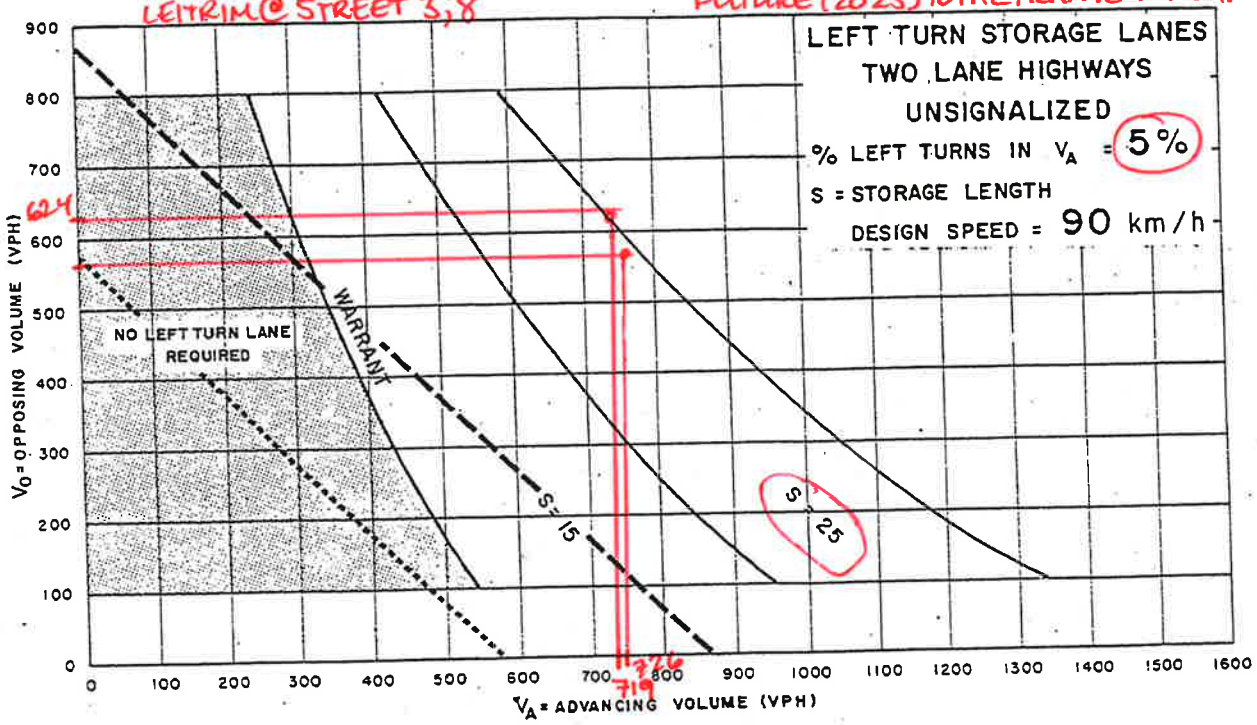
LEITRIM @ STREET 3;8

FUTURE (2025) TOTAL TRAFFIC - PM PEAK



TRAFFIC SIGNALS MAY BE WARRANTED IN RURAL AREAS OR URBAN AREAS WITH RESTRICTED FLOW

