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DETERMINING LEFT-TURN LANES

Left-turn lanes are auxiliary lanes that are not considered through travel lanes but are intended for the use of vehicular traffic that are turning left off of the traveled roadway. They increase the safety of the drivers by providing a separate storage area for turning traffic, a means of safe deceleration for the turning traffic, and significantly improve the capacity and safety of the intersection.

Traffic Study

The determination and design of a left-turn lane shall be accompanied by a traffic study. The following factors should be taken into account when looking at the addition of a left-turn lane:

- The type of highway
- Geometric conditions (horizontal and vertical alignment)
- Land use & future development
- Type of traffic control
- Type of left-turn phasing (if signal is present)
- Number of opposing through lanes
- Opposing approach speed limit
- Approach speed limit
- Volume of left-turning traffic
- Volume of opposing traffic
- Amount and locations of driveway accesses within the vicinity
- Location of island or raised median (if present)
- Sight distances
- Accident history
- Driver expectations

The final decision of determining the location and design of a new left-turn lane shall be determined by the Traffic Engineer. Left-turn lanes shall be installed on all legs of each new signalized intersection. The construction of new opposing left-turn lanes should be designed with a positive offset. A left-turn lane should be considered on a construction project of a high-speed rural highway that intersects with a heavily traveled intersecting roadway.

Volumes

A left-turn lane should be considered on a two-lane highway based on the latest version of Exhibit 9-75 of the “A Policy on Geometric Design of Highways and Streets”.

Additional guidance for left-turn lanes on two or more lane highways can be found from Figure 4-12 from the NCHRP report 279 “Intersection Channelization Design Guide”.

When left-turning volumes at an intersection approach 300 vehicles per hour or are projected to, double left-turn lanes should be considered. An additional capacity analysis of the intersection should be performed to determine what traffic controls are needed for proper functioning of the intersection.

Accidents

A left turn lane may also be considered if there are five or more crashes in a 12 month period attributed to the lack of a left turn lane .

