UNIVERSITI TEKNOLOGI MALAYSIA

UNIVERSITI PENYELIDIKAN

SKAA 4042
ROADWORKS

By: CHE ROS ISMAIL
PROF DR MOHD ROSLI HAININ
DR HARYATI YAACOB
DR SITTI ASMAH HASSAN
JGP-FKA, UTM

CONTENT

1. INTRODUCTION
2. STAGES OF HIGHWAY DEVELOPMENT
3. ROAD CATEGORY/CLASSIFICATION
4. DESIGN STANDARDS
5. DESIGN CONTROL AND CRITERIA
6. ELEMENTS OF DESIGN
7. CROSS SECTION ELEMENTS

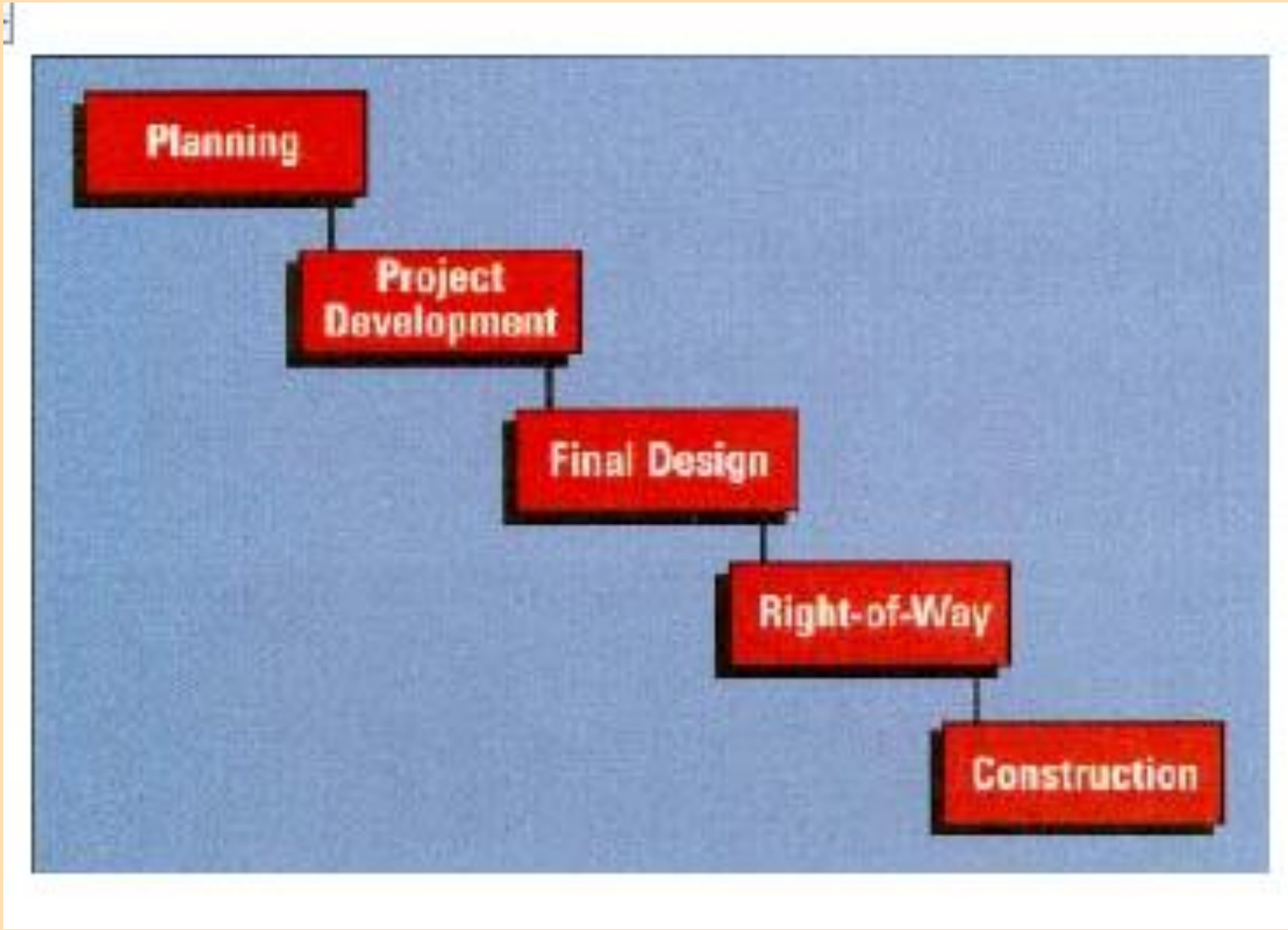
1. INTRODUCTION

- Highway design is only one element in the overall highway development process

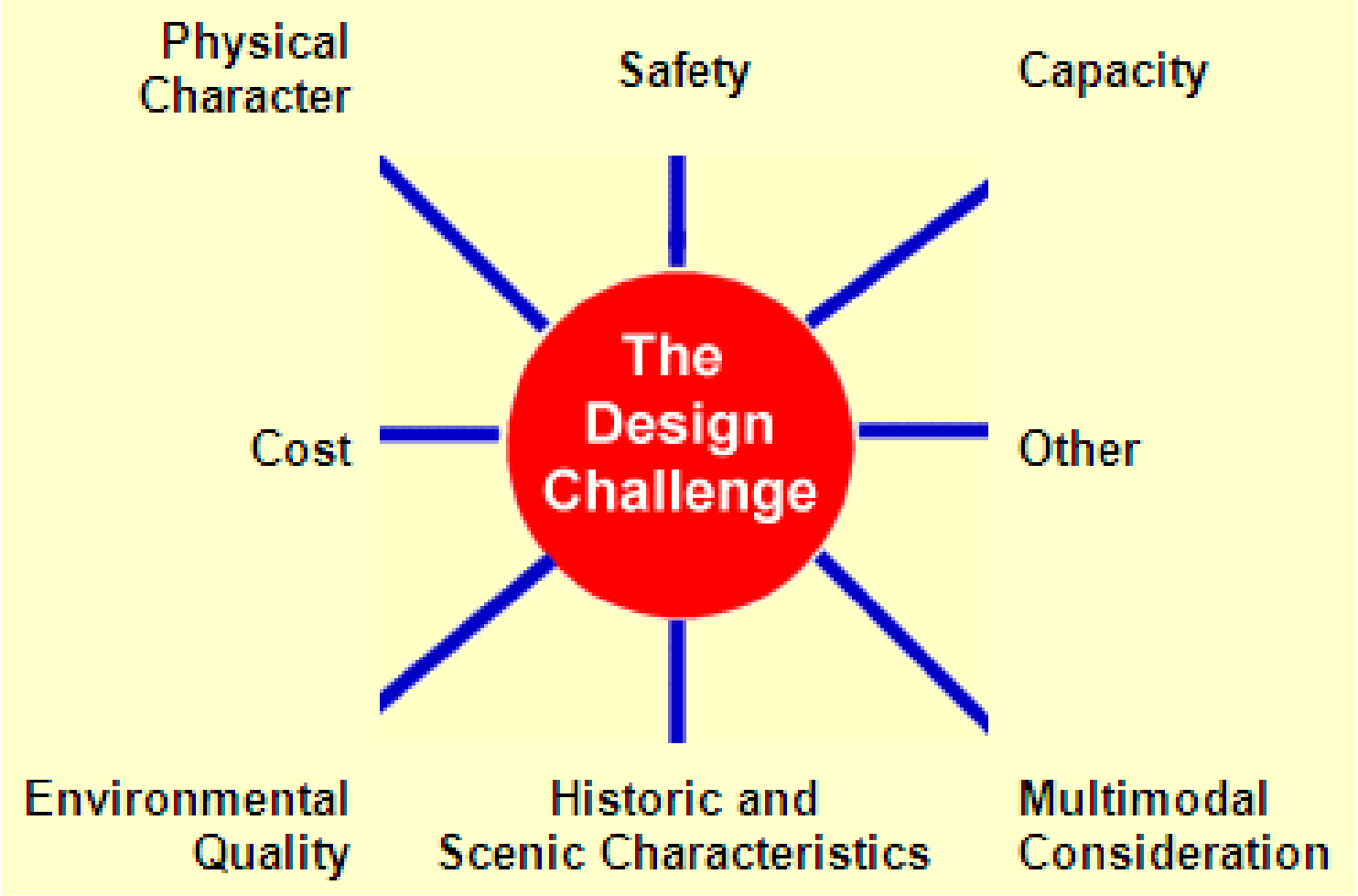
- Historically, detailed design occurs in the middle of the process, linking the preceding phases of planning and project development with the subsequent phases of right of way acquisition, construction, and maintenance

- Highway engineers must satisfy the needs:
  - users and integrity of the environment. Combinations of requirement that are always produce conflicting results.
- Engineers should also recognize:
  - sharing of transportation corridors by pedestrians, cyclists and public transit vehicles.