TRAFFIC SIGNALS MAY BE WARRANTED IN "FREE FLOW" URBAN AREAS

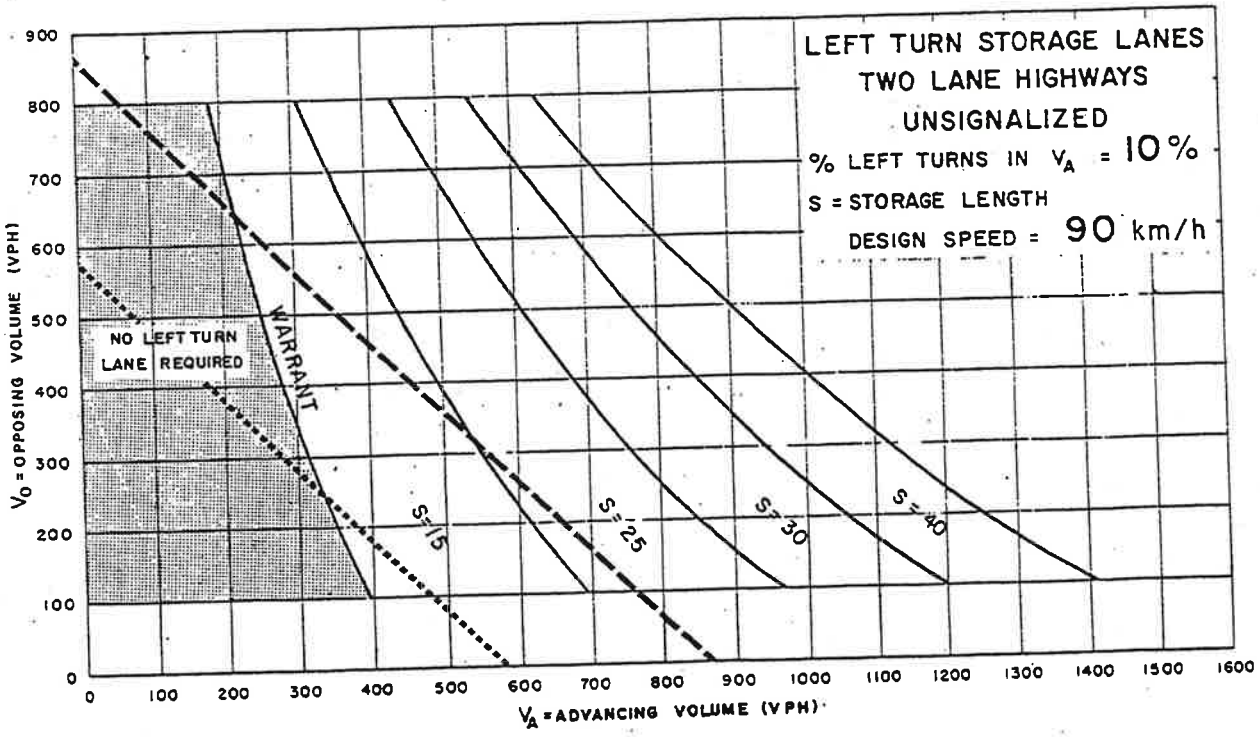
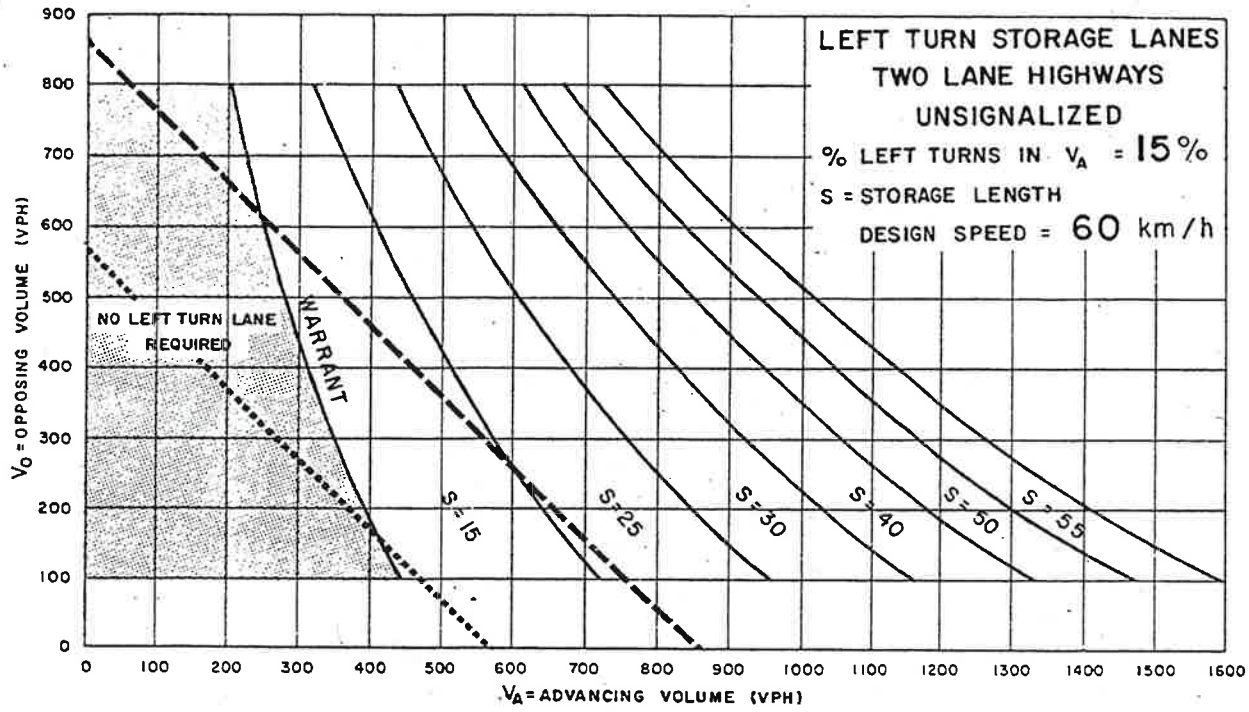


