards Manual' it is hope that such interfacing will act as platform towards the integration of road transport planning and landuse planning in the country.

TABLE 1: GENERAL SUMMARY - GEOMETRIC DESIGN CRITERIA FOR ROADS IN URBAN AREAS (METRIC).**

DESIGN CONTROL AND CRITERIA	1.	DESIGN STANDARD	-	U6			U5			U4			U3			U2			U1			U1A		
	2.	ACCESS CONTROL	-	FULL			PARTIAL			PARTIAL			PARTIAL/NIL			NIL			NIL			NIL		
	3.	TERRAIN	-	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III
	4.	DESIGN SPEED	Km/hr	100	80	60	80	60	50	70	60	50	60	50	40	50	40	30	40	30	20	40	30	20
CROSS SECTION ELEMENTS	5.	LANE WIDTH	M	3.50			3.50			3.25			3.00			2.75			(5.00)[a]			(4.50)[a]		
	6.	SHOULDER WIDTH	M	3.00	3.00	2.50	3.00	3.00	2.50	3.00	2.50	2.00	2.50	2.00	1.50	2.00	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
	7.	SHOULDER WIDTH (STRUCTURES) > 100m	M	1.00			1.00			1.00			0.50			0.50			0.50			0.50		
	8.	MEDIAN WIDTH (MINIMUM)	M	4.00	3.50	3.00	3.00	2.50	2.00	2.50	2.00	1.50	2.00	1.50	1.00	N/A			N/A			N/A		
	9.	MEDIAN WIDTH (DESIRABLE)	M	2.00	9.00	6.00	9.00	6.50	4.00	7.50	5.00	3.00	6.00	4.00	2.00	N/A			N/A			N/A		
	10.	MARGINAL STRIP (WIDTH)	M	0.50			0.50			0.25			0.25			0.00			0.00			0/00		
	11.	MINIMUM RESERVE WIDTH	M	60			60(50)[b]			4.(30)[b]			30(20)[b]			20			12			12		
ELEMENTS OF DESIGN	12.	STOPPING SIGHT DISTANCE	M	205	140	85	140	85	65	115	85	65	85	65	45	65	45	30	45	30	20	45	30	20
	13.	PASSING SIGHT DISTANCE	M	N/A			550	450	350	500	450	350	450	350	300	350	300	250	300	250	200	300	250	200
	14.	MINIMUM RADIUS	M	465	280	150	280	150	100	210	150	100	150	100	60	100	60	35	60	35	15	60	35	15
	15.	MINIMUM LENGTH SPIRAL	M	SEE TABLE 4 - 4B															N/A			N/A		
	16.	MAXIMUM SUPERELEVATION	RATIO	0.06			0.06			0.06			0.06			0.06			0.06			0.06		
	17.	MAXIMUM GRADE (DESIRABLE)	%	3	4	5	4	5	6	5	6	7	6	7	8	7	8	9	7	8	9	7	8	9
	18.	MAXIMUM GRADE	%	6	7	8	7	8	9	8	9	10	9	10	12	10	12	15	10	12	15	10	12	15
	19.	CREST VERTICAL CURVE (K)	-	60	30	15	30	15	10	15	10	10	10	10	5	10	5	5	10	5	5	10	5	5
	20.	SAG. VERTICAL CURVE (K)	-	40	28	15	28	15	12	15	12	10	12	10	8	10	8	8	10	8	8	10	8	8

REMARK : 1. ALL VALUES SHOWN ABOVE ARE MINIMUM / MAXIMUM VALUES. ALL EFFORT SHOULD BE MADE TO ACHIEVE AS HIGH A VALUE AS POSSIBLE.