2. THE STAGES OF HIGHWAY DEVELOPMENT

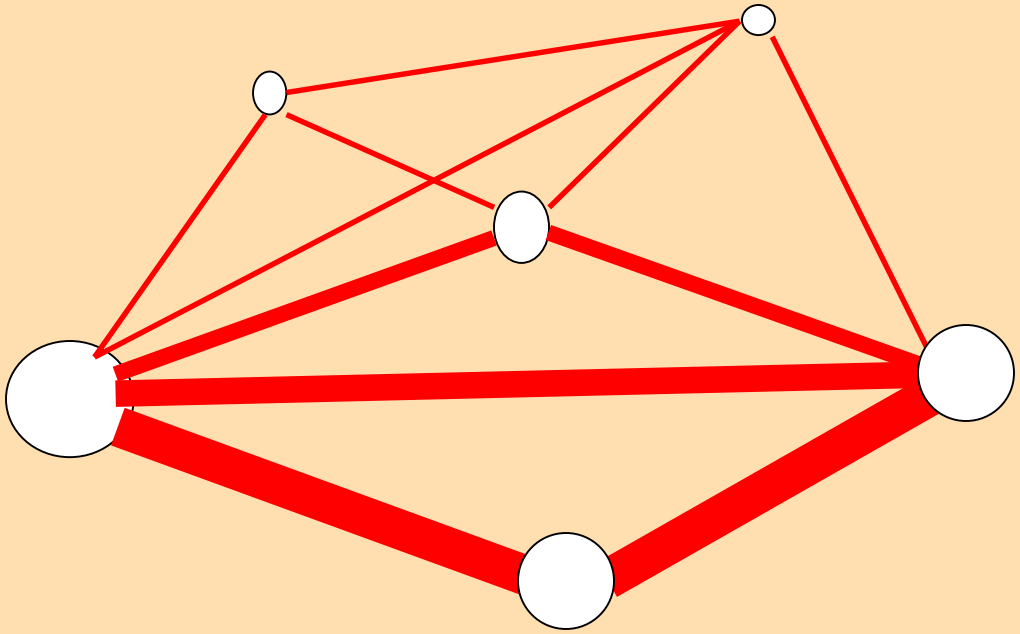


Factors need to be considered in planning



Desired lines of travel

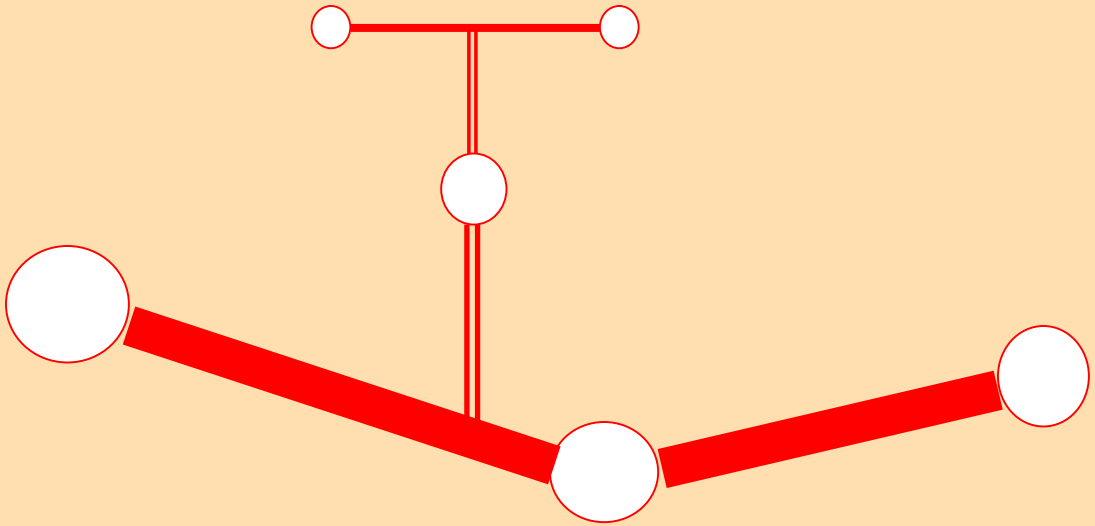
- Group streets and highways according to the character of service



