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April 20, 2000

'00 APR 24 P4:07
OFFICE OF ZONING
DISTRICT OF COLUMBIA

By Hand

Richard L. Aguglia, Esq.
Hunton & Williams
1900 K Street, N.W.
Washington, D.C. 20006

Re: The Field School

Dear Richard:

Pursuant to your request, enclosed please find the AASHTO references with regard to the left turn lane proposed on Foxhall Road by The Field School and the engineering profile of that entrance prepared by Gorove/Slade.

If you have any questions, please call me.

Sincerely,

Phil T. Feola

cc: Board of Zoning Adjustment (w/encl.)
Lou Slade (w/out encl.)
Elizabeth Ely (w/out encl.)

#191286

BZA
Case No. 16559
Exhibit No. 413

Board of Zoning Adjustment
District of Columbia
CASE NO.16559
EXHIBIT NO.413

A POLICY
on
GEOMETRIC DESIGN
of
HIGHWAYS
and
STREETS

1990

American Association of State
Highway and Transportation Officials
Suite 225, 444 North Capitol Street, N.W.
Washington, D.C. 20001
(202) 624-5800

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PREFACE

This Policy was developed as part of the continuing work of the Standing Committee on Highways. The Committee, then titled the Committee on Planning and Design Policies, was established in 1937 to formulate and recommend highway engineering policies. It has developed *A Policy on Geometric Design of Rural Highways*, 1954 and 1965 editions, *A Policy on Arterial Highways in Urban Areas*, 1957, *A Policy on Design of Urban Highways and Arterial Streets*, 1973, *Geometric Design Standards for the National System of Interstate and Defense Highways*, 1956 and 1967, *Geometric Design Standards for Highways Other Than Freeways*, 1969, *A Policy on Geometric Design of Highways and Streets*, 1984, and a number of other AASHO and AASHTO policy and "guide" publications.

An AASHTO publication is typically developed through the following steps: (1) The Committee selects subjects and broad outlines of material to be covered. (2) The appropriate subcommittee and its task forces, in this case the Subcommittee on Design and its Task Force on Geometric Design, assemble and analyze relevant data and prepare a tentative draft. Working meetings are held and revised drafts are prepared, as necessary, and reviewed by the Subcommittee, until agreement is reached. (3) The manuscript is then submitted for Standing Committee on Highways approval, and then Executive Committee approval. Standards and policies must be adopted by a two-thirds vote by the Member Departments before publication. During the developmental process, comments were sought and considered from all the States, the Federal Highway Administration, and representatives of the American Public Works Association, the National Association of County Engineers, the National League of Cities, and other interested parties.

Changes in allowable maximum dimensions for truck-trailer combinations, the revision of the *Highway Capacity Manual* in 1985 and other developments subsequent to the 1984 edition prompted AASHTO to again update this policy.

Following the procedures outlined above, the Task Force on Geometric Design met in 1987 to begin the work that has resulted in this current edition. It is anticipated that a continuing effort will be maintained by the Subcommittee on Design to keep the policy up to date with future developments in geometric design.

NOTICE TO USER

Accompanying the first printing of *A Policy on Geometric Design of Highways and Streets, 1990* was a technical corrections booklet entitled "Technical Corrections, A Policy on Geometric Design of Highways and Streets, 1990." This second printing of *A Policy on Geometric Design of Highways and Streets, 1990* incorporates the corrections that were published in that booklet. Therefore, no technical corrections booklet is provided with this printing.

American Association
of State Highway and
Transportation Officials
August, 1993

AUXILIARY LANES

General Design Considerations

From the foregoing discussions it is appropriate to deal with the design elements of auxiliary lanes as they relate to median openings and left-turning movements. In general, auxiliary lanes are used preceding the openings as described in this section and are also used at at-grade intersections preceding and following right turning movements to accommodate speed changes, weaving and maneuvering of traffic. Auxiliary lanes may also be added to increase capacity through an intersection.