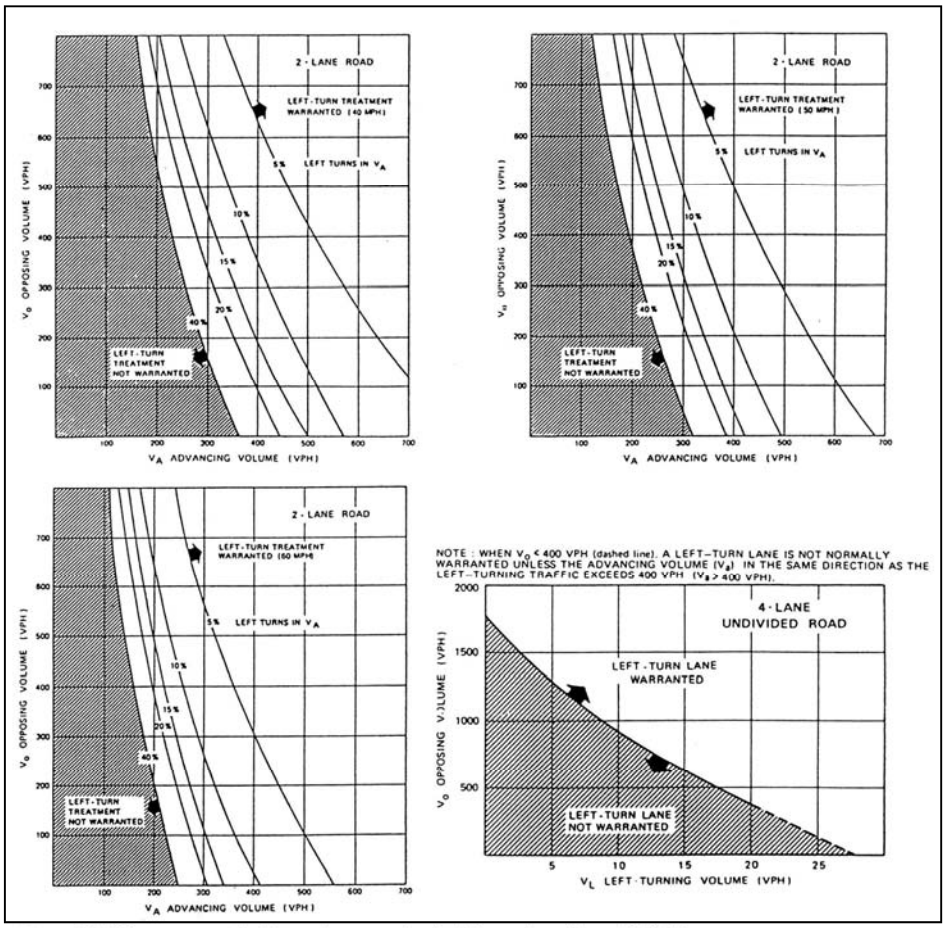
Design

The design of left-turn lanes should reflect the anticipated purpose of the lane, the characteristics of the highway, and any restrictions at the intersection. Design of the approach taper, bay taper, length of the lane (storage), width of the lane, and the departure taper shall be considered. Pages 55 and 56 of the NCHRP report 279 “Intersection Channelization Design Guide”, or taper/turn lane lengths as modified on page 4 of this procedure, may be used as guidance for the design of left-turn lane features. Also pavement markings and signing that will accommodate any left-turn lane design should be considered. The final design values shall be determined by the Traffic Engineer.

Additional guidance for the design of dual left-turn lanes can be found on page 57 in the NCHRP report 279 “Intersection Channelization Design Guide.”

Metric					US Customary				
Opposing volume (veh/h)	Advancing volume (veh/h) 5% left turns	10% left turns	20% left turns	30% left turns	Opposing volume (veh/h)	Advancing volume (veh/h) 5% left turns	10% left turns	20% left turns	30% left turns
60-km/h operating speed					40-mph operating speed				
800	330	240	180	160	800	330	240	180	160
600	410	305	225	200	600	410	305	225	200
400	510	380	275	245	400	510	380	275	245
200	640	470	350	305	200	640	470	350	305
100	720	515	390	340	100	720	515	390	340
80-km/h operating speed					50-mph operating speed				
800	280	210	165	135	800	280	210	165	135
600	350	260	195	170	600	350	260	195	170
400	430	320	240	210	400	430	320	240	210
200	550	400	300	270	200	550	400	300	270
100	615	445	335	295	100	615	445	335	295
100-km/h operating speed					60-mph operating speed				
800	230	170	125	115	800	230	170	125	115
600	290	210	160	140	600	290	210	160	140
400	365	270	200	175	400	365	270	200	175
200	450	330	250	215	200	450	330	250	215
100	505	370	275	240	100	505	370	275	240

Exhibit 9-75 - Guide for Left-Turn Lanes on Two-lane Highways



Volume warrants for left-turn lanes at unsignalized intersections
Figure 4-12 of the NCHRP report 279 “Intersection Channelization Design Guide”

Guidelines for Design of Left-Turn Lanes

See diagram on page 5 for additional details

$L_d/_b$ -- Length of Taper and Lane for Deceleration and Braking

Functional Basis: To provide sufficient length for a vehicle to decelerate and break entirely outside the through traffic lanes

Desirable Design: Deceleration in gear for 3 seconds (occurs over bay taper followed by comfortable breaking to a stopped position

Desirable Design Values For $L_d/_b$

S - Speed (mph)	Total
30	235
40	315
50	435
60	530

Minimum Design: Braking begins at 2/3 full lane width, with minimum 50-foot storage. For low speeds only, the following values apply

Minimum Design Values For $L_d/_b$

S - Speed (mph)	Total
30	230
35	250
40	280
45	320

L_s -- Length of Lane for Storage (Full Width Lane)

Functional Basis: To provide sufficient length for a reasonable number of vehicles to queue within the lane without affecting other lanes

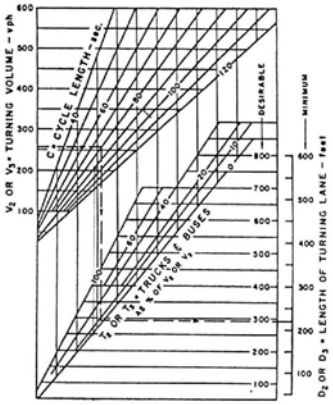
Desirable Design: Based on twice the mean arrival rate (per cycle for signals, per 2-minute period for stop control) during the peak hour of traffic

Minimum Design: Based on mean arrival rate, with minimum storage for one vehicle

L_s for Stop Control

DHV (vph)	L_s (ft)
≤ 60	50-75
61-120	100
121-180	150
>180	200 or more

L_s for Traffic Signal Control



Guidelines for Design Tapers of Left-Turn Lanes

L_a -- Approach Taper Design

Functional Basis: To provide a smooth lateral transition for all vehicle approaching the intersection

Form of Alignment: Tangent

Desirable Design: Provide a fully shadowed lane ($W_s > W_l$). Recommended for high speed intersections and intersections in rural and open urban areas with no space constraints.