A. Desired lines of travel

Provided road network

- Actual road constructed

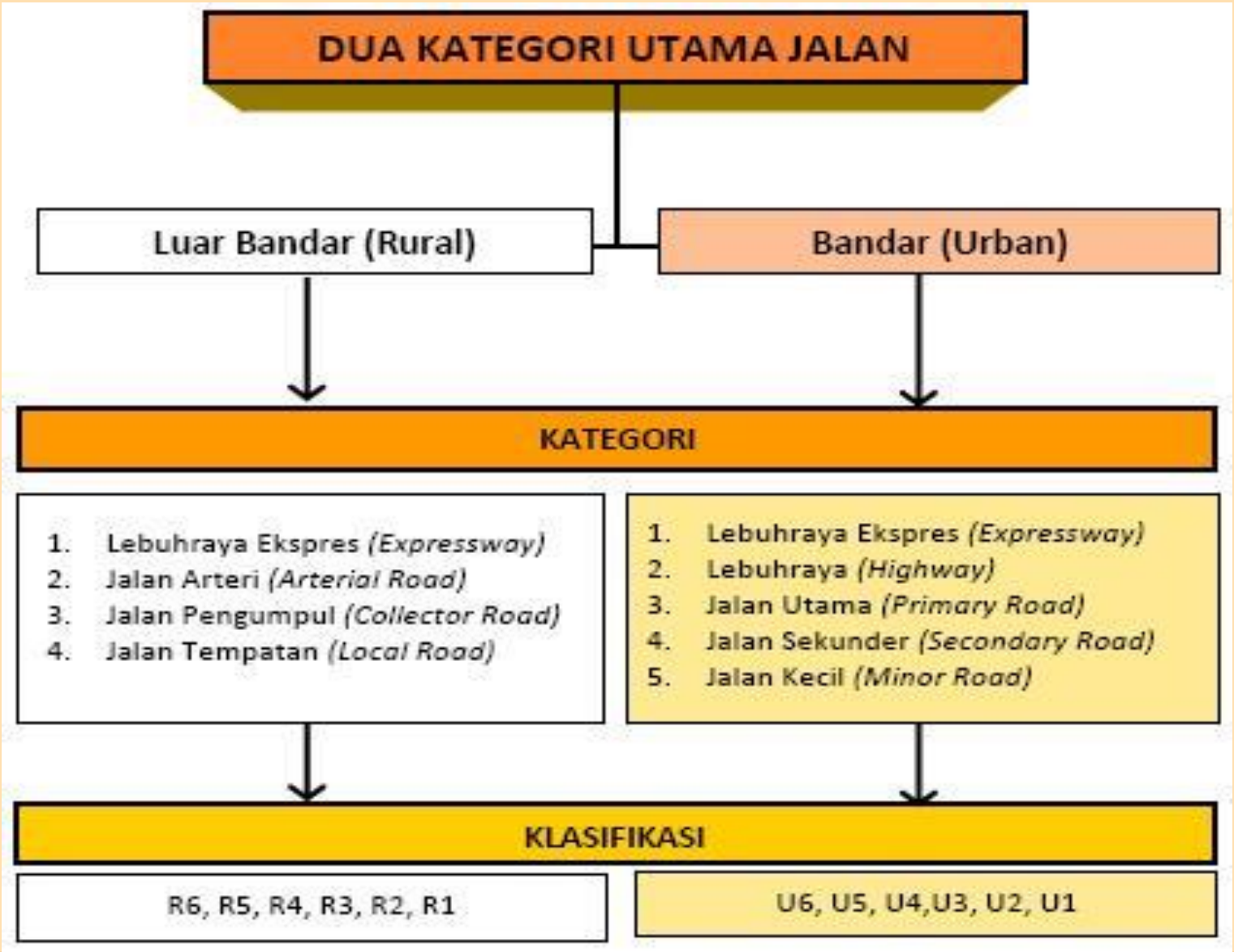


B. Road network provided

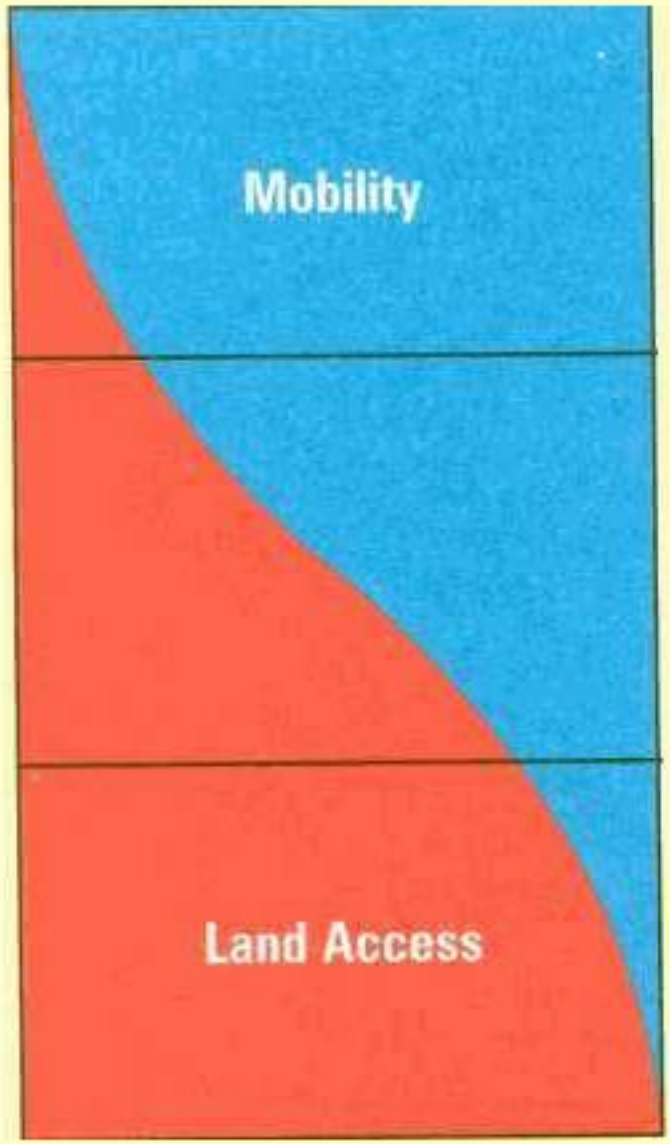
3. ROAD CATEGORY/CLASSIFICATION

- Category – helps to clarify policies concerning highway aspects (geometric design, speed, width, intersection types, access control)
- Functional classification – the process by which streets and highways are grouped into classes according to the character of service they are intended to provide i.e. national >> local network (varies in terms of mobility and accessibility)

HIERARCHY & CLASSIFICATION



Mobility vs. Access



Arterials

- higher mobility
- low degree of access

Collectors

- balance between mobility and access

Locals

- lower mobility
- high degree of access

Figure 3.1

Relationship of functionally classified highway systems in serving traffic mobility and land access.

Source: *Safety Effectiveness of Highway Design Features,* Volume I, Access Control, FHWA, 1992


Jalan Flora 1/5
Jalan Flora 1/4
Jalan Flora 1/3
Jalan Flora 1/1
Jalan Pontian Lama
Jalan Pulai 6
Jalan Pulai 3
Jalan Pulai 4
Jalan Pulai 2
Jalan Pulai
Jalan Pulai 19
Jalan Perdagangan
Jalan Pendidikan
Jalan Pendidikan 4
Jalan Pendidikan 1
Jalan Universiti
Skudai - Pontian Hwy
Lebuhraya Skudai - Pontian
Jalan Sejahtera 1
Jalan Harmoni 1
Jalan Harmoni 11
Jalan Tembaga
Jalan Sri Skudai
Jalan Skudai
Taman Jaya
Jalan Emas 1
Jalan Emas 2
Jalan Emas 12
Jalan Emas 3
Jalan Emas Puteh 5
Jalan Besi
Jalan Jaya
Taman Sri Skudai
Taman Sri Putri
Skudai Parade
Jalan Emas 14
Jalan Emas 13
Jalan Trmah 9
Jalan Depu
Jalan Tilan
Jalan Perak 7
Jalan Perak 1
Jalan Emas 20
Jalan Naga 8
Taman Harmoni 1
Jalan Tapah
Jalan Tomas
Jalan Jemerang
Jalan Puyu
Jalan Bujuk
Taman Skudai
Taman Harmoni 2
Taman Nesa
Jalan Inang 14
Jalan Inang 8
Jalan Joget 8
Jalan Joget 7
Jalan Joget 6
Jalan Kebudayaan
Jalan Kebudayaan 6
Jalan Kebudayaan 18
Jalan Kebangsaan 13
Jalan Kebangsaan 29
Jalan Kebangsaan 25
Jalan Kebangsaan 58
Jalan Kebangsaan 68
Jalan Sejahtera 16
Jalan Sejahtera 9
Jalan Sejahtera 8
Jalan Sejahtera 1
Jalan Keindahan 3
Jalan Keindahan 11
Jalan Kejayaan 10
Jalan Kemajuan 11
Jalan Perdagangan 1
Jalan Perdagangan 3
Jalan Perdagangan 4
Jalan Pulai 20
Jalan Pulai 40
Jalan Pulai 41
Jalan Pulai 42
Jusco Taman Universiti
Kawasan Perindustrian Universiti
Taman Desa Skudai
Taman Universiti
A
5
1