Figure EA-18


LEFT TURN STORAGE LANES
TWO LANE HIGHWAYS
UNSIGNALIZED
% LEFT TURNS IN V_A = 15%
S = STORAGE LENGTH
DESIGN SPEED = 60 km/h
NO LEFT TURN LANE REQUIRED
WARRANT
S=15
S=25
S=30
S=40
S=50
S=55
V_O = OPPOSING VOLUME (VPH)
V_A = ADVANCING VOLUME (VPH)
TRAFFIC SIGNALS MAY BE WARRANTED IN RURAL AREAS OR URBAN AREAS WITH RESTRICTED FLOW
TRAFFIC SIGNALS MAY BE WARRANTED IN "FREE FLOW" URBAN AREAS

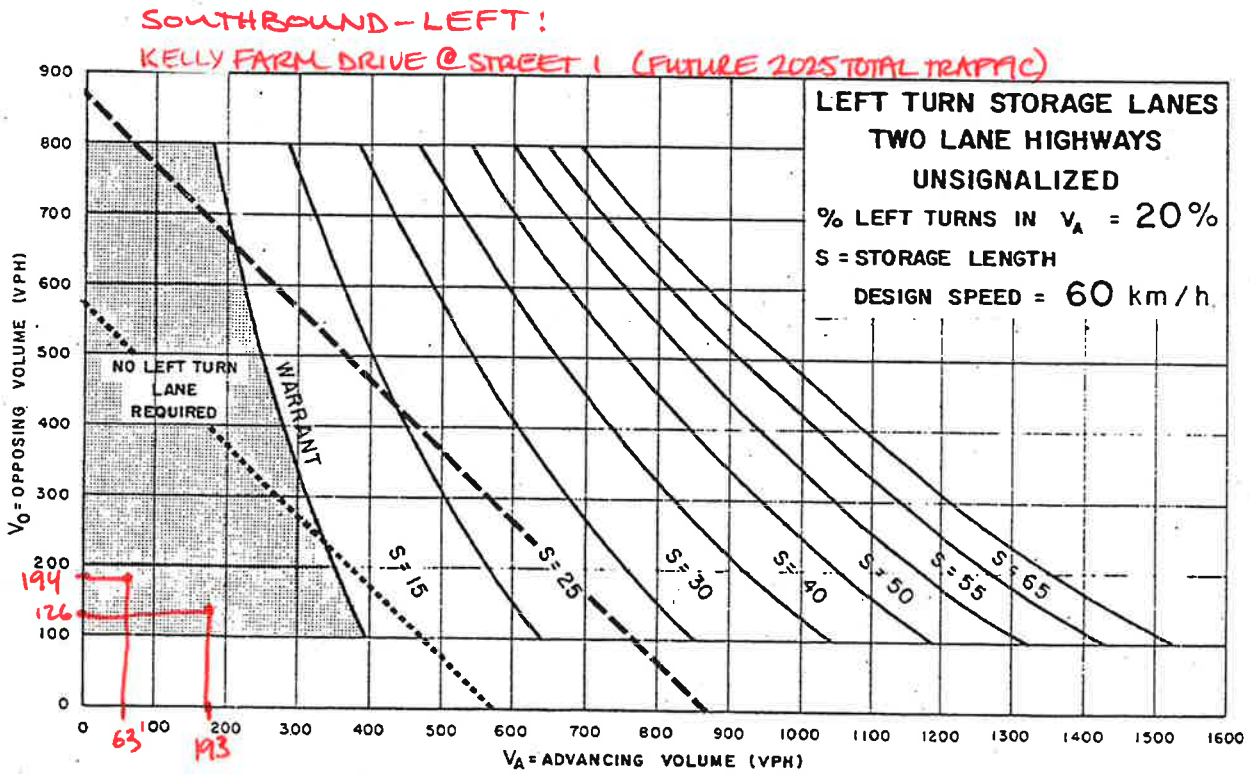

SOUTHBOUND - LEFT!
KELLY FARM DRIVE @ STREET 1 (FUTURE 2025 TOTAL TRAFFIC)
LEFT TURN STORAGE LANES
TWO LANE HIGHWAYS
UNSIGNALIZED
% LEFT TURNS IN V_A = 20%
S = STORAGE LENGTH
DESIGN SPEED = 60 km/h
NO LEFT TURN LANE REQUIRED
WARRANT
S=15
S=25
S=30
S=40
S=50
S=55
S=65
194
126
63
193
V_O = OPPOSING VOLUME (VPH)
V_A = ADVANCING VOLUME (VPH)

Figure EA-7

IBI GROUP	PROJECT:	PROJECT NO.:	SHEET: 1 OF:
	CLIENT:	PREPARED BY:	DATE:
	DESCRIPTION:	CHECKED BY:	OTHER:

AUXILIARY LANE ANALYSIS - FUTURE (2025) TOTAL TRAFFIC

- LEITRIM ROAD + KELLY FARM DRIVE (SIGNALIZED)

95TH PERCENTILE QUEUE LENGTH:

	AM PEAK	PM PEAK
EASTBOUND - RIGHT	1.8m	4.8m
WESTBOUND - LEFT	5.6m	16.3m
NORTHBOUND - LEFT	22.4m	15.1m

CITY OF OTTAWA QUEUE LENGTH CALCULATION:

$$\text{STORAGE} = \left[\frac{(\text{LEFT-TURNING VOLUME}) \times (\text{VEHICLE LENGTH})}{(\#\text{ OF CYCLES PER HOUR})}\right] \times 1.5$$

	AM PEAK	PM PEAK
WESTBOUND - LEFT	8.0m	18.6m
NORTHBOUND - LEFT	24.1m	15.2m

- BANK STREET + ROTARY WAY/STREET 1 (SIGNALIZED)

95TH PERCENTILE QUEUE LENGTH:

	AM PEAK	PM PEAK
EBL	5.2m	3.9m
WBL	4.4m	3.4m
NBL	1.5m	3.2m
SBL	7.7m	16.8m

CALCULATED QUEUE LENGTH:

	AM PEAK	PM PEAK
EBL	4.2m	2.5m
WBL	3.2m	1.9m
NBL	1.1m	4.5m
SBL	8.7m	31.5m

IBI GROUP	PROJECT:	PROJECT NO.:	SHEET: 2 OF:
	CLIENT:	PREPARED BY:	DATE:
	DESCRIPTION:	CHECKED BY:	OTHER:

- ALBION ROAD + LEITRIM ROAD (SIGNALIZED)

95TH PERCENTILE QUEUE LENGTH:

	AM PEAK	PM PEAK
EASTBOUND-LEFT	50.6m	44.8m
WESTBOUND-LEFT	16.9m	65.7m
NORTHBOUND-LEFT	14.8m	32.9m
SOUTHBOUND-LEFT	25.3m	27.7m

CALCULATED QUEUE LENGTH:

	AM PEAK	PM PEAK
EBL	30.3m	28.7m
WBL	12.8m	39.9m
NBL	24.0m	23.1m
SBL	13.1m	32.0m

- BANK STREET + LEITRIM ROAD (SIGNALIZED, WITH NEW 2x EBL)

95TH PERCENTILE QUEUE LENGTH:

	AM PEAK	PM PEAK
EASTBOUND-LEFT	82.8m	37.1m
WESTBOUND-LEFT	36.4m	70.7m
NORTHBOUND-LEFT	13.2m	18.3m
SOUTHBOUND-LEFT	33.2m	33.5m

CALCULATED QUEUE LENGTH:

	AM PEAK	PM PEAK
* EBL	160m (88.0m)	76.0m (41.8m)
WBL	33.6m	69.0m
NBL	15.8m	13.3m
SBL	35.4m	53.2m

*DOUBLE-LEFT - ASSUME 55/45 SPLIT BETWEEN LANES.