2. ABBREVATION:

f = FALT
R = ROLLING
M = MOUNTAINOUS

N/A = NOT APPLICABLE
( ) a = TOTAL WIDTH OF PAVEMENT
( ) b = RESERVE WIDTH DEPENDS ON ROAD CATEGORY

** = AMENDED SEPTEMBER 1989

SOURCE : Public Works Department. 1988

TABLE 2: GENERAL SUMMARY - GEOMETRIC DESIGN CRITERIA FOR ROADS IN URBAN AREAS (METRIC).*

DESIGN CONTROL AND CRITERIA	1.	DESIGN STANDARD	-	R6			R5			R4			R3			R2			R1			R1A		
	2.	ACCESS CONTROL	-	FULL			PARTIAL			PARTIAL			PARTIAL			NIL			NIL			NIL		
	3.	AREA TYPE	-	F	R	M	F	R	M	F	R	M	F	R	M	F	R	M	F	R	M	F	R	M
	4.	DESIGN SPEED	Km/hr	120	100	80	100	80	60	90	70	60	70	60	50	60	50	40	40	30	20	40	30	20
CROSS SECTION ELEMENTS	5.	LANE WIDTH	M	3.50			3.50			3.20			3.00			2.75			(5.00)[a]			(4.50)[a]		
	6.	SHOULDER WIDTH	M	3.00	3.00	2.50	3.00	3.00	2.50	3.00	3.00	2.00	2.50	2.50	2.00	2.00	2.00	1.50	1.50	1.50	1.50	1.50	1.50	1.50
	7.	SHOULDER WIDTH (STRUCTURES > 100m)	M	1.00			1.00			1.00			0.50			0.50			0.50			0.50		
	8.	MEDIAN WIDTH (MINIMUM)	M	6.0	5.0	4.0	4.0	3.5	3.0	3.0	2.5	2.0	N/A			N/A			N/A			N/A		
	9.	MEDIAN WIDTH (DESIRABLE)	M	18.0	12.5	8.0	12.0	9.0	6.0	9.0	6.5	4.0	N/A			N/A			N/A			N/A		
	10.	MARGINAL STRIP (WIDTH)	M	0.50			0.50			0.25			0.25			0.00			0.00			0.00		
	11.	MINIMUM RESERVE WIDTH	M	60			60(50)[b]			4.(30)[b]			20			20			12			12		
ELEMENTS OF DESIGN	12.	STOPPING SIGHT DISTANCE	M	285	205	140	205	140	85	180	120	85	120	85	65	85	65	45	45	30	20	45	30	20
	13.	PASSING SIGHT DISTANCE	M	N/A			700	550	450	625	500	450	500	450	350	450	350	300	300	250	200	300	250	200
	14.	MINIMUM RADIUS	M	570	375	230	375	230	125	300	175	125	175	125	85	125	85	50	50	30	15	50	30	15
	15.	MINIMUM LENGTH OF SPIRAL	M	SEE TABLE 4 - 4A															N/A			N/A		
	16.	MAXIMUM SUPERELEVATION	RATIO	0.10			0.10			0.10			0.10			0.10			0.10			0.10		
	17.	MAXIMUM GRADE (DESIRABLE)	%	2	3	4	3	4	5	4	5	6	5	6	7	6	7	8	7	8	9	10		
	18.	MAXIMUM GRADE	%	5	6	7	6	7	8	7	8	9	8	9	10	9	10	12	10	12	15	25		
	19.	CREST VERTICAL CURVE (K)	-	120	60	30	60	30	15	45	22	15	22	15	10	15	10	10	10	5	5	10	5	5
	20.	SAG. VETICAL CURVE (K)	-	60	40	28	40	28	15	35	20	15	20	15	12	15	12	10	10	8	8	10	6	8

REMARK : 1. ALL VALUES SHOWN ABOVE ARE MINIMUM / MAXIMUM VALUES. ALL EFFORT SHOULD BE MADE TO ACHIEVE AS HIGH A VALUE AS POSSIBLE.
2. FOR DEFINATION OF AREA TYPE SEE TABLE 3
3. ABBREVATIONS: N/A = NOT APPLICABLE
( ) a = TOTAL WIDTH OF PAVEMENT
( ) b = RESERVE WIDTH DEPENDS ON ROAD CATEGORY

* = AMENDED SEPTEMBER 1989

SOURCE : Public Works Department. 1988

3.0 HIGHWAY NETWORK HIERARCHY[1]

3.1 Concept

The underlying concept is formed on the provision of better highway from the higher functional centres to lower functional centres. The Highway Network Hierarchy are established on the following premises:

i. Correct unbalanced social-economic growth between state regional centres and state sub-regional centres within the region; and promote equity in distribution of benefits by means of providing better highway linkages to major or minor local centres;

ii. Provide better linkages from established state regional centres to planned growth centres in regional land development schemes; and

iii. Provide better road accesses to important focal points such as ports, airport, tourist and industrial development areas, new growth centres and regional land development schemes.

