JABATAN KERJA RAYA MALAYSIA

REKABENTUK PERSIMPANGAN
GEOMETRIC STANDARD

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GEOMETRIC STANDARDS

1. Horizontal Alignment
2. Vertical Alignment
3. Sight Distance
    1. Sight Triangle
    2. Sight Distance For Approach
    3. Sight Distance For Departure
    4. Effect of Skew
    5. Effect of Grades
4. Right Turn Lanes
    1. Design Consideration
    2. Length Of Right Turn Lanes
    3. Width of Right Turn Lanes; same with thru lane or min 3m
    4. Seagull Island
    5. Central Island and Median Design

5. Left Turn Lanes
    1. Simple Left-Turn
    2. Separate Left-Turn lanes
        1. Design Speed of Left-Turn Lanes
        2. Radius for Separate Left-Turn Lanes
        3. Width of Left-Turn Lanes
6. Pavement Tapers
    1. Taper Length
    2. Types of Tapers
7. Auxiliary Lanes
    1. Deceleration Lanes
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    3. Width of Auxiliary Lanes; Desirably 3.5m, Min 3m

8. Islands and Opening
    1. Traffic Islands
    2. Median Islands
    3. Median Openings
9. Widening of Major Road
10. Minor Road Treatment
11. Shoulders
12. Crossfall and Surface Drainage
13. Weaving

1. Horizontal Alignment

- Right angle intersections
- Angle between two roads is 70 ° to 90°
- Improvement: realignment or staggered T-intersections
- Stop or Give Way sign should be provided on minor road of unsignalised T-intersections

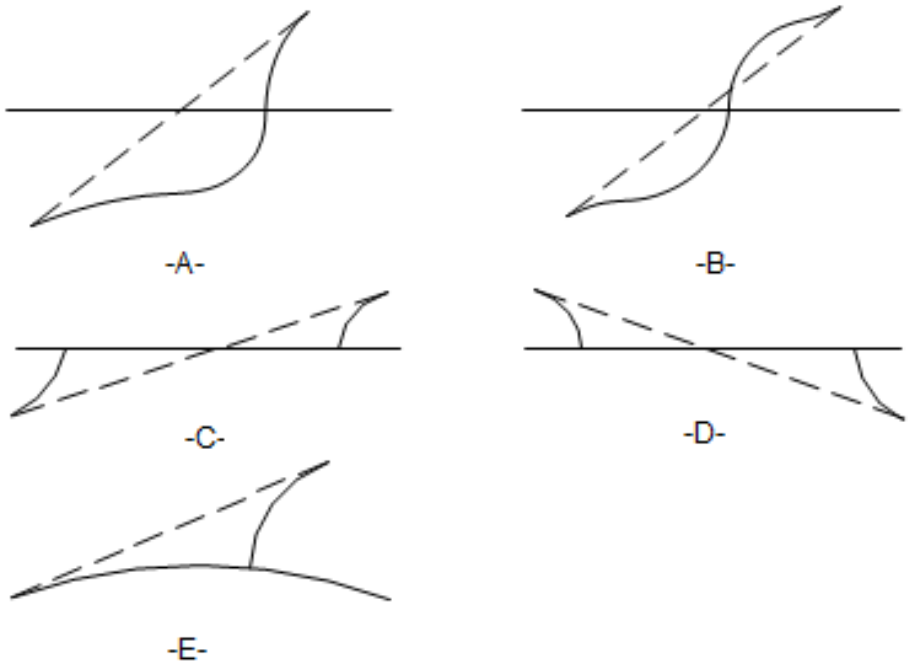


FIGURE 3.1 - REALIGNMENT VARIATIONS AT INTERSECTIONS

2. Vertical Alignment

- The gradient of the intersecting highways should be as flat as practicable
- Grades > 3% should be avoided

3. Sight Distance

- Two aspects to be considered for drivers passing through an intersections;
  - Sufficient unobstructed view to recognize potential conflicting traffic, traffic sign or signals
  - Sufficient sight distance to make safe departure after the vehicle has stopped at the stop line

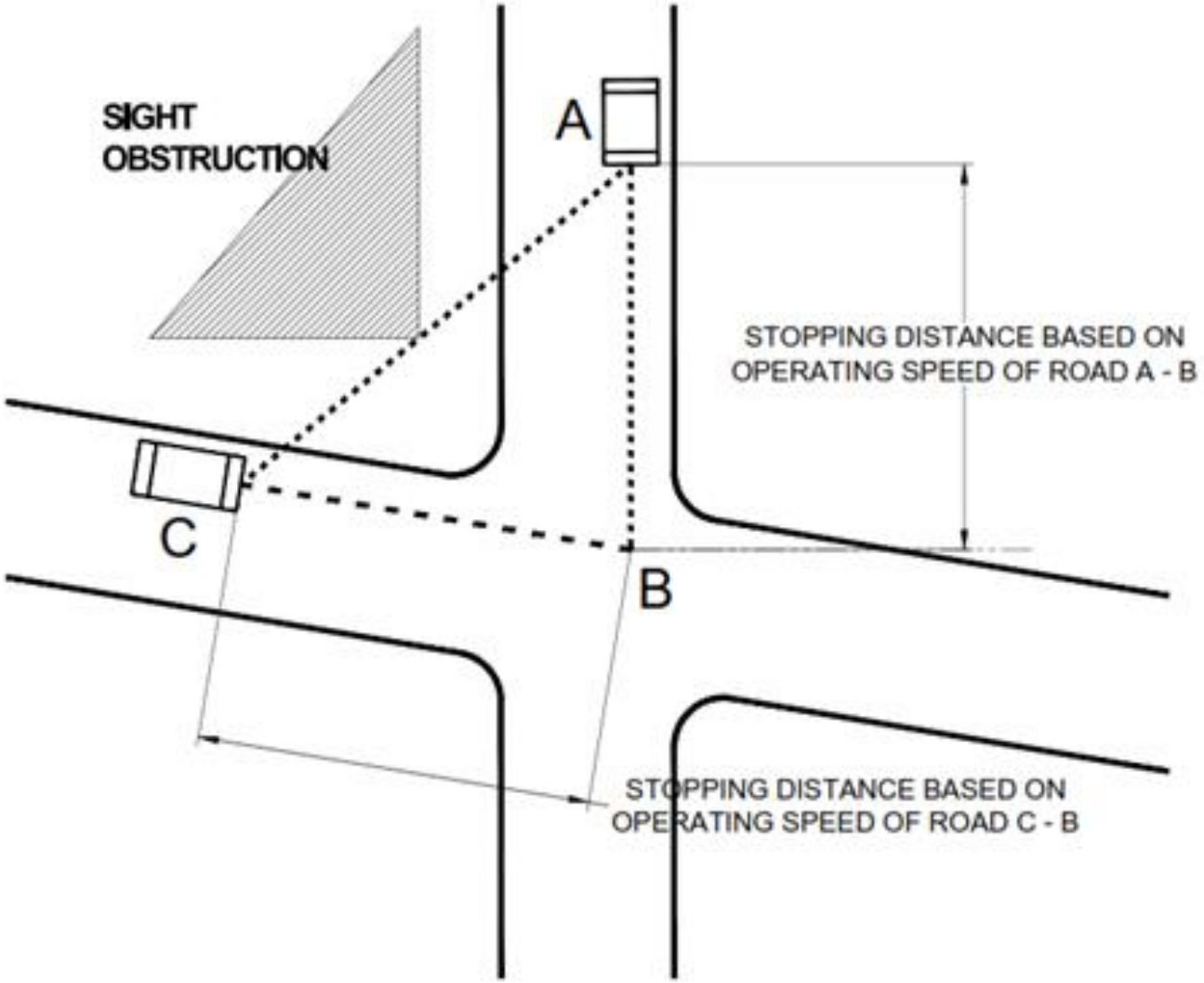
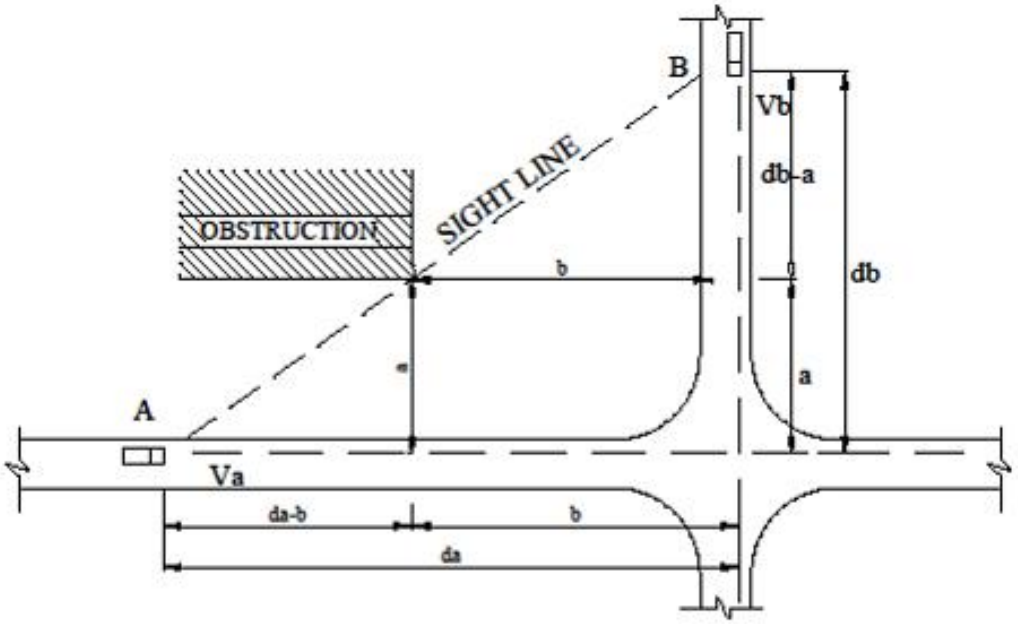
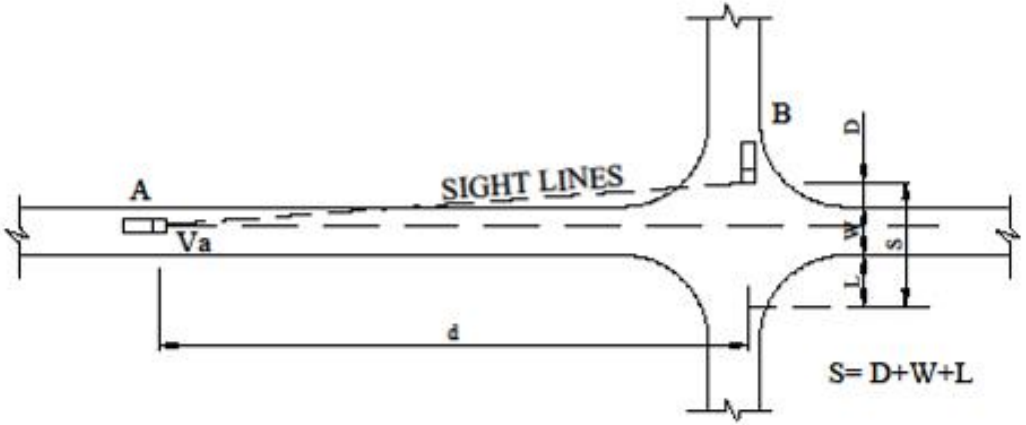