4. DESIGN STANDARDS

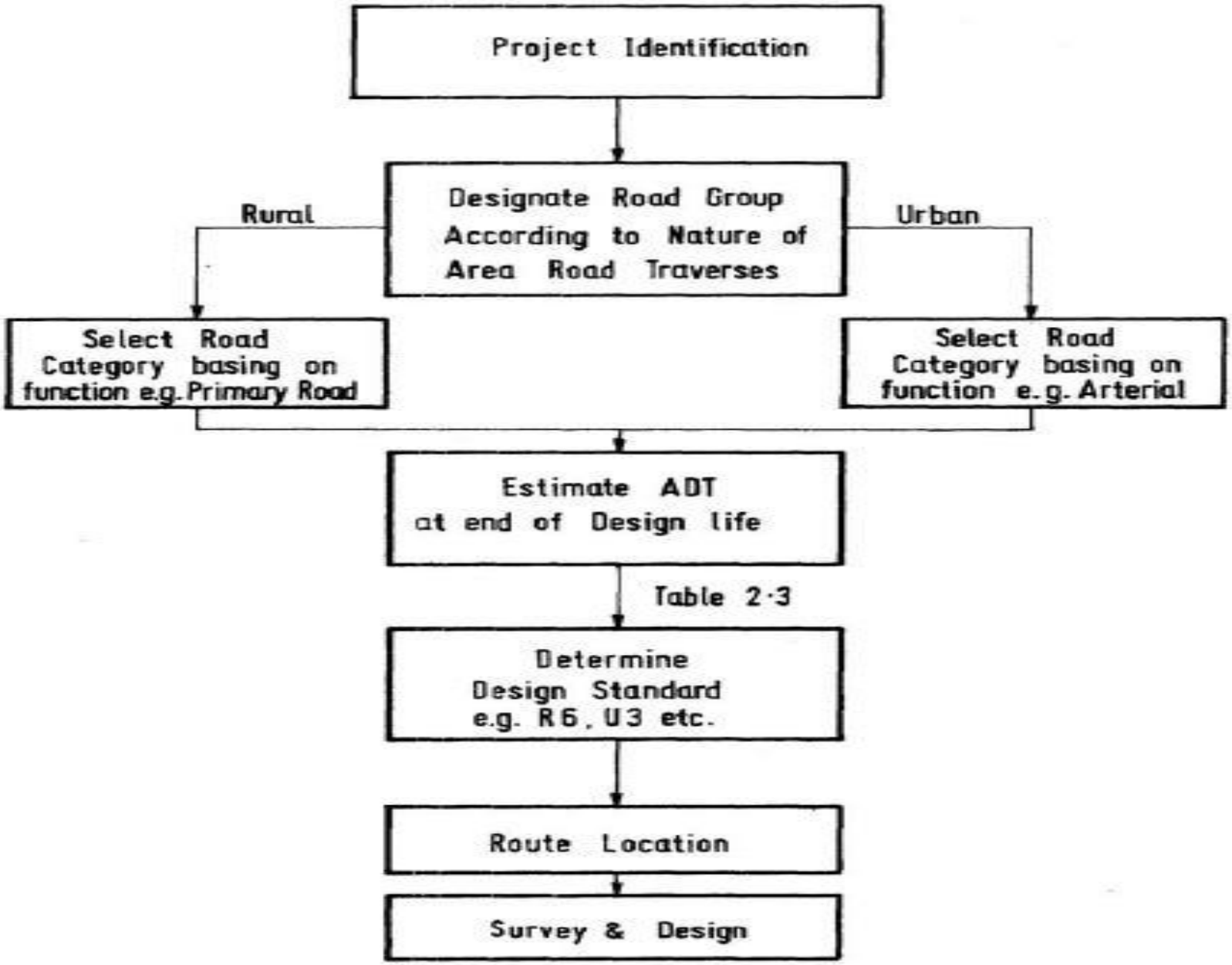
Geometric design of all roads need to be standardised because:

1. to provide a uniformity in the design of roads according to their performance requirements.
2. to provide a consistent, safe and reliable road facilities for movement of traffic.
3. to provide a guide for less subjective decisions on road design.

SELECTION OF DESIGN STANDARDS

Area	Road category / projected ADT	All traffic volume	>10,000	10,000 to 3,000	3,000 to 1,000	1,000 to 150	<150
R	Expressway	R6	-	-	-	-	-
U	National Highway	R5	-	-	-	-	-
R	Primary Road	-	R5	R4	-	-	-
A	Secondary Road	-	-	R4	R3	-	-
L	Minor Road	-	-	-	-	R2	R1
U	Expressway	U6	-	-	-	-	-
R	Arterials	-	U5	U4	-	-	-
Ba	Collector	-	U5	U4	U3	-	-
N	Local Street	-	-	U4	U3	U2	U1

FIGURE 2-1 : FLOW CHART FOR SELECTION OF DESIGN STANDARDS



Standard	Max design speed limit (km/h)	Minimum lane width (m)	Access control	Application
JKR U6	100	3.5	Full	Expressways under the administration of Malaysian Highway Authority
JKR U5	80	3.5	Partial	Arterial roads and partial access municipal highways
JKR U4	70	3.25	Partial	Arterial / collector roads
JKR U3	60	3.0	Partial	Collector roads / Local streets
JKR U2	50	2.75	None	Local streets ***Note:*** *JKR U2 is the minimum geometrical standard for 2-lane roads*
JKR U1	40	(5.0)*	None	Single-lane street (in towns)
JKR U1a	40	(4.5)*	None	Single-lane street (as in low-cost housing areas)

Divided multilane highway in a rural environment

Divided multilane highway in an urban environment

5. DESIGN CONTROL AND CRITERIA

Characteristics governing the design element:

1. Topography and land use – terrain (flat, rolling, mountainous) or area type
2. Traffic – ADT, composition
3. Design Vehicle – passenger car, rigid truck, semi-trailer
4. Speed – design speed, operating speed (need to fulfill road function)
5. Capacity – ability of road to accommodate traffic (i.e 2000 pcu/hr), affect LOS

Design Vehicle		Dimension in metre						Turning Radius (m)
Type	Symbol	Wheel Base	Overall		Overall Lenght	Overall Width	Height	
			Front	Rear				
Passenger Car	P	3.4	0.9	1.5	5.8	2.1	1.3	7.3
Single Unit Truck	SU	6.1	1.2	1.8	9.1	2.6	4.1	12.8
Truck Combination	WB-50	7.9	0.9	0.6	16.7	2.6	4.1	13.7

Design Standard	Category of Road	Design Speed (kph)		
		Area Type		
		I	II	III
U6	Expressway	100	90	80
U5	Arterials Collectors	90 80	70 70	60 60
U4	Arterials Collectors Local Streets	80 70 70	60 60 60	50 50 50
U3	Collectors Local Streets	60 60	50 50	40 40
U2 U1	Local Streets	50 40	40 30	30 30

6. ELEMENTS OF DESIGN

1. Sight Distance – length of road ahead visible to drivers: SSD, PSD, DSD
2. Horizontal Alignment – super elevation, min radius, transition & circular curves, sight distance
3. Vertical Alignment – Max & min grades, critical grade length, climbing & passing lanes, crest & sag curve

Design Speed (km / hr)	Min. Stopping Sight Dist (m)
120	285
100	205
80	140
60	85
50	65
40	45
30	30
20	20

$$R_{min} = \frac{V^2}{127\,(e + f)}$$

where :

R_{min} = minimum radius of circular curve(m)
V = Design speed (km/hr)
e = maximum superelevation rate
f = maximum alowable side friction factor

Design Speed (km/hr)	120	100	80	60	50	40	30	20
Minimum k value	120	60	30	15	10	10	5	5

Design Speed (km/hr)	Desirable Maximum Grade (%)	Maximum Grade (%)
120	2	5
100	3	6
80	4	7
60	5	8
50	6	9
40	7	10
30	8	12
20	9	15

7. CROSS SECTION ELEMENTS

1. Pavement – surface type, cross slope
2. Number of lanes, lane width, marginal strips, shoulders and kerbs
3. Sidewalks, pedestrian crossing, traffic barriers and median
4. U-turns – locations and design considerations (also distance between successive intersections/U-turns)

TABLE 5-1 : TYPICAL PAVEMENT SURFACE TYPE

Design Standard	Description
R6/U6	Asphaltic Concrete/Concrete
R5/U5	Asphaltic Concrete/Concrete
R4/U4	Dense Bituminous Macadam/Asphaltic Concrete/Concrete
R3/U3	Bituminous Macadam/Concrete
R2/U2	Surface Treatment/Semigrout
R1/U1	Gravel/Semigrout

TABLE 5.2 : LANE & MARGINAL STRIP WIDTHS

Design Standard	Lane Width (m)	Marginal Strip Width (m)
R6/U6	3.65	0.50
R5/U5	3.50	0.50
R4/U4	3.25	0.25
R3/U3	3.00	0.25
R2/U2	2.75	0.00
R1/U1	5.00*	0.00
Interchange Ramps		
Single Lane	4.50	Lt 1.50 Rt 0.50
Multi Lanes	3.50	Lt 0.50 Rt 0.50
Single Lane Loop	4.50	Lt 1.50 Rt 0.50

Note : * denotes the total two-way width

TABLE 5-5B : MEDIAN WIDTH (URBAN)

Design Standard	Median Width (m)					
	Area Type					
	I		II		III	
	Minimum	Desirable	Minimum	Desirable	Minimum	Desirable
U6	4.0	9.0	3.5	6.0	2.0	4.0
U5	3.0	6.5	2.5	4.0	2.0	3.0
U4	2.5	5.0	2.0	3.0	1.5	2.0
U3	2.0	4.0	1.5	2.0	1.5	2.0

Suggested References

1. REAM GL2/2002 A Guide on Geometric Design of Roads
2. Manual Garis Panduan dan Piawaian Perancangan Negeri JPBD or PBT
3. Latest JKR RTVM
4. Arahan Teknik (Jalan) 5/85 (2013) Manual on Pavement Design
5. Arahan Teknik (Jalan) 11/87 A Guide to the Design of At-Grade Intersections
6. Nota Teknik (Jalan) 13/88 Buku Panduan Rekabentuk Jalan
7. Arahan Teknik 6/85 Guidelines for Presentation of Engineering Drawing
8. REAM GLX/2006 Guidelines on Traffic Control and Management Devices

Tasks to be completed!!!