E.7 OPEN THROAT WITH AUXILIARY LANES

Tapers and/or additional lanes may be provided for through and turning movements at simple open throat intersections thereby improving the capacity.

E.7.1 RIGHT TURN TAPER

To facilitate right turns from a main highway onto a minor local road such as a township road, having a 'Cross' or 'T' intersection treatment, a 60 m taper may be added, as shown in Figures E7-1 and E7-2. This taper is not added in every case. A factor such as the gravel soilage justifies the addition of a 60 m taper. However the 60 m taper is of sufficient length for deceleration, where the operating speed is 60 km/h or less. For speeds greater then 60 km/h, the deceleration of the turning vehicles will start on the through lane. Where the turning vehicles significantly impede the through traffic flow, consideration should be given to the design as outlined in Section E.7.2.

At cross intersections a 30 m recovery taper with a 1.5m offset should be applied beyond the intersection when a right turn taper is used on a two lane highway, as shown in Figure E7-2. This enables vehicles on the main highway to pass standing left turning vehicles and safely return to the through lane.

The 30 m taper is to be used only on two lane highways. It is not required on four lane highways, at 'T' intersections or where the standard left turn lane has been provided.

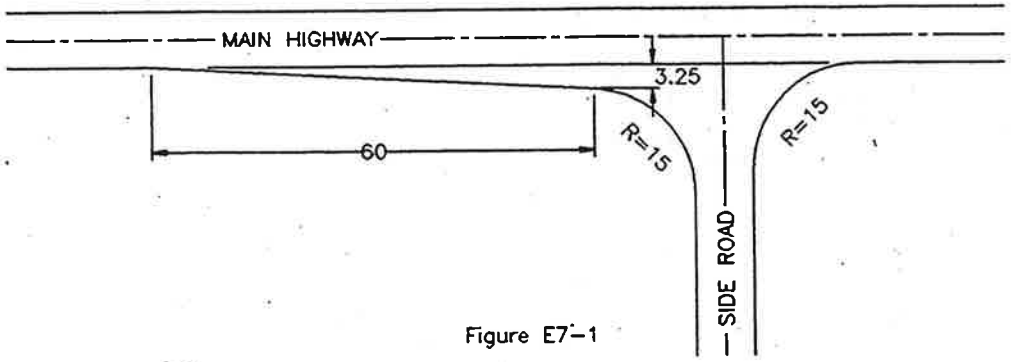


Figure E7–1

Right Turn Taper Lane Design at 'T' Intersections

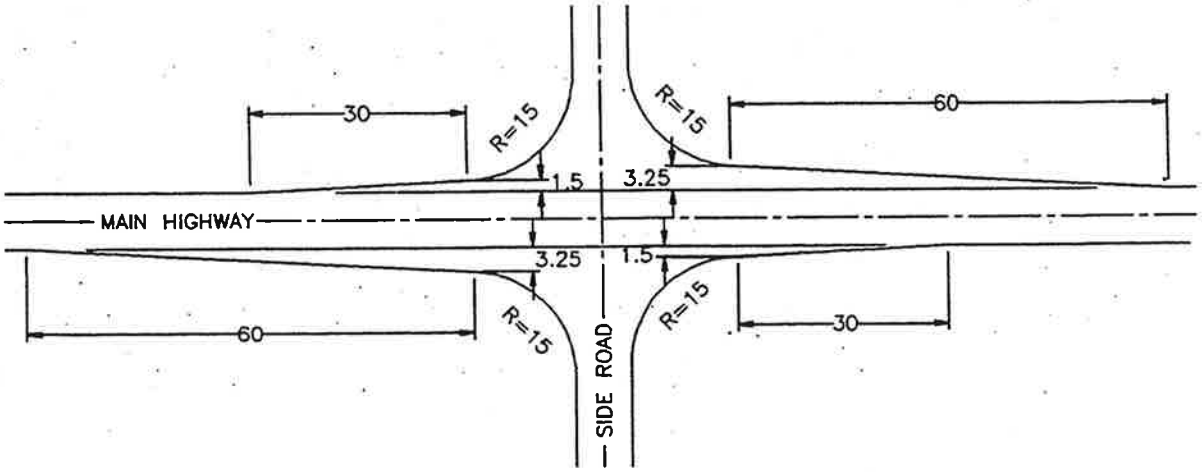


Figure E7–2

Right Turn Taper Lane Design at 'Cross' Intersections

E.7.2 RIGHT TURN TAPER WITH PARALLEL LANE

When the volume of right turning vehicles is such that it creates a hazard and reduces capacity at an intersection, or when the volume approaches the channelization criteria, as outlined in Sub-Chapter E.8, consideration should be given to the provision of a deceleration lane in the form of a taper and parallel lane for the right turning traffic, as shown in Figure E7-3.