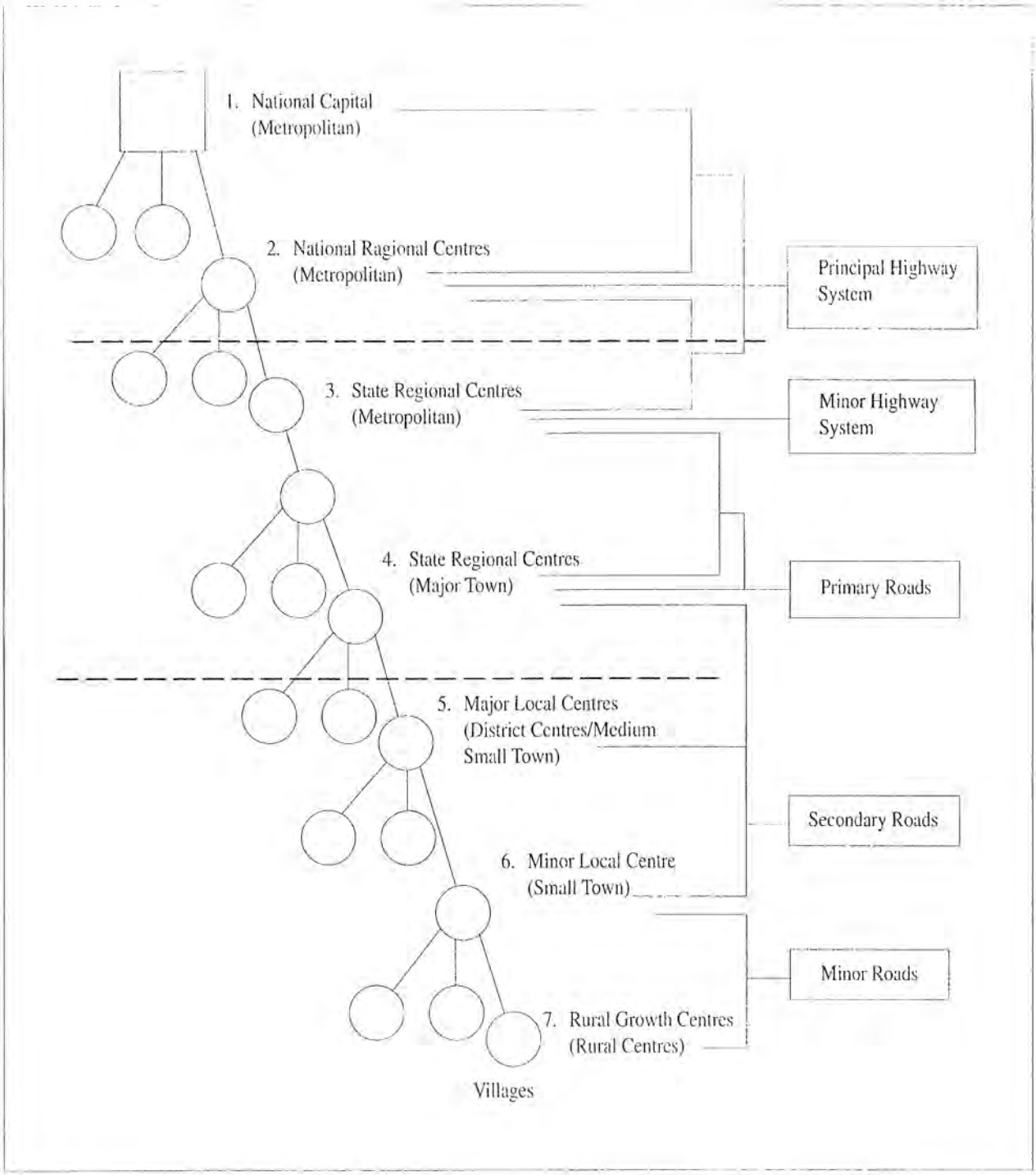
Conceptually the Highway Network Hierarchy ties up to the Urban Hierarchy System as defined by the National Urbanisation Plan. The network spacing suggested general guidelines which are influenced largely by geographical conditions and density of settlements. Figure 1 provides figurative representation of the network system concept.

3.2 Functional Highway Network Hierarchy

The national highway network envisaged for Malaysia in future consists of the following highway systems with their respective service level and functions:

[1] HNDP - 1993, HPU and JICA

FIGURE 1 : FUNCTIONAL HIGHWAY NETWORK CONCEPT



Source: JPBD Headquarters National Urban Hierarchy paper 1990 HNDP 1993

i. Principal Highway System

The principal highway system shall make up of routes spanning over the country with the following functions and service characteristics:

a. To cater for corridor movement with long trip length and high density commensurate with national and interstate travel;

b. To cater for travels between the national capital and state regional centres; and

c. To link international seaports, airports and major international boundary connections.