For speeds 45 mph or under: $T_a = \frac{W_l S^2}{60}$

For speeds over 45 mph: $T_a = W_l S$

Minimum Design: A 10:1 taper ratio should be used

L_b -- Bay Taper Design

Functional Basis: To direct left-turning vehicle into the turn lane

Form of Alignment: Tangent; or reverse curves with 1/3 of the total length comprised of a central tangent

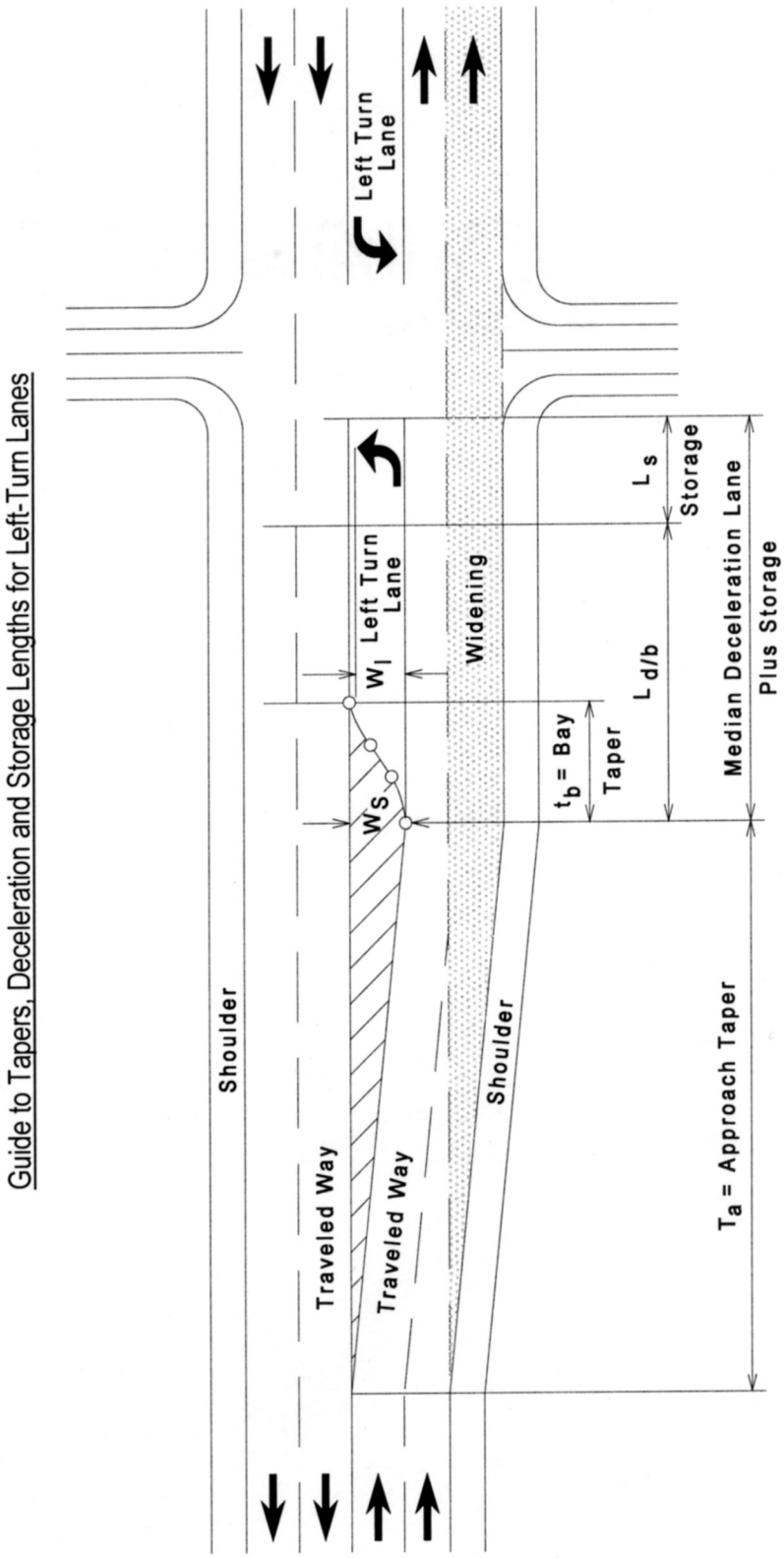
Desirable Design: For fully shadowed left turn lane

$$T_b = \frac{W_l S}{3.0}$$

Minimum Design: Taper ratios of 8:1 can be used for tangent bay tapers. For constrained locations, ratios as low as 4:1 can be used with painted channelization.

W_l = Width of Lane (ft) S = Speed (mph)

See Also: Figure 4-18 & 4-19 on pages 55 - 56 of the NCHRP report 279 "Intersection Channelization Design Guide"



NOTE: Roadway widening shown in this figure is on right side. Roadway may be widened on both sides with same taper ratios, as on one side.

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