- Proposed road network and existing contour
- Proposed road levels
- Internal traffic circulation (including road classification, width, etc)
- Intersection design for main entrance (geometric design/layout, structural thickness design, traffic control system, acceleration & deceleration lanes) – need to identify location of project and traffic projection
- Design for horizontal and vertical alignments where applicable
- Design for junctions (curb radius, turning lanes, etc), cross sections, structural thickness, signages, road markings and furnitures (or standard design where applicable)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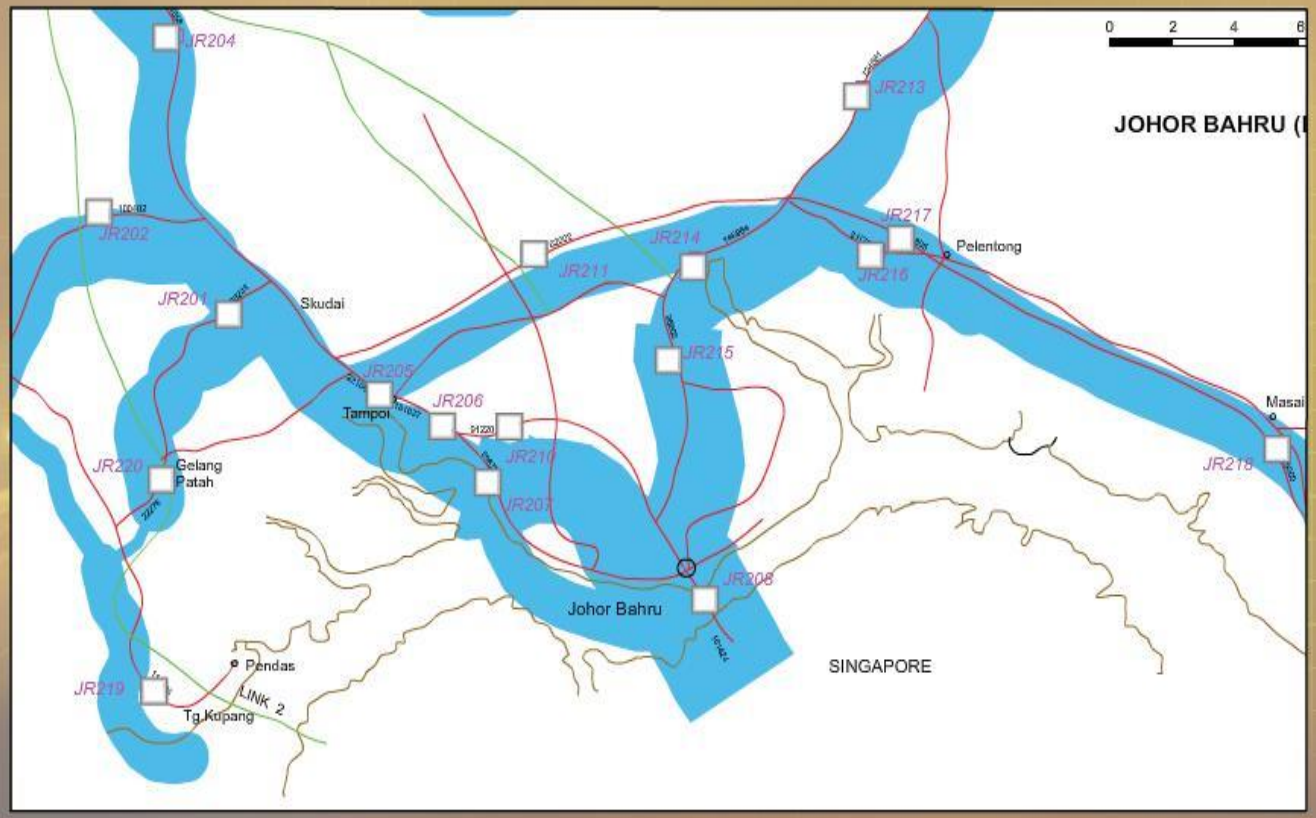
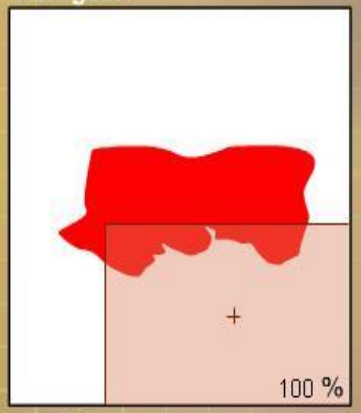
TRAFFIC VOLUME

Traffic Volume

Change Search Mode: Map



Navigator



Navigate and **Zoom** in the map, click on prefered **Station** and click **Get data**

Get Data

Print Map

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TRAFFIC VOLUME

Traffic Volume | Growth

Change Search Mode: List | Map

1. Please choose your location :

State: JOHOR — Add | Filter

2. Please choose either District / Station No / Route No :

District: JOHOR BAHRU — Add

Station No: JR101 — Add

Route No: - — Add

3. Your selected locations :

District / Station No / Route No
JR101
JOHOR BAHRU
JOHOR

Click on Item to delete

Location | April | October | Average

Reset | Export Excel

4. Your search result :

rict	Station No	Survey Type	RouteNo	KM	Description of Location
J PAHAT	JR101	0	5	142	Johor Bahru-Batu Pahat-Mua
DR BAHRU	JR201	3	J4	19.3	Johor Bahru-Gelang Patah
DR BAHRU	JR202	3	5	25	Johor Bahru-Pontian (140m '
DR BAHRU	JR203	3	1	34	Johor Bahru-Ayer Hitam (80(
DR BAHRU	JR204	1	1	20.9	Johor Bahru-Kulai (400m noı
DR BAHRU	JR205	1	1	12.7	Johor Bahru-Skudai
DR BAHRU	JR206	1	1	6.8	Johor Bahru-Skudai (100m r

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ROAD TRAFFIC VOLUME MALAYSIA 2010

TRAFFIC VOLUME

Traffic Volume | Growth | Change Search Mode | List | Map

1. Please choose your location :

State: JOHOR — Add — Filter

2. Please choose either District / Station No / Route No :

District: JOHOR BAHRU — Add

Station No: JR101 — Add

Route No: - — Add

3. Your selected locations :

District / Station No / Route No
JOHOR BAHRU

Click on Item to delete

Location | April | October | Average | Reset | Export Excel

4. Your search result :

District	Station NO	Route No	Average 16 H	Average Car	Average Van	Average Mec	Average Hea	Average Bus	Average Mot	Average
JOHOR BAHRU	JR201	J4	36243	56.5	6.2	4.25	1.5	1.3	30.2	4100
JOHOR BAHRU	JR202	5	100401.5	65.9	7.9	4.55	1.65	1.5	18.45	8057.5
JOHOR BAHRU	JR203	1	33679	63.9	8.5	9.15	5.25	1.5	11.7	2612
JOHOR BAHRU	JR204	1	101856	75.15	4.9	4.95	2.8	2.35	9.8	8126.5
JOHOR BAHRU	JR205	1	221084	73.15	3.65	1.9	1.1	1.7	18.5	17720.5
JOHOR BAHRU	JR206	1	181636.5	71.45	2.9	1.95	1.25	1.75	20.7	14105.5
JOHOR BAHRU	JR207	1	59675.5	69.45	6.05	1.65	1.4	1.85	19.6	5227.5