The principal highway system is thus made up of expressway and highways. An expressway for this Study is taken to be a divided highway with full access control, allowing high speed travel and direct linkages to national capital and national regional centres. Highway classified in this category are routes that form part of the basic framework of the national trunk road network and are designed to provide high speed travel and smooth traffic flow.

The principle highway system thus forms the basic backbone on which more dense road network can be built. The North – South Expressway, NKVE are examples of expressway in this category. The Bukit Kayu Hitam – Gurun Highway, Senai – Johor Bahru Highways, KL – Karak Highways are example of highways defined above.

ii. Minor Highway System

The minor highway system shall consist of a network that possess the following service characteristic which support and complement the Principal Highway System.

a. To cater for movement between state regional centres;

b. To link major traffic generators such as industrial zones or estates or resort area;

c. To facilitate integration of interstate services; and

d. To function as alternative route to the Principle Highway System.

The minor highway system shall therefore constitute routes designed to provide relatively high speed travel and minimum interference from through traffic movements. The major federal routes 1,2,3,4, and 5, are example of routes that make up this minor highway system.

iii. Primary Road System

Roads under the system generally serve intra-state movement rather than inter-state. They form the basic framework of the road system within a state connecting state regional centres and state sub-regional centres or major towns. They serve trips having intermediate trip-lengths and medium travel speeds. Smooth traffic flow is provided through partial access control. Some federal routes and most of the state roads are examples of routes forming this road system. The ideal network is in the range of 5 – 10 km.

iv. Secondary Road System

These are routes that form the road network within a district of regional development areas. They are designed to serve trips with relatively short trip lengths. They provide linkages to major local centres and state sub-regional centres within the district or regional development centres. This system of roads thus cater to many trips related to daily living and needs. Most of the state roads come under this category of classification. The ideal spacing is in the ranges of 1 - 5 km.

The road design standards of the above Highway Network Hierarchy has incorporated JKR's 'Geometric Design of Road - JKR 8/86 and summarised in Table 3.

TABLE 3: FUNCTIONAL HIGHWAY CLASSIFICATION AND DESIGN STANDARD

Road Category		Design Standard			Level of Service
		60m R6	50-60m R5	30-40m R4	
Principal Highway System	Expressway	●			B or C
	Major Highway		●		C
Minor Highway System			●	( )	C
Primary Road System				●	C

Source: HNPD

● Desirable ( ) Minimum

4.0 GENERAL GUIDELINES

4.1 Urban Road Network Hierarchy[2]

The concept of establishing an urban road network hierarchy involves the categorisation and management of roads within an urban network according to the functions which they serve. The categorisation and management of existing urban road system in the form of a hierarchy of roads are conceptualised on the following premises:

i. Activities more closely related to frontage buildings can be given more space when environmental and access functions are allowed to predominate;

ii. Activities which are incompatible with traffic flow can be restricted on designated routes where traffic movement should predominate;

[2] Malaysia Urban Transport Planning Manual - 1995 HPU, Halcrow Fox

iii. The capacity of designated routes can be increased by segregating different forms of traffic and by restricting vehicular access to frontages;

iv. The risk of accidents can be reduced and junction capacities increased by reducing the number of intersections and vehicular conflicts on the designated traffic routes;

v. The overall environmental impact of traffic can be reduced by concentrating flows onto fewer routes; and

vi. The rate of return on new investment designated to improve traffic flow, reduce accidents and mitigate environmental intrusion can be increased by concentrating traffic movements onto a few selected corridors.

4.2 Functional Urban Network Within A Hierarchy

A typical major urban area road network can be described in terms of five hierarchy levels based on function. However, the number of levels required is related to the size of the urban area and also to population densities and levels of vehicle ownership. The five levels of road category normally used are as follows:

i. Primary Distributor Roads;

ii. District Distributor Roads;

iii. Local Distributor Roads;

iv. Access Roads; and

v. Pedestrian Streets.

The main distinction to be made between primary and district distributor roads (whose primary objectives is the efficient movement of vehicular traffic) and, local distributor and access roads.