The lengths of the taper and the parallel lane for various design speeds are given in Table E7-1. The taper length is derived from design values calculated at a 3 s lane change criterion for the appropriate operating speed.

For grades greater than 2%, the length of deceleration lane should be corrected according to the factors shown in Table E7-2. The correction is applied by multiplying the total deceleration lane by the appropriate factor. The resultant deceleration length will comprise the total deceleration lane. The length of taper remains as shown in Table E7-1.

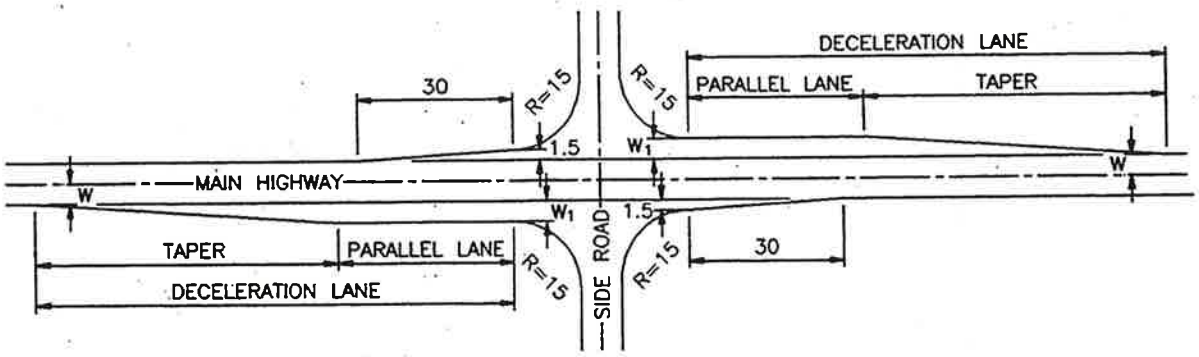


Figure E7–3

Right Turn Taper with Parallel Deceleration Lane Design

Highway Design Speed (km/h)	Length of Taper (m)	Length of Parallel Lane (m)	Total Length of Deceleration Lane (m)
50	40	20	60
60	50	30	80
70	60	45	105
80	70	60	130
90	75	70	145
100	80	85	165
110	85	100	185
120	90	110	200

Table E7-1

Right Turn Taper with Parallel Deceleration Lane Lengths
Flat Grades 2% or Less

E.9 LEFT TURN LANES; UNSIGNALIZED INTERSECTIONS

POLICY

WHEN THE NUMBER OF LEFT TURNING VEHICLES AT INTERSECTIONS IS SUCH THAT IT CREATES A HAZARD AND REDUCES CAPACITY, CONSIDERATION SHOULD BE GIVEN TO THE PROVISION OF A SEPARATE LEFT TURN LANE DESIGN, CONSISTING OF A DECELERATION LANE AND A LEFT TURN STORAGE LANE.

The addition of a left turn lane will facilitate the through traffic flow on the by-pass lanes.

The deceleration lane is comprised of a parallel lane with taper and varies in length according to the design speed and the grade of the highway. The deceleration length is equal to the length of the parallel lane plus 2/3 of the length of the taper. See Figure E9-1. The application of the left turn lane taper results in a deflection of the through traffic lane. However, this can be minimized or softened by the use of flat curves at the beginning and end of tapers.

For deceleration lane lengths see Table E9-1.

The left turn storage lane requirements for two-lane, four-lane divided and undivided highways are based on:

- volume warrants; and
- accident warrants

Volume Warrants

When opposing traffic volumes are such that left turning vehicles must wait for a gap to make their turn, they interfere with the through traffic. The magnitude of this interference depends on:
(1) the opposing volume, (2) the advancing volume and (3) the percentage of left turning vehicles.