*FIGURE 3.2: INTERSECTION SIGHT TRIANGLE



NO STOP OR SIGNAL CONTROL AT INTERSECTION



STOP CONTROL ON MINOR ROAD

*TABLE 3.2: SIGHT DISTANCE FOR INTERSECTION APPROACH

Design Speed Of Major Road	Signal Control		Stop Control On Minor Road
(Km/h)	Rural (m)	Urban (m)	
100	480	370	260
80	350	260	170
60	240	170	105
50	190	130	80
40	140	100	55
30	100	70	35
20	60	40	20

Note: On The Major Roads Of Stop Controlled Intersections, The Stopping Sight Distances Given In latest Arahan Teknik (Jalan) 8/86 "A Guide To Geometric Design Of Roads" Must Be Satisfied.

- Sight distance for departure, d

$$d = 0.28V\,(J + ta)$$

where d = Min sight dist. (meters)

v = design speed of major road, km/h

J = sum of perception time and time required to shift to first gear, seconds

(assumed 2 seconds)

ta = time required to accelerate and traverse the distance S to clear the major road, seconds

(Figure 3-4)

- Value of ta can be read directly from Figure 3.4 for a given distance S in m.

$$S = D + W + L$$

where D = distance from near edge of pavement to front of stop vehicle

W = width of pavement along path of crossing vehicle

L = length of vehicle

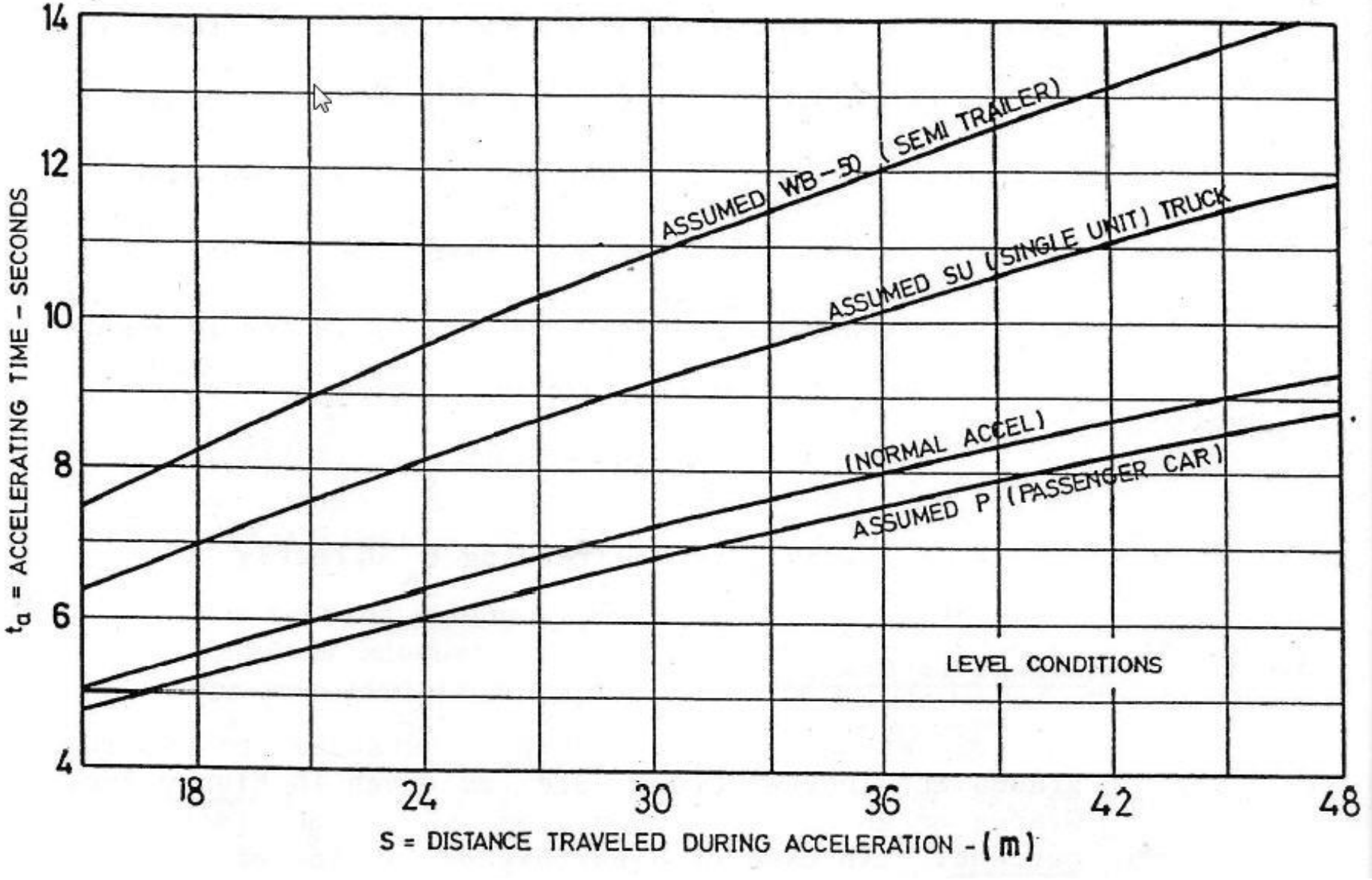


Figure 3-4: Sight Distance at Intersection Data On Acceleration From Stop

d= 0.28V (2 + ta), reading ta directly from Figure 3.4

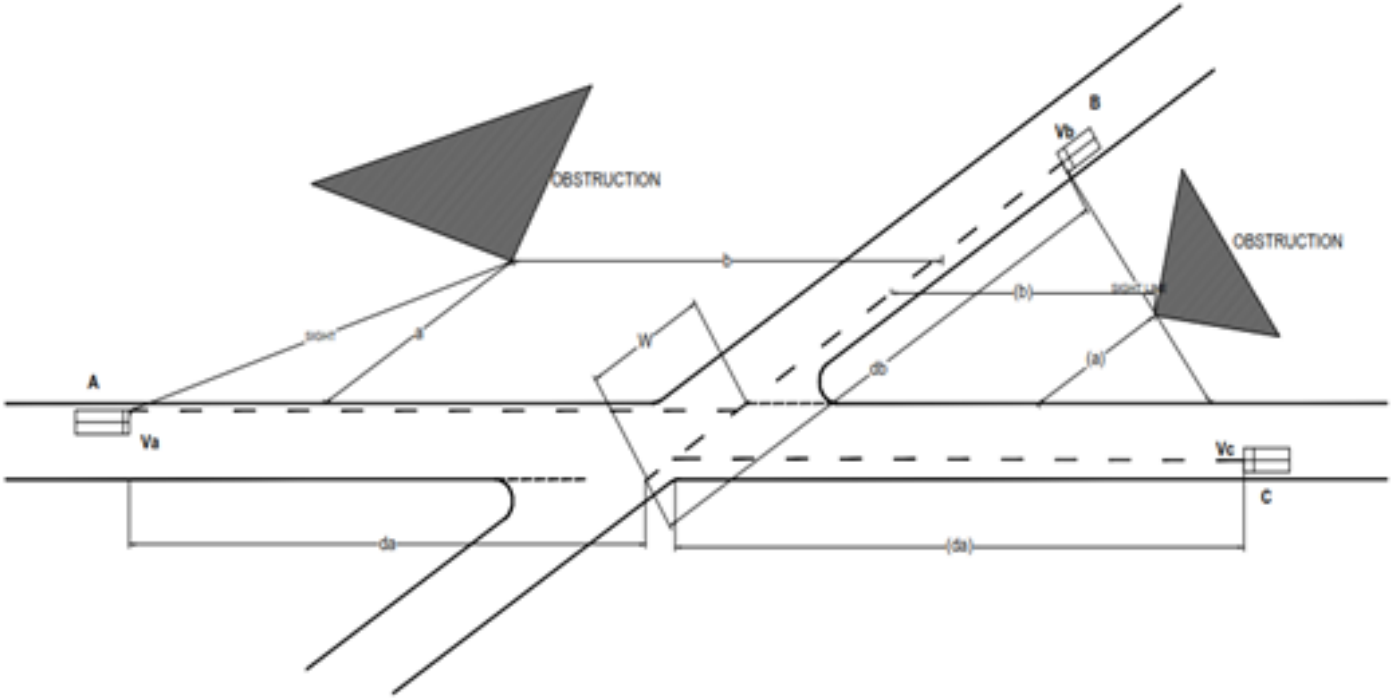


*FIGURE 3.5: SIGHT DISTANCE AT INTERSECTIONS EFFECT OF SKEW

*TABLE 3.3: EFFECT OF GRADE ON STOPPING SIGHT DISTANCE WET CONDITIONS

Design Speed. (Km/hr)	Correction In Stopping Distance – Metre					
	Decrease For Upgrades			Increase For Downgrades		