Auxiliary lanes should be at least 10 ft wide and desirably should equal that of the through lane. Where curbing is to be used adjacent to the auxiliary lane, an appropriate curb offset should be provided. The length of the auxiliary lanes for turning vehicles consists of three components: (1) deceleration length (2) storage length and (3) entering taper.

Desirably, the total length of the auxiliary lane should be the sum of the length for these three components. Common practice, however, is to accept a moderate amount of deceleration within the through lanes and to consider the taper as a part of the deceleration length. Where intersections occur as frequently as four per mile, it is customary to forego most of the deceleration length and to provide only the storage length plus taper. Each component of the auxiliary length is discussed in the following section.

Deceleration Length

Provision for deceleration clear of the through-traffic lanes is a desirable objective on arterial roads and streets and should be incorporated into design whenever feasible. The total length required is that needed for a safe and comfortable stop from the design speed of the highway. Minimum deceleration lengths for auxiliary lanes on grades of 2 percent or less, with an accompanying stop condition, for design speeds of 30, 40 and 50 mph are 235, 315 and 435 ft respectively.

These lengths exclude the length of taper which should be approximately 8 to 15 ft longitudinally to 1 ft transversely. Long tapers indicate the path drivers are to follow and reduce the unused portion of the pavement. However, long tapers tend to entice some through drivers into the deceleration lane. On the other hand, shorter tapers produce better "targets" for approaching drivers and give positive visibility of the added auxiliary lane.

On many urban facilities it will not be feasible to provide full length for deceleration. In such cases at least a part of the deceleration must be accomplished before entering the auxiliary lane. However, the lengths given should be accepted as a desirable goal and should be provided where practical and feasible. Deceleration lengths shown are applicable to both left and right-turning lanes, but speed is usually lower in the right lane than in the left lane.

Storage Length

The auxiliary lane should be sufficiently long to store the number of vehicles likely to accumulate during a critical period. The storage length should be sufficient to avoid the possibility of left-turning vehicles stopping in the through lanes. The storage length should be sufficiently long so that the entrance to the auxiliary lane is not blocked by vehicles standing in the through lanes waiting for a signal change or for a gap in the opposing traffic flow.

At unsignalized intersections the storage length, exclusive of taper, may be based on the number of turning vehicles likely to arrive in an average 2-min period within the peak hour. As a minimum requirement, space for at least two passenger cars should be provided; with over 10 percent truck traffic, provisions should be made for at least one car and one truck. The 2-min waiting time may need to be changed to some other interval that depends largely on the opportunities for completing the left-turn maneuver. These intervals, in turn, depend on the volume of opposing traffic. Where the volume of turning traffic is high, a traffic signal will usually be required.

At signalized intersections the required storage length depends on the signal cycle length, the signal phasing arrangement, and the rate of arrivals and departures of left-turning vehicles. The storage length is a function of the probability of occurrence of events and should usually be based on one and one-half to two times the average number of vehicles that would store per cycle, which is predicated on the design volume. This length will be sufficient to serve heavy surges that occur from time to time. As in the case of unsignalized intersections, provision should be made for storing at least two vehicles.

Traffic signal design fundamentals are discussed further in MUTCD (**5**).

Where turning lanes are designed for two-lane operation, the storage length is reduced to approximately one-half of that required for single-lane operation. Reference should be made to the *Highway Capacity Manual* (**2**).

Taper

On high-speed highways the taper of an auxiliary lane should generally conform to that discussed under "Ramp Terminals" in the section "Speed-Change Lanes" in Chapter X. However, on most urban streets approaching at-grade intersections, shorter tapers are satisfactory because of lower operating speeds.

Some States permit the tapered section of deceleration auxiliary lanes to be constructed in a "squared-off" section at full paving width and depth. This construction requires a painted delineation of the taper and is only applicable to noncurbed sections. The design requires transition of the outer or median shoulders around the squared-off beginning of the deceleration lane.