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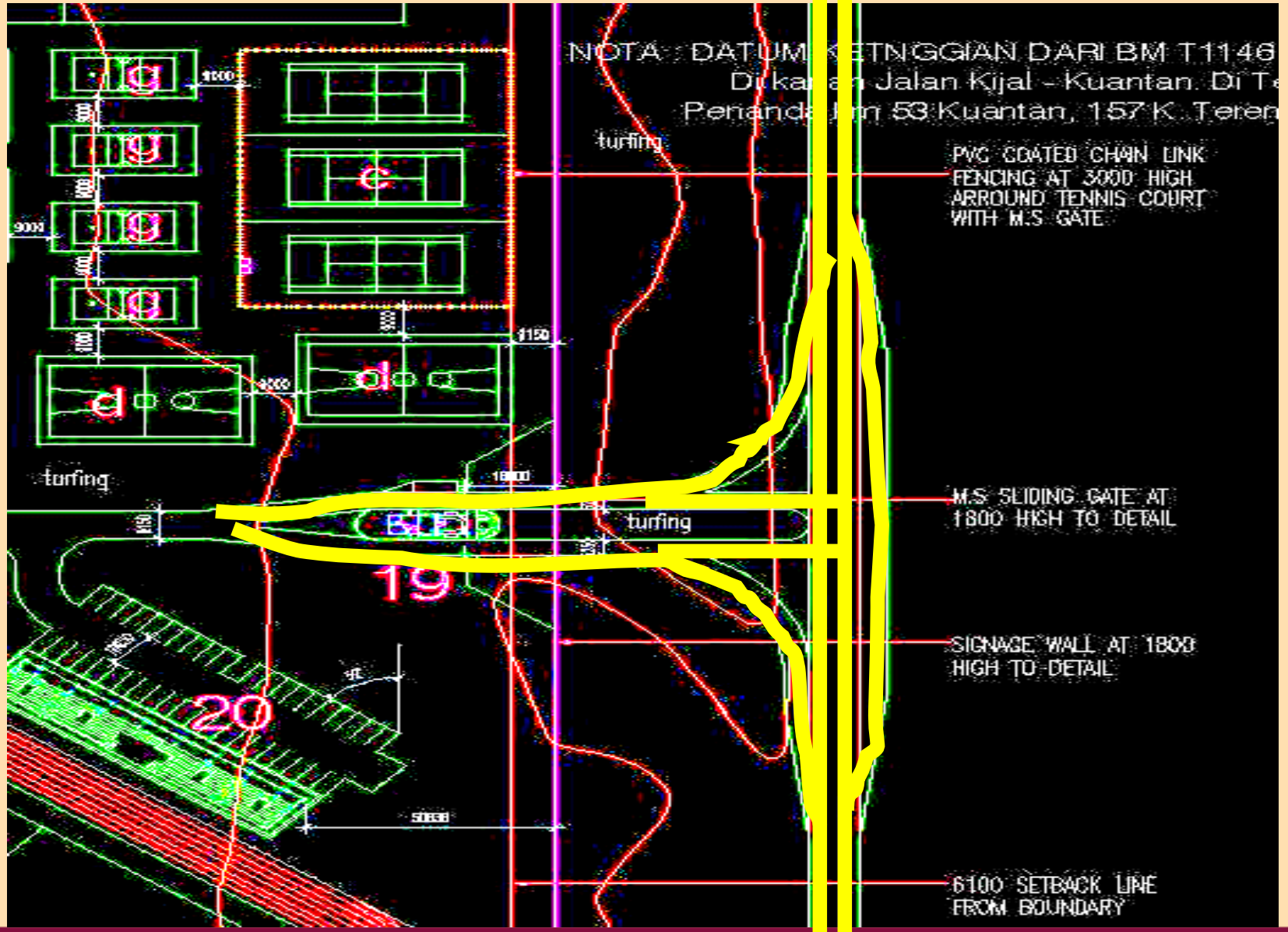
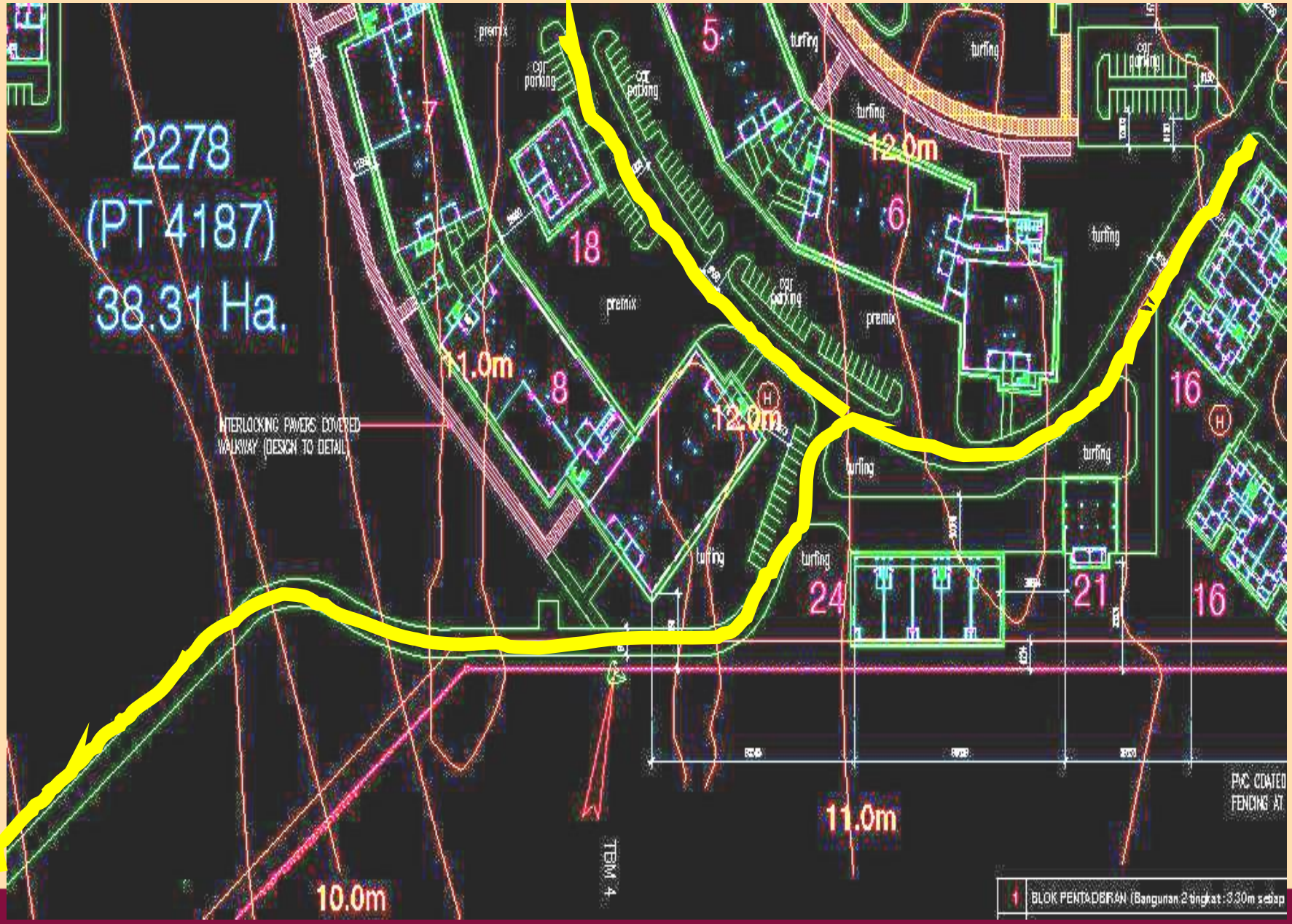
PROJECT DRAWING