	3%	6%	9%	3%	6%	9%
30	-	-	3			3
40		3	3		3	6
50	-	3	6	3	6	9
60	3	6	9	3	9	15
80	6	9	-	6	15	-
100	9	15	-	9	24	-

*TABLE 3.4: CORRECTION FACTOR FOR THE EFFECT OF GRADE ON ACCELERATION TIME, TA

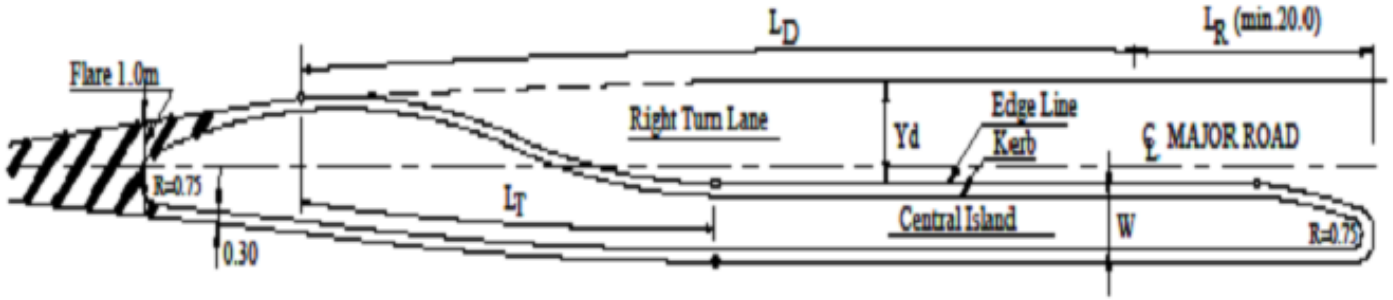
Design Vehicle	Minor Road Grade (%)				
	-4	-2	0	+2	+4
Passenger Cars (P)	O.7	0.9	1.0	1.1	1.3
Single Unit Trucks (SU)	0.8	0. 9	1.0	1.1	1.3
Semi-Trailers (WB - 15)	0.8	0.9	1.0	1.1	1.7

4. Right Turn Lanes

Should be considered in following cases;

1. Major road flow exceeds 600 vehicles/hr
2. At all intersections on divided urban roads with sufficiently wide median.
3. At all intersection on undivided urban roads where turning traffic is likely to cause unacceptable congestion and / or hazard

A) LAYOUT



B) LENGTH OF TAPER

$$LT = \frac{1}{3}\sqrt{Yd}$$

Where

Y = Design speed in km/h.

Yd = Width of right turn lane (m)

LT = May be rounded to the nearest multiple of 5m

For design of S-curve
See Figure:3-22

C) WIDTH OF CENTRAL ISLAND

	Yd (m)	W (m)		
		Pedestrian Refuge	Signal pedestal No pedestrians	No Signal or pedestrians
Desirable	3.5	2.50	2.50	2.50
Minimum	3.0	2.50	1.80	1.20

D) DECELERATION LENGTH, LD (m)

Gradient in %		Design speed in km/h						
		20	30	40	50	60	80	100
Uphill	4	20	28	41	54	72	108	153
	2	20	30	45	60	80	120	170
Level	0	20	30	45	60	80	120	170
Downhill	2	20	30	45	60	80	120	170
	4	20	34	53	72	96	144	204

NOTES

1. The length of the reservoir space shall be rounded upwards to the nearest multiple at 5m
2. Deceleration lengths for other gradients may be found by interpolation or up to 6% by extrapolation.
3. All dimensions are in m.