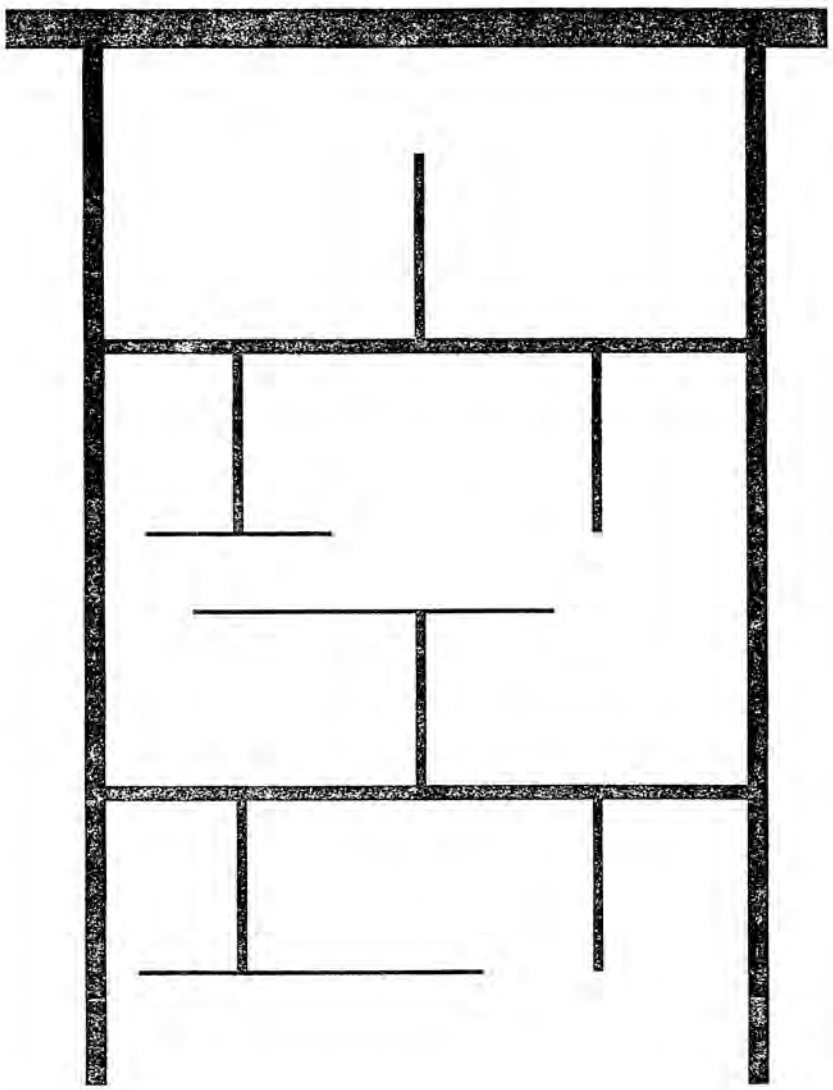
A summary of the main function is presented in Table 4 and conceptually represented in Figure 2 Typical characteristics of each road category within the identified hierarchy is summarised in Table 5.

TABLE 4: CATEGORISATION OF URBAN ROAD BY FUNCTION (NETWORK HIERARCHY)

	PEDESTRIAN STREET	ACCESS ROADS	LOCAL DISTRIBUTORS	DISTRICT DISTRIBUTORS	PRIMARY DISTRIBUTORS
PREDOMINANT ACTIVITY	Walking Meeting Trading	Walking Vehicle Access Delivery of Goods Slow moving vehicles	Vehicle movements near start or end of journey Bus stop	Medium distance traffic Public Transport services All through traffic with respect to environmental areas	Fast moving long distance traffic No pedestrian of frontage access
PEDESTRIAN MOVEMENT	Complete Freedom Predominant Activity	Considerable Freedom with crossing at random	Controlled with channelised (e.g. zebra) crossings	Minimum pedestrian activity with positive measures for their safety	nil-vertical segregation between vehicles and pedestrian
STATIONERY VEHICLES	Nil except for servicing and emergency	Some, depending on safety consideration	Considerable if off Highway facilities not provided	Some depending on traffic flow conditions	nil
HEAVY GOODS VEHICLES ACTIVITY	Essential servicing and frontage deliveries only	Predominant Activity	Some to more significant activity centre	Nil apart from major centres i.e. equivalent to local distributor level of vehicle flow	Nil apart from sites of national traffic importance
VEHICLE ACCESS TO INDIVIDUAL	Nil but may include public transport	Nil	Predominant Activity	Some-only a few localities may be severed, junction spacing	Nil apart from sites of national traffic importance
LOCAL TRAFFIC MOVEMENTS	Nil but may include public transport	Nil	Predominant Activity	Some-only a few localities may be severed, junction spacing importance	Very little - junction spacing may prelude local movements
THROUGH TRAFFIC MOVEMENTS	Nil	Nil	Nil	Predominant role for medium distance traffic	Predominant role for long distance traffic
VEHICLE OPERATING SPEED/SPEED LIMITS	Less than 5 miles/h(8km/h)(vehicles enter on sufferance)	Less than 20 miles/h (32km/h) with speed control devices	Subject to 30 miles/h (48km/h) limit layout should discourage speed	Subject to 30 or 40 miles/h(48/64km/h) limit within the built-up area	More than 40 miles/h(64km/h) depending on geometric constraints