The squared-off design principle can be applied to median deceleration lanes, and it can also be used at the beginning of deceleration right-turn exit terminals when there is a single exit lane. When two or more exit lanes are used, the tapered designs discussed in the section "Speed-Change lanes" in Chapter X is recommended.

Additional guidance for lengths of tapers may be found in the "Manual of Uniform Traffic Control Devices" (**5**) which recommends the following for design speeds equal to or greater than 45 mph: length of taper (L) equals the design speed (S) multiplied by the offset (W), $L = SXW$. For design speeds equal to or less than 40 mph; the length of taper (L) equals the offset (W) multiplied by the design speed (S) squared, then divided by 60, or $L = WS^2/60$.

Some State highway agencies believe that the abrupt squared-off beginning of deceleration exits offers improved driver commitment to the exit maneuver and also contributes to driver security and safety because of the elimination of the unused portion of long tapers. For example, a 15:1 taper ratio is recommended for design speeds up to 50 mph. If the auxiliary lane was 12 ft wide, the taper length would be 180 ft. This approach section could be 12 ft wide and constructed for its full length. The painted delineation taper could be 12 ft wide and constructed for its full length. The painted delineation taper could be established on a 4:1 ratio that would produce a stripe approximately 50 ft long. This design principle could be applied to all deceleration design speeds and should operate with relatively quick exit maneuvers to the full-width lane under low design speeds and still provide for the longer exit maneuvers at the higher design speeds.

The longitudinal location along the highway, where a vehicle will move from the through lane to a full-width deceleration lane, will vary depending on many factors. These factors include the type of vehicle, the driving characteristics of the vehicle operator, the speed of the vehicle, weather conditions, and lighting conditions.

This design principle could also improve capacity by offering an early exit to the daily users that would diminish slow-down interference to the through movements.

The discussions to follow and figure references do not relate to the "squared-off" design section. However, the design principles described in the preceding can be applied.

Straight-line tapers are frequently used, as shown in Figure IX-70A. The taper rate may be 8:1 for design speeds up to 30 mph and 15:1 for design speeds of 50 mph. A short curve is desirable at either end, as shown in Figure IX-70B, but may be omitted for ease of construction. Where curves are used at the ends, the tangent section should be about one-third to one-half of the total length. Figure IX-70C shows a taper with a symmetrical reverse curve; a length of about 90 ft or more is necessary. At low speeds, taper (2) will operate as desired and taper (1) probably will not. A more desirable reverse-curve taper has the turnoff curve radius about twice that of the second curve (Figure IX-70D). When 100 ft or more in length is provided, tapers (1) and (2) are suitable for low-speed operation. All the dimensions and configurations shown in Figure IX-70 are applicable to right-turn lanes as well as left-turn lanes.

Median Left-Turn Lanes

A median left-turn lane is an auxiliary lane for storage or speed change of left-turning vehicles located at the left of one-directional pavement within a median or divisional island. Accident potential, inconvenience, and considerable loss in efficiency of operation are evident on divided highways where such lanes are not provided. Median lanes, therefore, should be provided at intersections and at other median openings where there is a high volume of left turns or where the vehicular speeds are high. Minimum designs of median openings are shown on Figures IX-58 through IX-60 and in Tables IX-16 through IX-18. Median lane designs for various widths of median are shown in Figures IX-71 and IX-72.

Median widths of 20 ft or more are desirable at intersections with single median lanes, but widths of 16 to 18 ft permit reasonably adequate arrangements. Where two median lanes are used, a median width of at least 28 ft is desirable to permit the installation of two 12-ft lanes and a 4-ft separator. Although not equal in width to a normal traveled lane, a 10-ft lane with a 2-ft curbed separator or with traffic buttons or paint lines, or both, separating the median lane from the opposing through lane may be acceptable where speeds are low and the intersection is controlled by traffic signals.

EXHIBIT 413

FROM

CASE 16559

IS AN OVERSIZED DOCUMENT

PLEASE SEE AT OFFICE