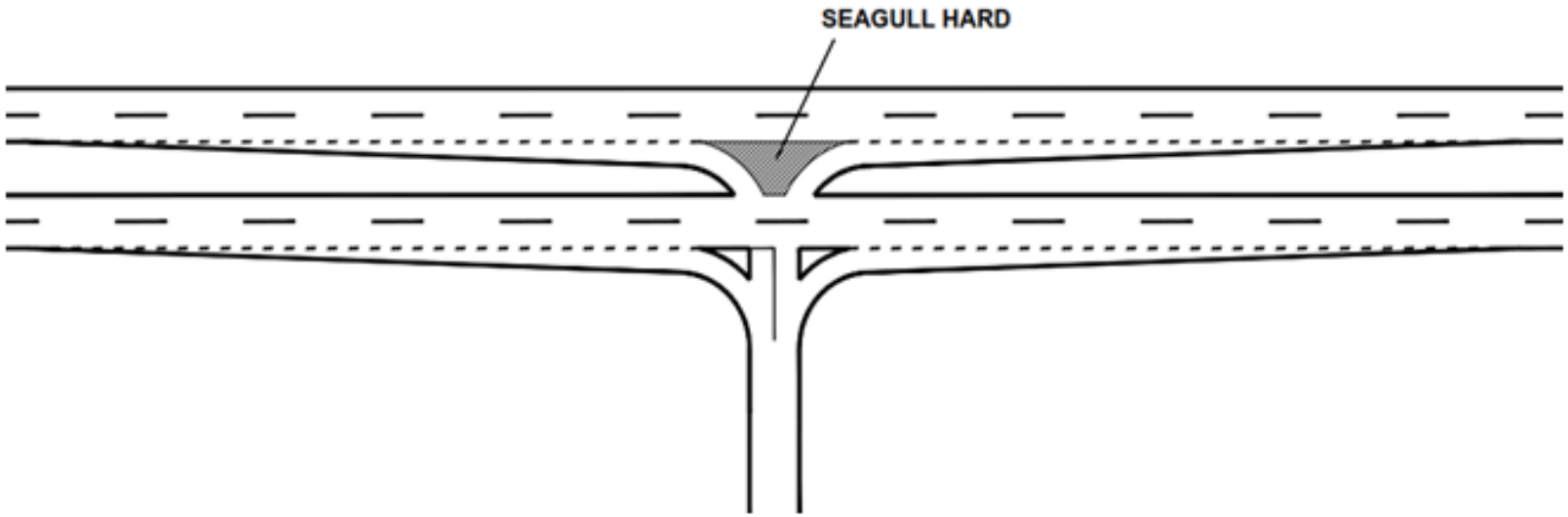


*FIGURE 3.9: SEAGULL ISLAND

Central Island and Median Design

1. Painted as cross hatched areas on pavement (ghost island)
2. Raised island surrounded by kerbs

Ghost Island

Kerbed Island

5. Left Turn Lanes

1. Simple left turns

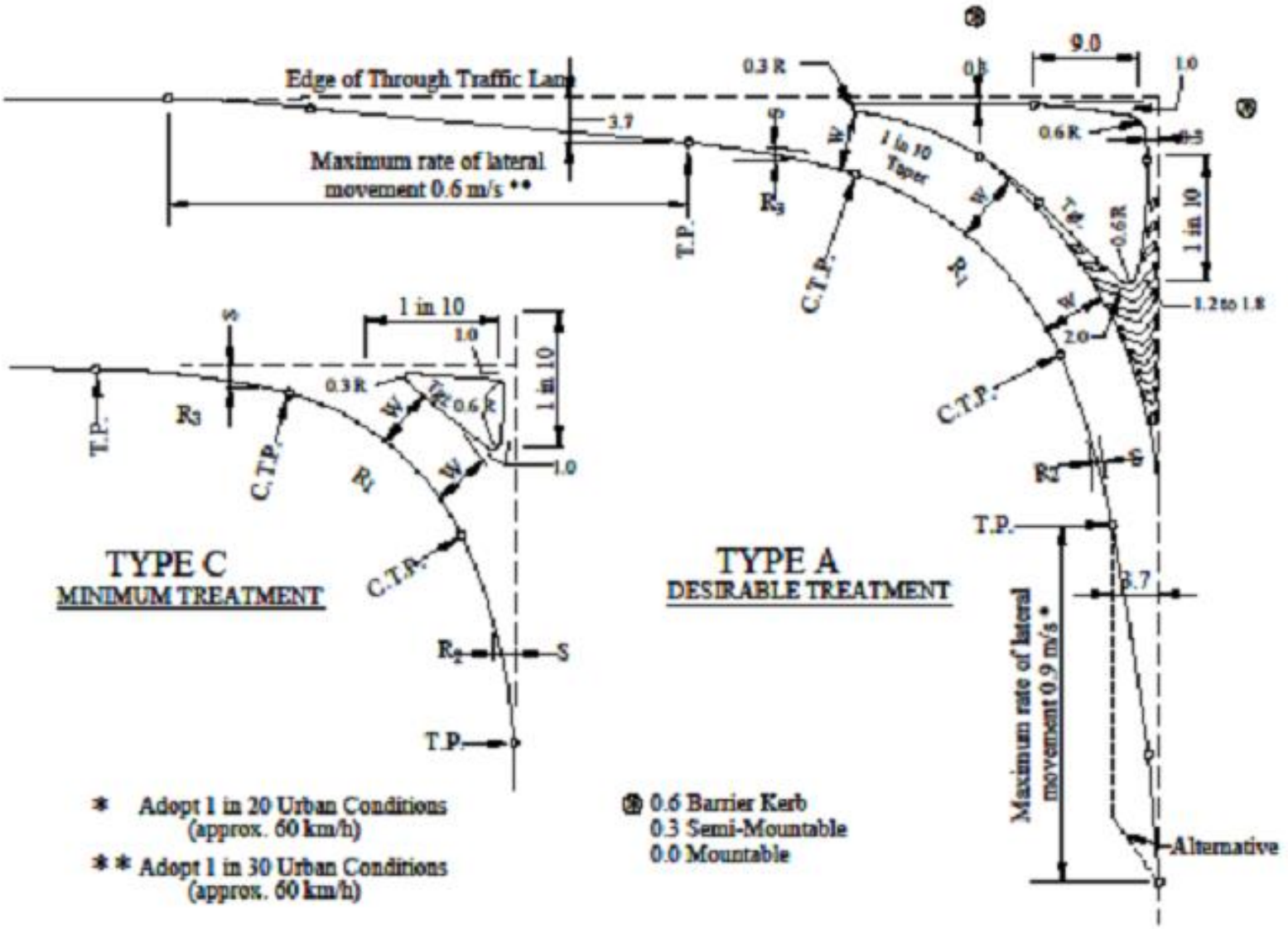
- Provided where traffic volumes are low
- Radius of kerb for left turn at Urban Intersection should be a minimum 6 m.