Source: Malaysia Ur Transport Planning Project 1995

FIGURE 2: FUNCTIONAL URBAN ROAD NETWORK CONCEPT



Source: Malaysia Urban Transport Planning Project 1995

TABLE 5: TYPICAL CHARACTERISTICS OF URBAN ROAD (NETWORK HIERARCHY)

	PEDESTRIAN STREET	ACCESS ROADS	LOCAL DISTRIBUTORS	DISTRICT DISTRIBUTORS	PRIMARY DISTRIBUTORS
DESIGN SPEED	32 kph	40 kph	50 kph	60 kph	80 - 100kph
CARRIAGEWAY WIDTH	4.8 metres (min)	5.5 metres (min)	6.75 metres (min)	7.3 metres (min)	
HORIZONTAL ALIGNMENT	20 metres (min)	25 metres (min)	35 metres (min)	127 metres (min)	
FOOTWAY PROVISION					
JUNCTION SPACING	20 metres (min)	20 metres (min) – Opposites junctions 50 metres (min) – Adjacent Junctions	50 metres (min) – Opposite junctions 100 metres – Adjacent Junctions	100 metres (min) – Opposite junctions 100 metres – Adjacent Junctions	300 metres (min) – Opposite junctions 500 metres – Adjacent Junctions
TYPICAL TRAFFIC FLOW	50 - 300 veh/day	300 - 750 veh/day	300 - 750 veh/day	500 - 1500 veh/day	5,000 - 20,000 veh/day

Source: Malaysia Urban Transport Planning Project 1995

i. Primary Distributors

These roads form the primary network for the urban centres as a whole and will normally comprise Federal and important State roads, providing links to/from the Expressway system. All longer distance traffic movements to, from and within urban areas should be accommodated on the primary distributor roads.

ii. District Distributors

These roads distribute traffic within the main residential and industrial districts. They form a link between the primary network and the roads within environmentally sensitive areas.

iii. Local Distributors

These roads distribute traffic within local areas. They form links between distributors and access roads.

iv. Access Roads

These roads provide direct access to individual buildings or land will generally be District roads.

v. Pedestrian Streets

These roads are primary for the passage of pedestrian and sometimes for cyclists, but may permit vehicles to enter at specified times of the day to allow service access or to provide for public transport services.

4.3 Highway Development On Environment

The construction of highway can bring about a myriad of favourable as well as unfavourable impact on the living environment. These impacts include economic, social, regional development impacts as well as impacts on the natural environment. To

mitigate and minimise the short and long term impacts of highway development on the natural and living environments, it is recommended that;

i. In the conduct of feasibility and engineering studies of the highway, alignment and structure of the road shall be carefully studied to minimise effects on the natural environment. (Environmental Impact Assesment Studies (EIA));

ii. During construction of the highway, suitable construction method be chosen to minimise the adverse effect on the environment;

iii. Upon completion of a highway, prompt action shall be taken to protect the exposed ground by tree planting, turfing of slopes and other slope protection measures;

iv. Sufficient right-of-way shall be provided to reduce noise and air pollution by the erection of noise screen such as tree planting, setback or bunking;

v. The grade separated accesses shall be provided to neighbouring communities wherever possible to safeguard safety of roadside residents;

vi. The appropriate landuse planning for adjacent land of highway shall be carried out carefully; and

vii. Regulations with respect to smoke emission and noise level control shall be effectively enforced.