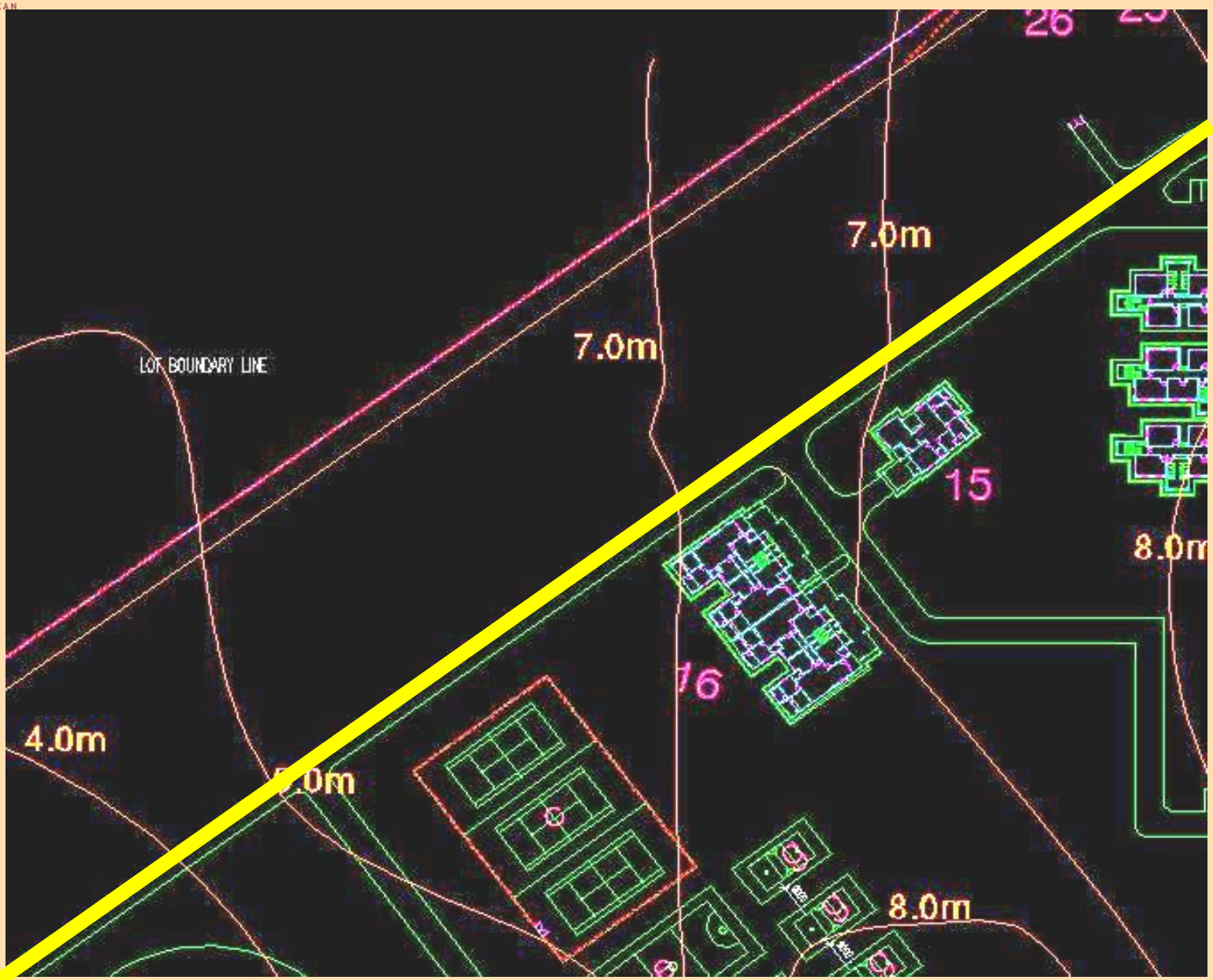
INTERSECTION DESIGN



HORIZONTAL CURVE



VERTICAL CURVE



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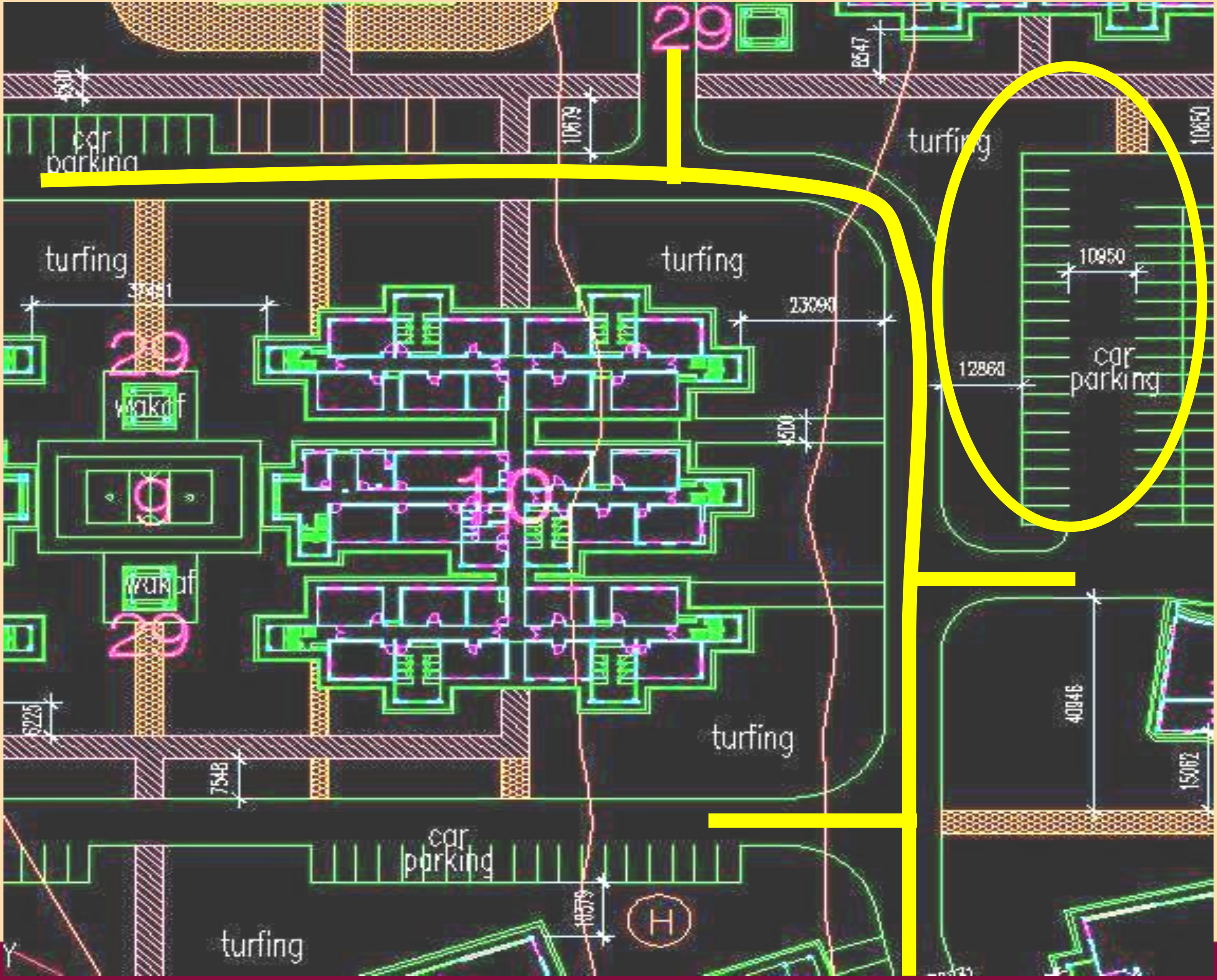
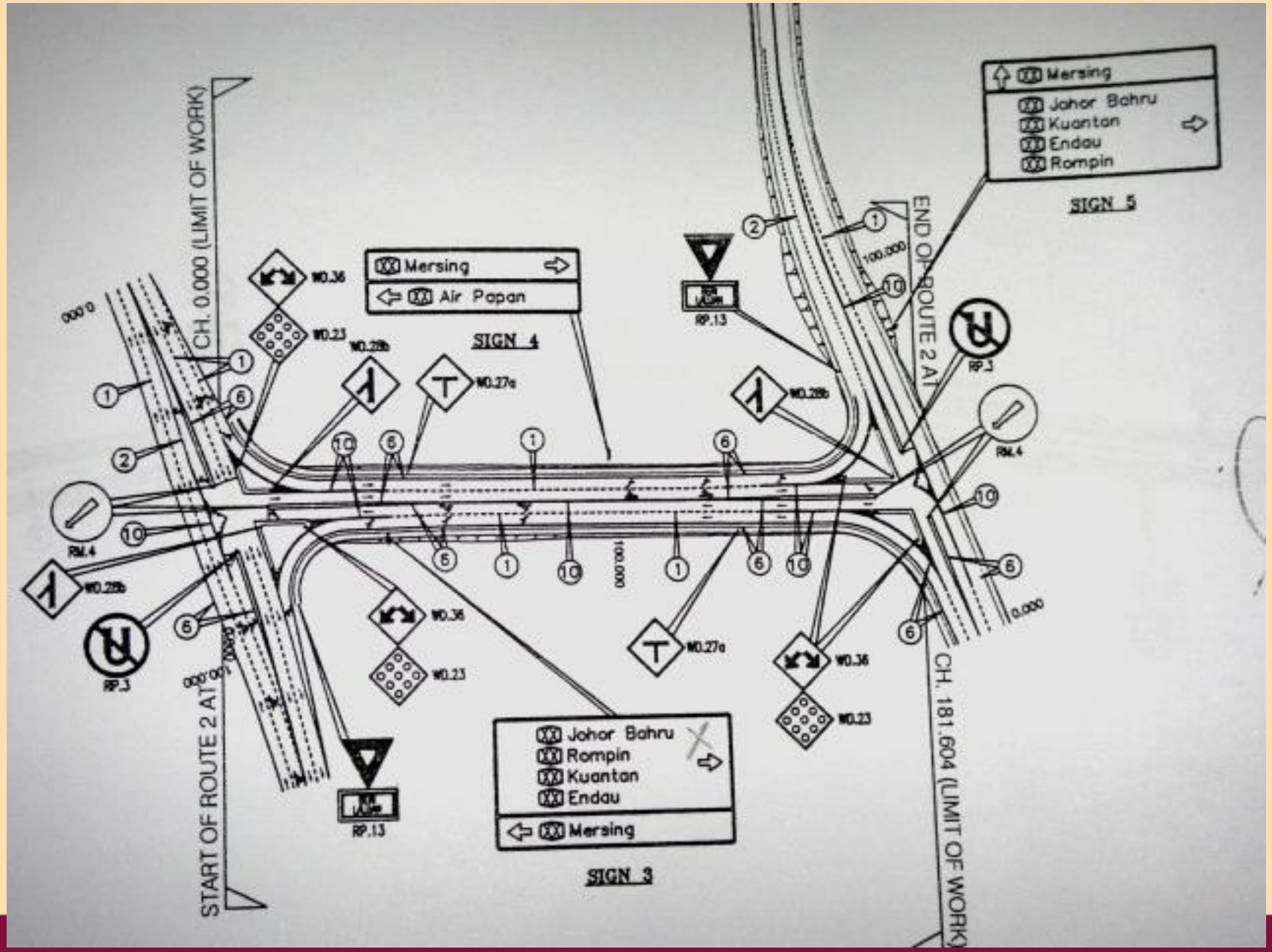
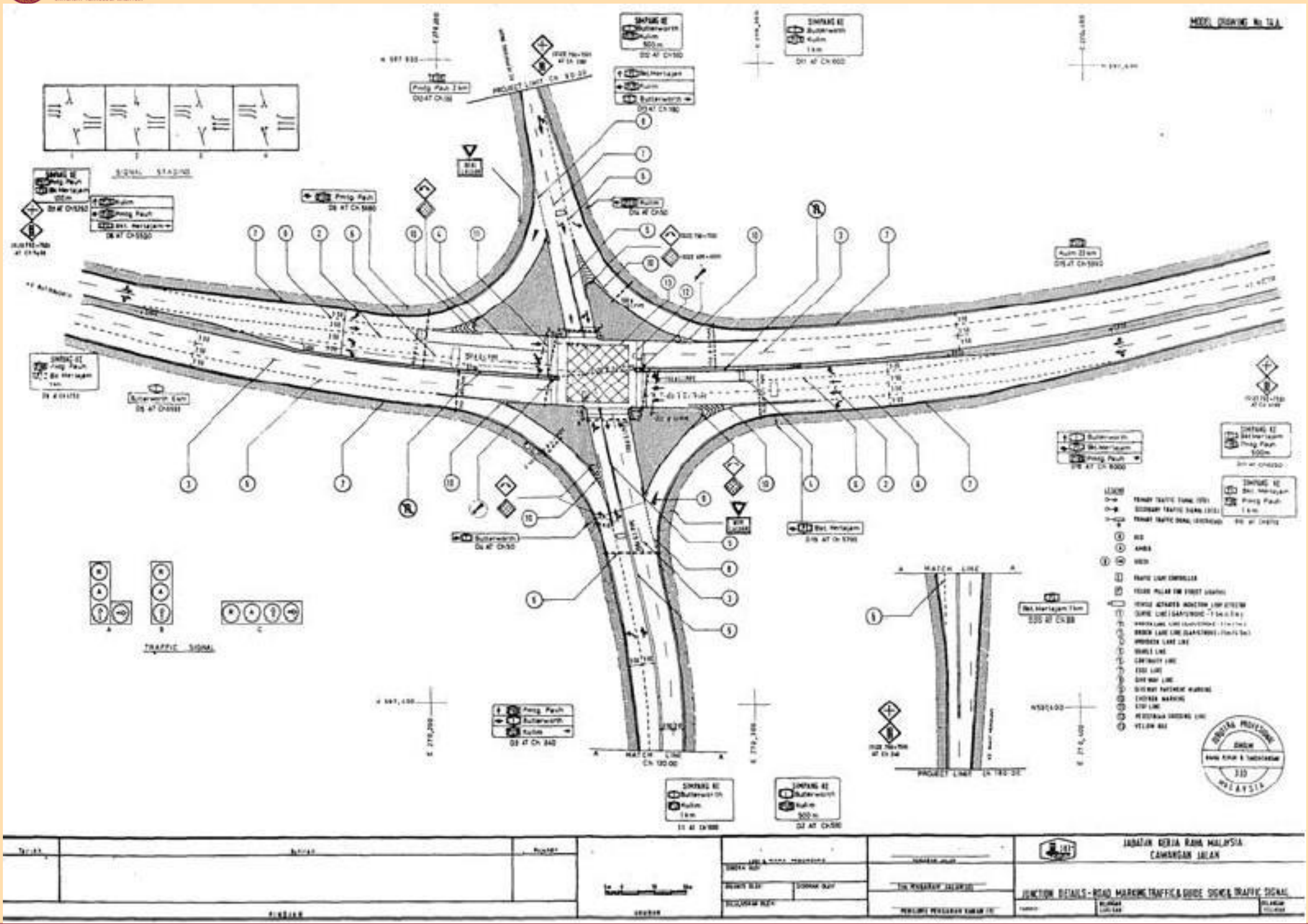
JUNCTION



SIGNAGE & MARKINGS




SIGNAL STAGING
TRAFFIC SIGNAL
JABATAN KERJA RAYA MALAYSIA
CAWANGAN JALAN
JUNCTION DETAILS - ROAD MARKING TRAFFIC & GUIDE SIGNS & TRAFFIC SIGNAL

PAP requirement in Road Design Report

Please write a proper report including all listed below (not limited to):

- Assumptions for traffic forecasting/generation (TIA, Traffic/trip generation) e.g. 10% of main traffic
- Complete sample calculation (e.g. intersection design, vertical and horizontal curves, pavement structural thickness, etc; the rest just tabulate the design values)

PAP requirement in Road Design Report

- Drawings to be submitted:
  1. road network with existing contour
  2. traffic circulation
  3. designed/proposed road level at intersections
  4. standard junctions with dimensions and traffic markings/signages
  5. complete main intersection design
  6. cross-sections for different ROW/hierarchy
  7. pavement structural thickness, and
  8. vertical and horizontal curves with chainages.

PAP requirement in Road Design Report

- Copy pages of references (table, requirement, figure) as attachment/put in report (highlighted)
- List of references