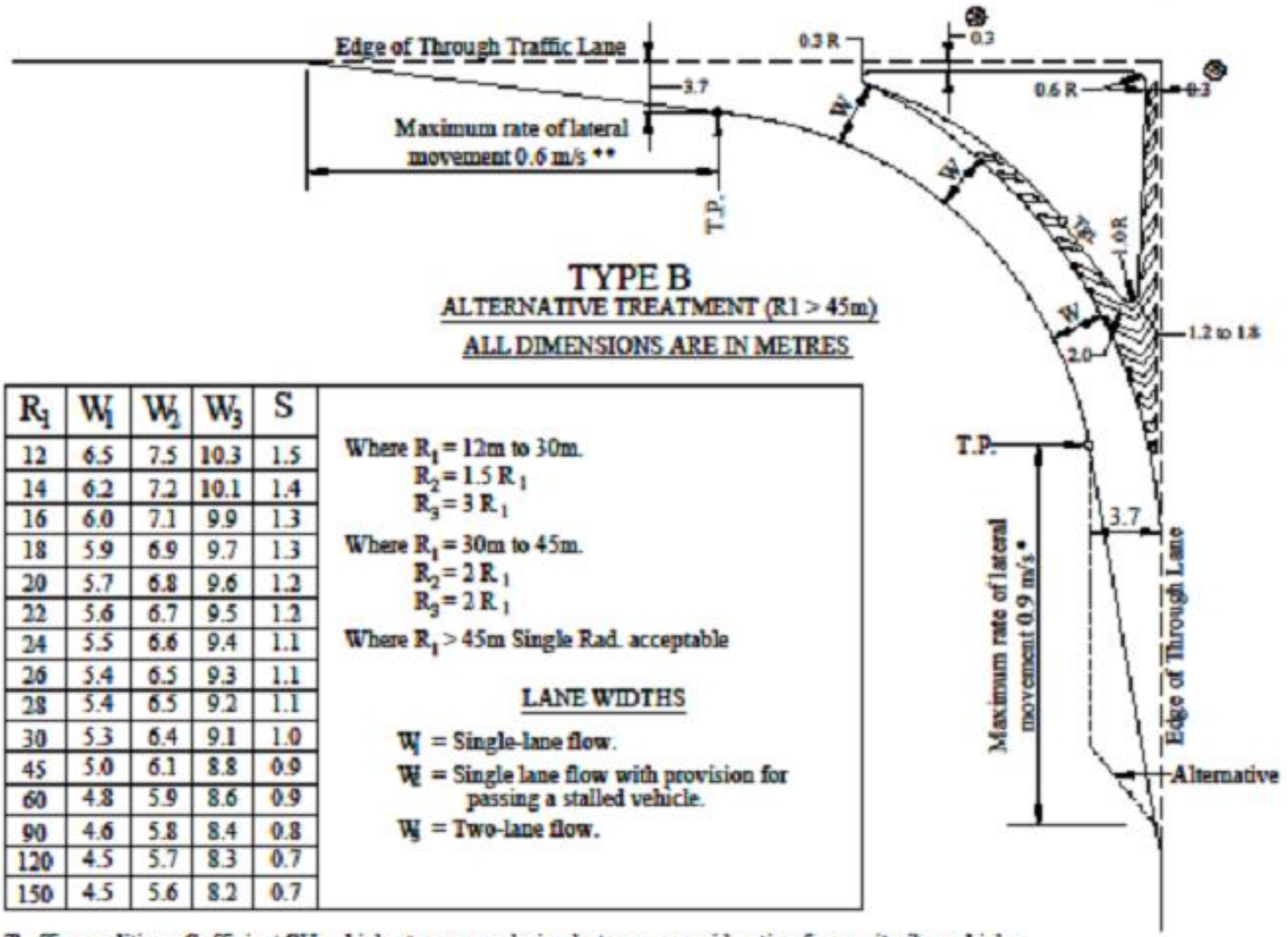
2. Separate Left Turn Lanes

- A corner island can be introduced to create a separate left-turn lane.

*TABLE 3.5: MINIMUM DESIGN SPEEDS FOR LEFT-TURN CHANNEL

Design Speed Of Approach Road (Km/h)	Minimum Design Speed Of Left-Turn Lanes (Km/h)
100	50
80	40
60	30
50	30
40	20
30	20
20	20


Edge of Through Traffic Lane
3.7
Maximum rate of lateral movement 0.6 m/s **
T.P.
C.T.P.
0.3 R
0.6 R
1 in 10 Taper
1 in 10
1.2 to 1.8
2.0
9.0
1.0
0.5
TYPE A
DESIRABLE TREATMENT
Maximum rate of lateral movement 0.9 m/s *
Alternative
TYPE C
MINIMUM TREATMENT
S
* Adopt 1 in 20 Urban Conditions (approx. 60 km/h)
** Adopt 1 in 30 Urban Conditions (approx. 60 km/h)
0.6 Barrier Kerb
0.3 Semi-Mountable
0.0 Mountable



TYPE B
ALTERNATIVE TREATMENT (R1 > 45m)

ALL DIMENSIONS ARE IN METRES

R_1	W_1	W_2	W_3	S
12	6.5	7.5	10.3	1.5
14	6.2	7.2	10.1	1.4
16	6.0	7.1	9.9	1.3
18	5.9	6.9	9.7	1.3
20	5.7	6.8	9.6	1.2
22	5.6	6.7	9.5	1.2
24	5.5	6.6	9.4	1.1
26	5.4	6.5	9.3	1.1
28	5.4	6.5	9.2	1.1
30	5.3	6.4	9.1	1.0
45	5.0	6.1	8.8	0.9
60	4.8	5.9	8.6	0.9
90	4.6	5.8	8.4	0.8
120	4.5	5.7	8.3	0.7
150	4.5	5.6	8.2	0.7

Where R_1 = 12m to 30m.
$R_2 = 1.5\ R_1$
$R_3 = 3\ R_1$

Where R_1 = 30m to 45m.
$R_2 = 2\ R_1$
$R_3 = 2\ R_1$

Where R_1 > 45m Single Rad. acceptable

LANE WIDTHS

W_1 = Single-lane flow.

W_2 = Single lane flow with provision for passing a stalled vehicle.

W_3 = Two-lane flow.

Traffic condition : Sufficient SU vehicles to govern design but some consideration for semitrailer vehicles.

Figure 3.10: Design of Separate Left-Turn Lanes

Scale : Not to scale

6. Pavement Tapers

Taper Length

The minimum lengths of pavement taper for diverging and merging movements can be computed by the formula:

$$Td = \frac{V}{3.6} \times \frac{Yd}{0.9}$$

$$Tm = \frac{V}{3.6} \times \frac{Ym}{0.6}$$

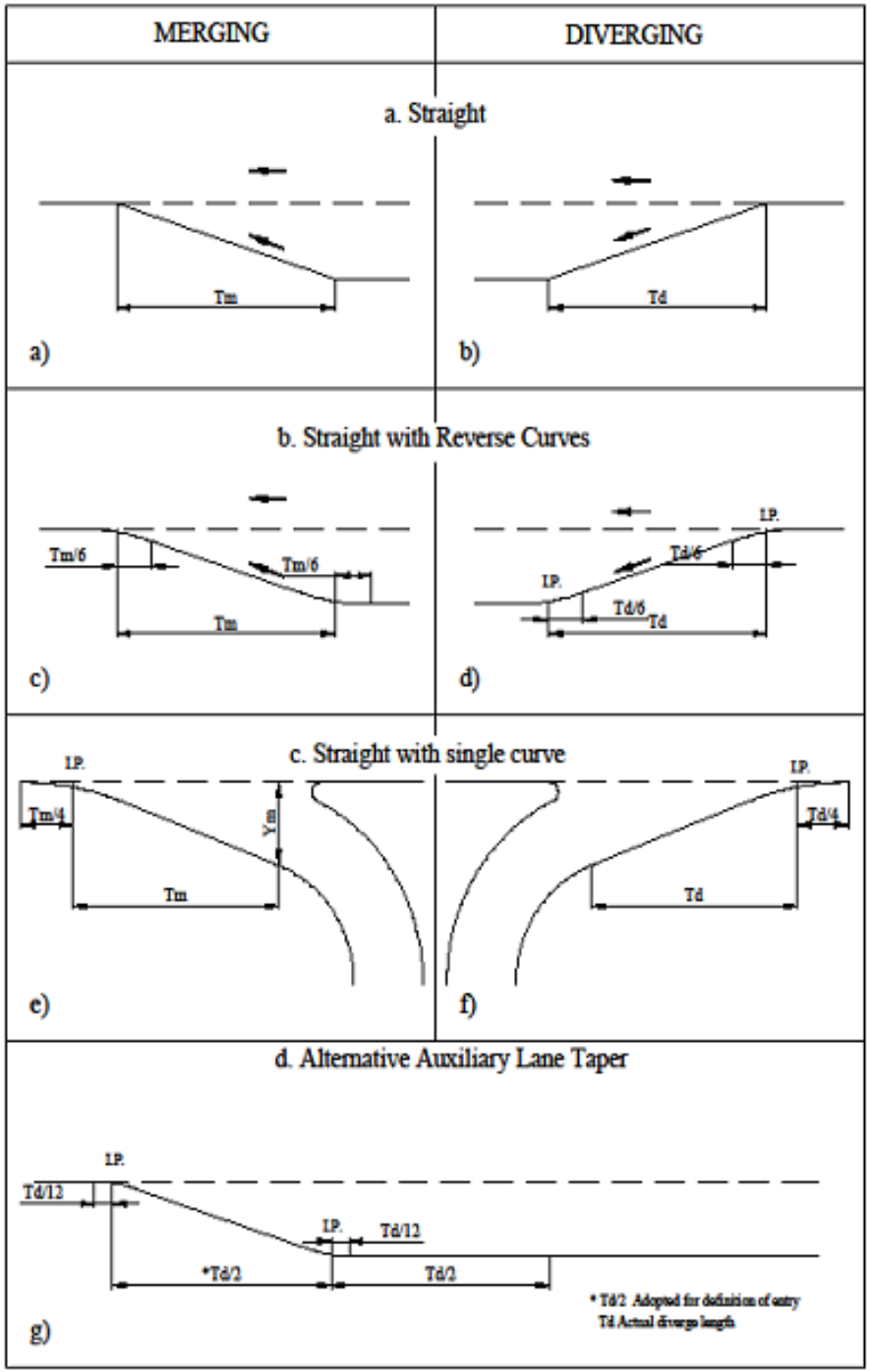
Where,

Td - Min length of pavement taper for diverging movements (m)

Tm - Min length of pavement taper for merging movements (m)

Yd - Lateral deflection of diverging traffic (m)

Yd - Lateral deflection of merging traffic (m)


MERGING
DIVERGING
a. Straight
Tm
Td
a)
b)
b. Straight with Reverse Curves
Tm/6
Tm/6
Tm
P.
Td/6
P.
Td/6
Td
c)
d)
c. Straight with single curve
P.
Tm/4
Ym
Tm
P.
Td/4
Td
e)
f)
d. Alternative Auxiliary Lane Taper
P.
Td/12
P.
Td/12
*Td/2
Td/2
* Td/2 Adopted for definition of entry
Td Actual diverge length
g)

7. Auxiliary Lanes

Design Speed of Approach Road (km/h)	Length* of Deceleration Lane – (m) (including length of tapered approach) Where design speed of exit curve (km/h) is.						
	0**	20	30	40	50	60	80
40	45	40	32	–	–	–	–
50	60	54	46	32	–	–	–
60	80	74	64	50	28	–	–
80	120	112	104	94	82	64	–
100	170	162	154	144	132	118	80

*Length for level grade (See Table 3.10 for Grade Correction)

**Length required when a vehicle decelerates to zero speed.

NOTE: Where the length of deceleration lane shown is less than the standard taper Td, Td should not be reduced.

TABLE 3.9 : LENGTH OF DECELERATION LANES

Grade	Ratio of Length on Grade to Length on Level	
	Upgrade	Downgrade
0 – 2%	1.0	1.0
3 – 4%	0.9	1.2
5 – 6%	0.8	1.35

TABLE 3.10 : CORRECTION FOR GRADE

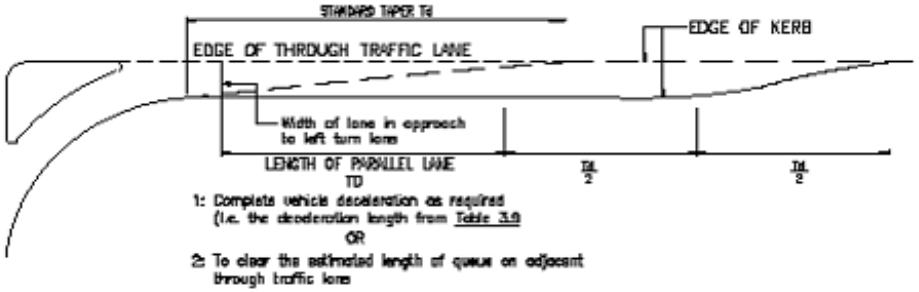


FIGURE 3.13 : TREATMENT IN APPROACH TO LEFT-TURNS

8. Islands and Median

1. Traffic Island

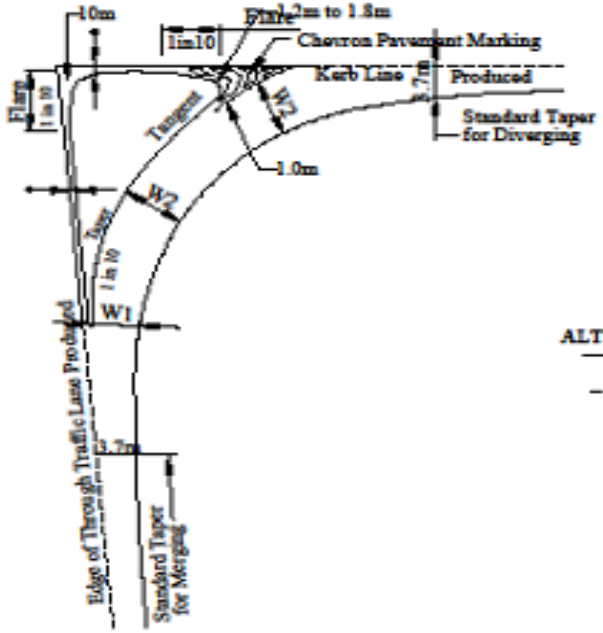
- In Urban area, raised island area > 8 meter square
- In Rural area, raised island area > 50 meter square

2. Median Island

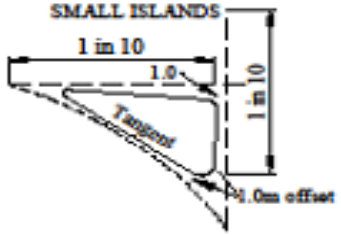
- To separate opposing traffic stream
- Provide refuge for pedestrian crossing
- Reduce conflicting road crossing points

DESIRABLE LAYOUT FOR CORNER ISLANDS

Where standard pavement tapers can be provided and lane width is W2



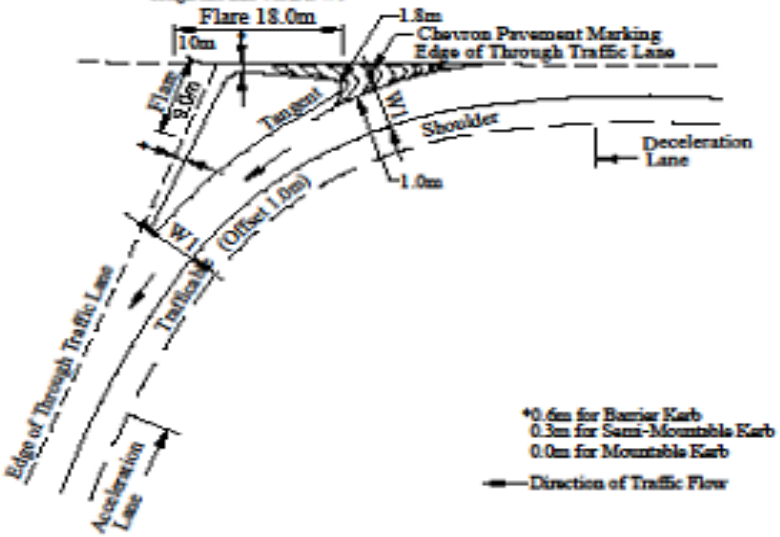
ALTERNATIVE TREATMENTS FOR SMALL ISLANDS