4.4 Exclusive Motor Cycle Lanes

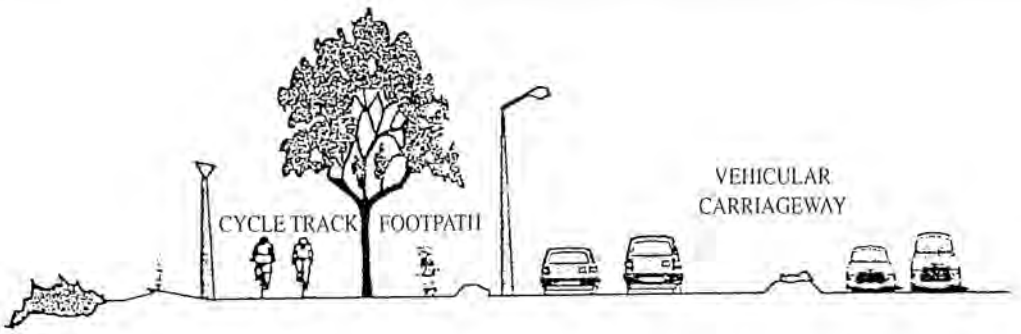
i. General Considerations

In areas where there is usually a high proportion of motor cyclists, the volume may be so substantial as to effect the smooth flow of traffic. In such instances, the provision of separate and exclusive cycle lanes should be considered. Figure 3 shows the various types of cycle tracks uses. The general warrant for determining the need for an exclusive cycle lane are:

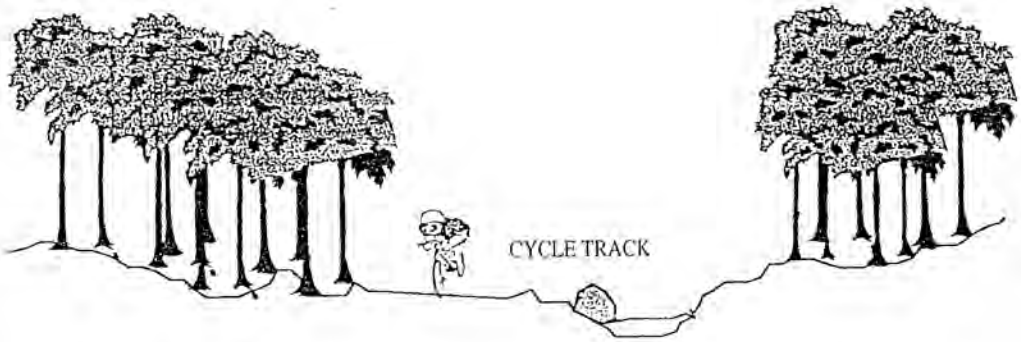
a. The total volume of traffic exceeds the provided lane capacity; and

b. The volume of motorcycles exceeds 20% of the total volume of traffic.

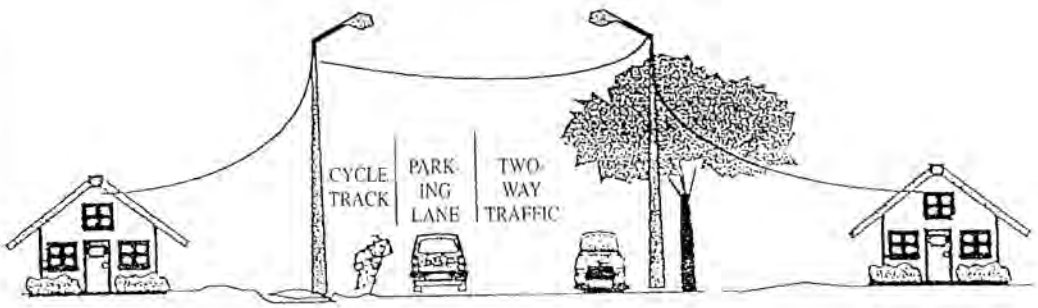
FIGURE 3: TYPE OF CYCLE TRACKS



(A) EXCLUSIVE CYCLE TRACK URBAN



(B) EXCLUSIVE CYCLE TRACK RURAL



(C) RESTRICTED CYCLE TRACK

Source: Malaysia Urban Transport Planning Project 1995

ii. Lane Width

The required widths of the cycle lane is as shown in Table 6. The cycle lane must be separated from any pedestrian sidewalk and the width of separation must be at least 1.0m

TABLE 6: WIDTH OF MOTOR CYCLE LANE

Volume of Motorcycles/hr	Width of Cycle Lane (m)	
	Minimum	Desirable
1000-1500	2.0	2.5
1500-200	2.5	3.0
> 2000	3.0	3.5

Source: Malaysia Urban Transport Planning Project 1995

4.5 Service Roads

i. General Guidelines

Service roads are generally found in urban areas and they can have numerous functions, depending on the type of road they serve and character of the surrounding area. They may be used to control access or function as a street facility serving adjoining property. They segregate local traffic from the higher speed through traffic and intercept driveways of residence and commercial establishments along the road. Service roads also not only provide more favourable access for commercial and residential development than the faster moving arterial but also helps to preserve the safety and capacity of the latter.