Uniform volume warrants graphs and design guidelines of left turn storage lanes at unsignalized intersections have been developed and were based on theoretical analysis and on a series of field studies of traffic behaviour at intersections.

Accident Warrants

A left turn storage lane may also be considered at locations where four or more left turn related accidents occur per year or where six or more occur within a two year period, provided the accidents are of a type which could reasonably be expected to be eliminated by provision of a left turn lane. The storage length for the accident warrant is 15 m.

The warrant graphs, based on vehicles operating at the design speed indicated, show the conditions when left turn storage lanes should be added or where traffic signals are to be considered. For use of graphs see Appendices A, B and C.

When traffic signals are warranted, storage lengths are subject to the signal cycle timing and the graphs should not be used to determine the storage lane lengths.

Generally, the traffic volumes and directional flow diagrams are obtained from the Regional Traffic Section. The supplied information is then analyzed and checked for left turn lane requirements.

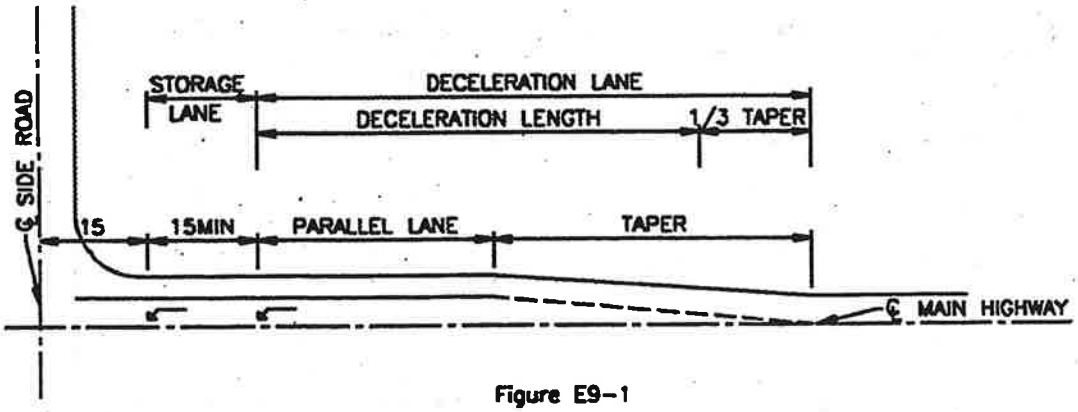


Figure E9-1

Left Turn Lane
Pictorial Description of Terms

For grades greater than 2%, the length of deceleration lane should be corrected according to the factors shown in Table E9-2. The correction is attained by multiplying the deceleration length added to 1/3 taper will comprise the total deceleration lane. The length of taper remains as shown in Table E9-1.

The width of left turn lanes should be one increment (0.25 m) less than the through lane with a minimum of 3.25 m and separated from through lanes by a solid painted line and indicated by painted arrows, as shown in the Manual of Uniform Traffic Control Devices.

The Runout Lane

The runout lane terminates the adjacent left turn lane on the far side of the intersection. The width of the parallel section of the runout lane is same as that of the left turn lane. The taper length varies with the design speed and is the same as that applied to the deceleration lane. The runout lane is indicated in Figures E9-2 and E9-3.

HWY DESIGN SPEED (km/h)	TAPER (m)	PARALLEL LANE (m)	DECELERATION	
			LANE (m)	LENGTH (m)
50	85	20	105	77
60	100	30	130	97
70	115	40	155	117
80	130	50	180	137
90	145	60	205	157
100	160	70	230	177
110	170	80	250	193
120	180	90	270	210

Table E9-1

Deceleration Lengths for Left Turn Lanes;
For 2-Lane and 4-Lane Highways
Flat Grades 2% Less

	DOWN GRADE %	GRADE FACTOR > 1	UP GRADE %	GRADE FACTOR ≤
ALL	8 - 7	1.5	2 - 3	1.0
DESIGN	7 - 6	1.4	3 - 4	0.9
SPEEDS	6 - 5	1.4	4 - 5	0.9
km/h	5 - 4	1.3	5 - 6	0.8
	4 - 3	1.2	6 - 7	0.8
	3 - 2	1.1	7 - 8	0.7

Table E9-2

Grade Factors
for Deceleration Length