ALTERNATIVE LAYOUT FOR CORNER ISLANDS

DESIRABLE LAYOUT FOR CORNER ISLANDS

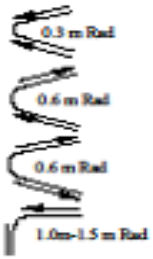
For Rural or Semi-Urban locations where turning speed is basis for design and lane width is W1



*0.6m for Barrier Kerb
0.3m for Semi-Mountable Kerb
0.0m for Mountable Kerb

Direction of Traffic Flow

MINIMUM RADIUS AT ENDS OF TRAFFIC ISLANDS AND MEDIANS



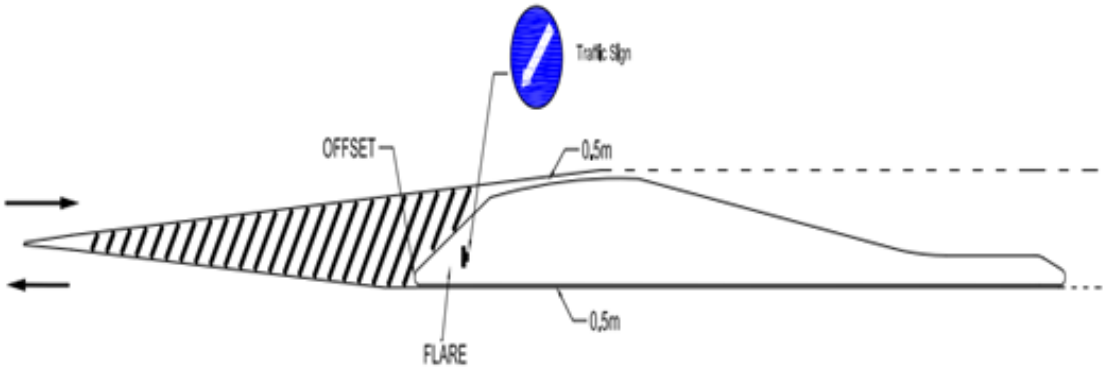


*FIGURE 3.16: OFFSET TO MEDIAN ISLAND

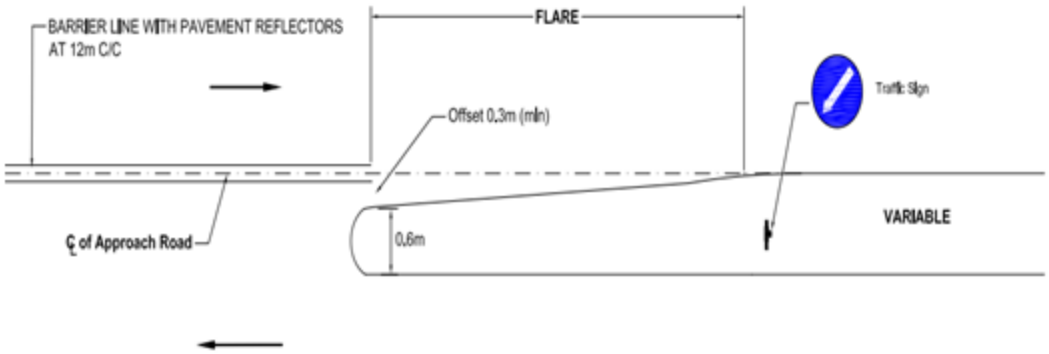


*FIGURE 3.17: END TREATMENT FOR NARROW MEDIAN

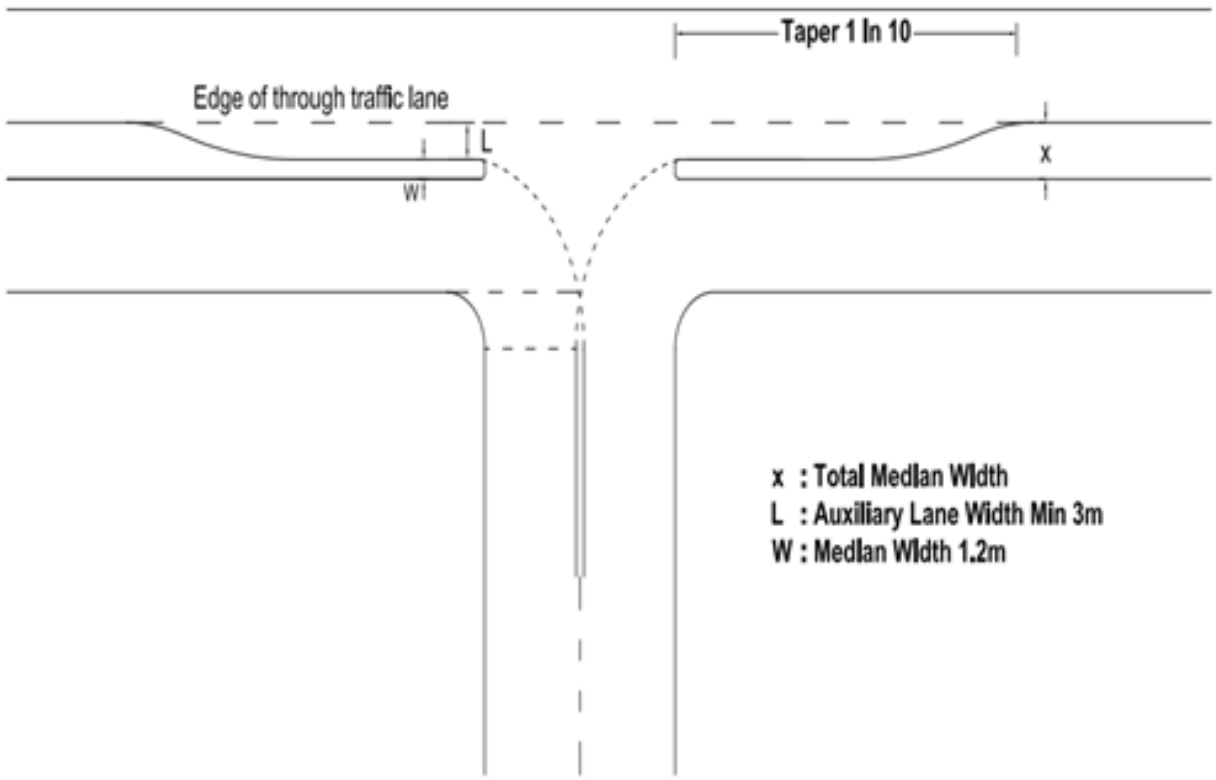
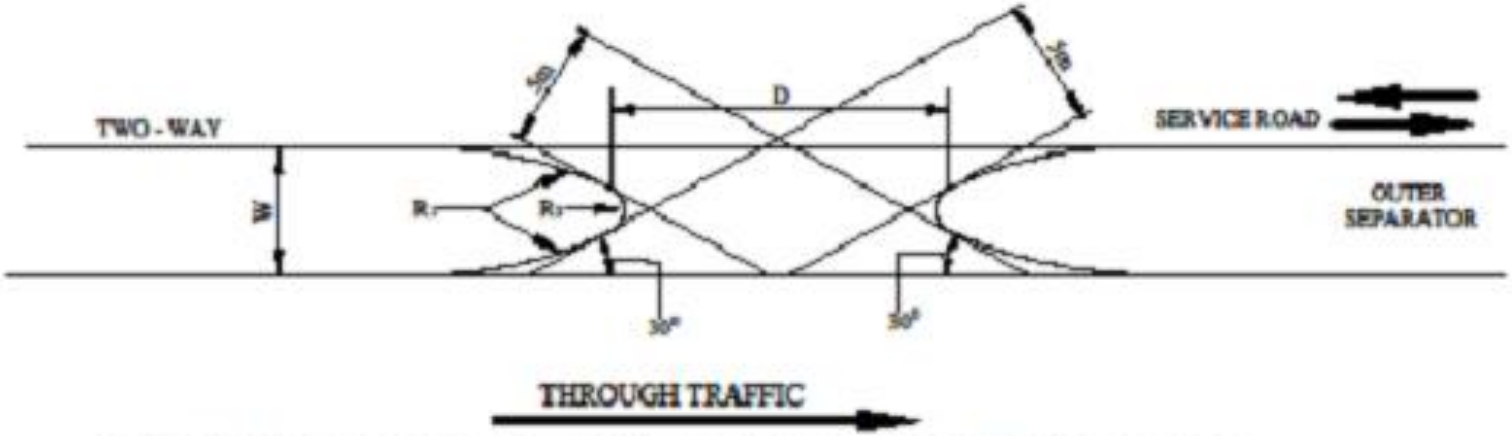