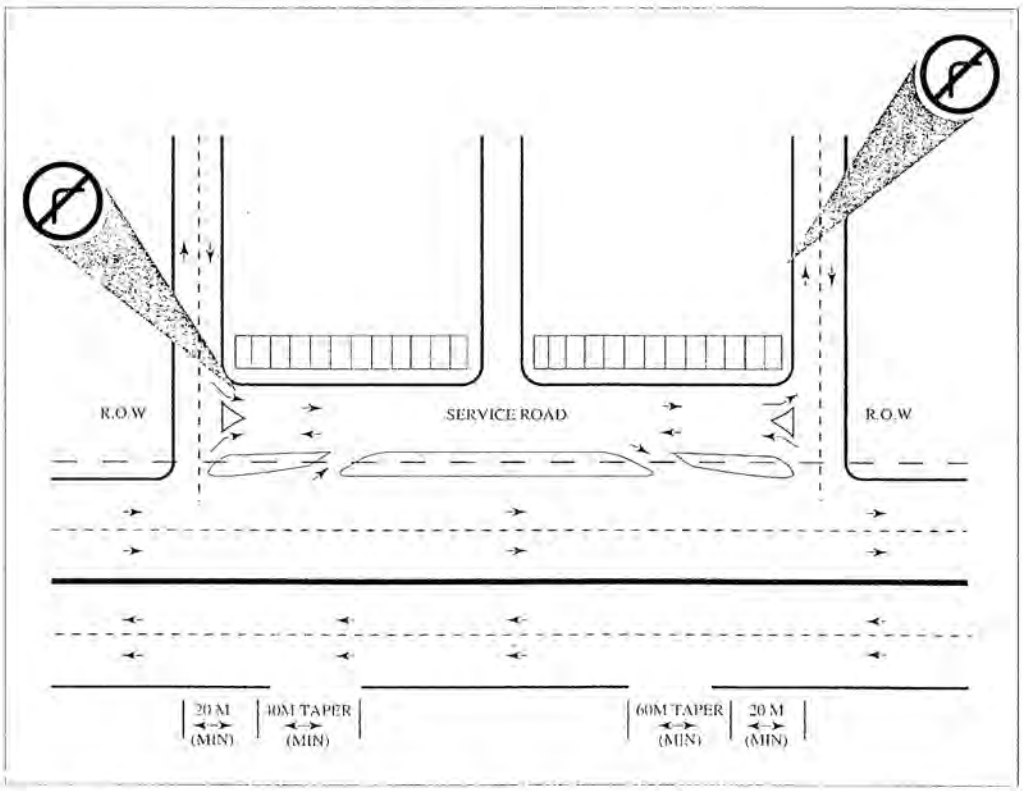
ii. Design Requirements

From an operational and safety standpoints, one way roads are much preferred to two-way and should be considered. One-way operation inconvenience local traffic to

some degree, but the advantages in reduction in vehicular and pedestrian conflicts at intersecting streets often fully compensate for this inconvenience.

Two-way service roads may be considered for partially developed urban areas where the adjoining road system is so irregular and disconnected that one-way operation would introduce considerable added travel distance and cause undue inconvenience. Two-way service roads may also be necessary for suburban or rural areas where points of access to the through facility are infrequent; where only one service road is provided, where roads connecting with the service roads are widely spaced or where there is no parallel street within reasonable distance of the service roads in urban areas that are developed or likely to be developed. (Refer Figure 4)

FIGURE 4: TWO-WAY SERVICE ROAD



Source: Malaysia Urban Transport Planning Manual - 1995

5.0 CONCLUSION

This document form a supplementary document to the 'Planning Standard Manual' which is currently being reviewed integrating standards and guidelines from across other agencies such as the Highway Planning Unit and Public Works Department (JKR). It is hope that this will act as a platform towards integrating landuse planning and road network planning in totality.