*FIGURE 3.20: MEDIAN OPENING



TWO-WAY OPENING BETWEEN THROUGH ROAD AND SERVICE ROADS

Radius		
Outer Separator Width W (m)	R_1 (m)	R_2 (m)
5-10	15	0.2W
11-15	23	0.2W
16-25	30	0.2W

Note:-

Two way opening only applicable for low speed ie 60km/h

10. Minor Road Treatment

***TABLE 3.13: MINOR ROAD TREATMENT**

a) Rural Area

Minor Road					
Highway	Primary Road	Secondary Road	Minor Road		
C	C	F	F/N	Highway	Major Road
	C/F	F	N	Primary Road	
		F/N	N	Secondary Road	
			N	Minor Road	

* Normally at-grade intersection should not be adopted

b) Urban Area

Minor Road				
Arterial	Collector	Local Street		
C	C/F	F/N	Arterial	Major Road
	F	N	Collector	
		N	Local Street	

Where two alternatives are given, traffic volume should be taken into account for the selection

C = Channelised

F = Flared

N =NoTreatment

11. Shoulders

Shoulder widths in general shall remain unchanged but may be reduced.

12. Crossfall and Surface Drainage

- Crossfall of thru lane of major road shall remain unchanged thru the intersections.
- Superelevation of corner lanes in connection with triangular islands on the minor road shall in general not exceed 6 percent.

13. Weaving

- A weaving section is a road segment where the pattern of traffic entering and leaving at contiguous points of access results in vehicle paths crossing each other.
- Traffic through a weaving section consists of weaving traffic and non-weaving traffic.

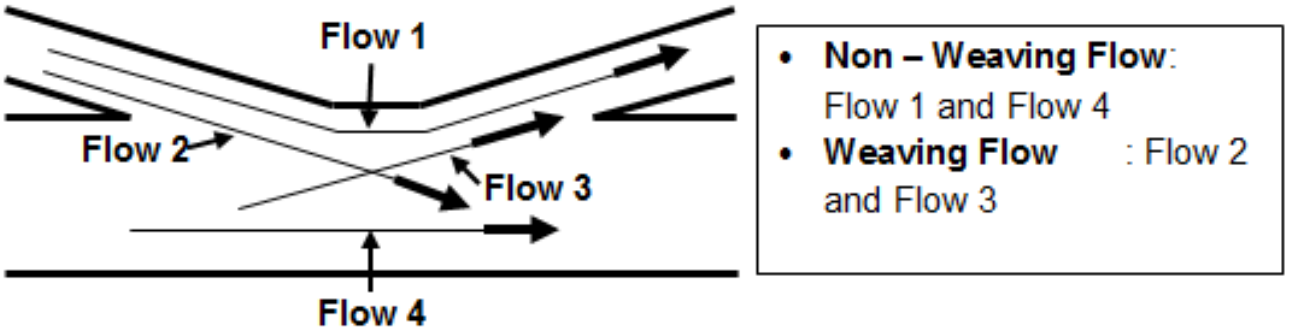


FIGURE 3.24: TERM USED WEAVING

Source: Design Manual for Roads and Bridges Volume 6 Section 2 Part 1 TD 22/06- Figure 2/9

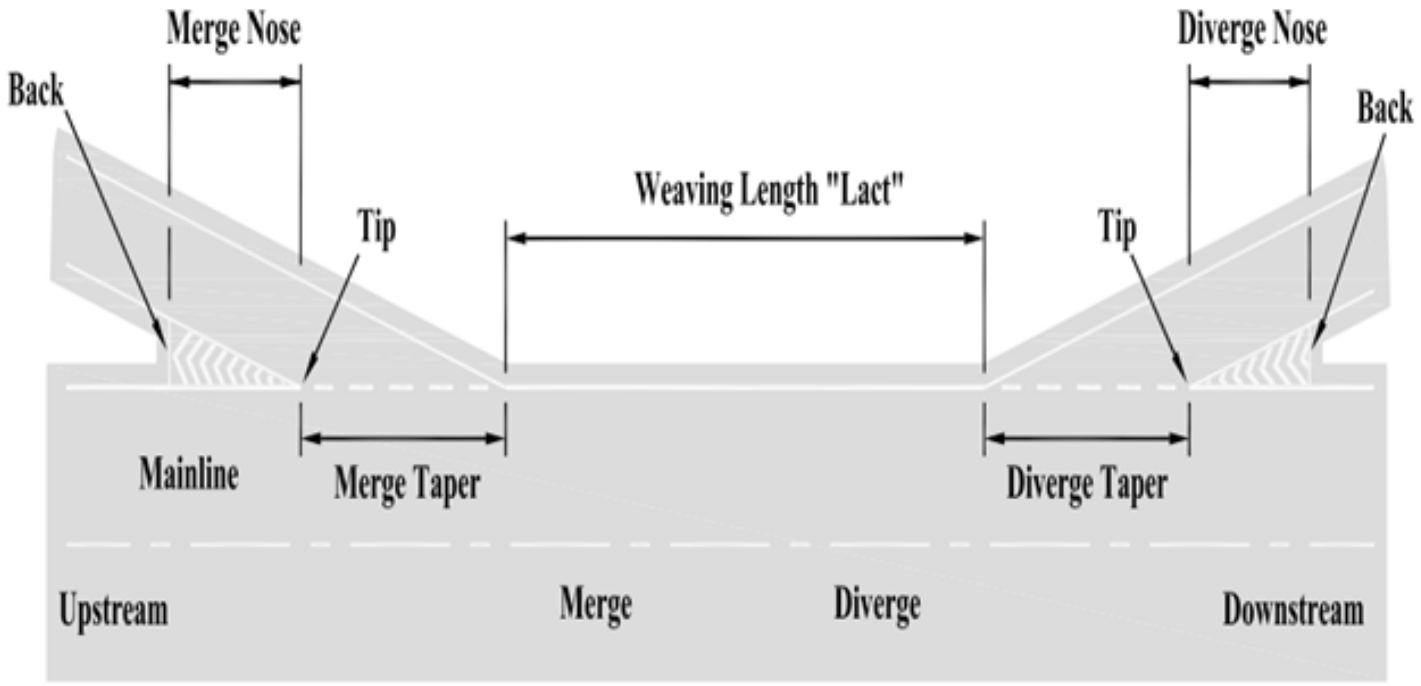
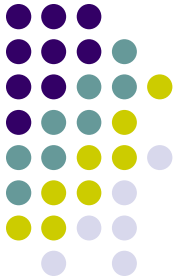


FIGURE 3.25: DEFINITION OF TERMS USED IN WEAVING AND MEASUREMENT OF WEAVING LENGTH FOR TAPER AND AUXILIARY LANE LAYOUTS

Source: Design Manual for Roads and Bridges Volume 6 Section 2



THANK YOU