Optimum Width for Widening Secondary Arterial Streets

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(A Condensation)

Committee D-A2, Geometric Highway Design, considers that there is general need for research data on vehicle operations on connector and secondary streets of various widths. Reliable data in substantial quantity would be helpful to policy-making agencies in establishing design criteria or standards for these streets. The report, as here condensed, is sponsored by the committee and describes a method for obtaining data for this purpose through field research. A summary presentation was made at the January 1964 meeting of the committee, after which this condensed form of publication was arranged both to emphasize the subject for research and to point out an easily used method.

This report describes a method for easily determining speeds and placement on streets, with parking on one or both sides, and outlines criteria for determining effective street width. The sample of data was too limited to warrant general conclusions but the report serves a very useful purpose by suggesting the types of data that should be obtained and by describing simple procedures for collecting and analyzing the information. The committee urges additional research studies of this type.

THE PROBLEM

The street pattern of many of the residential areas of American cities was laid out 30 to 50 years ago, when traffic volumes were much lower than today. In many instances, streets laid out with 50- to 60-ft right-of-way are now being used as collectors or secondary arterial streets. Many of these streets have a pavement width of only 20 to 30 ft on right-of-way which has numerous shade trees. When improving these secondary arterial streets, questions have arisen as to policies on street widening so as to provide adequate traffic service and still preserve the quality of the residential neighborhood.

According to the AASHO Urban Policy, it is recommended that at least two moving lanes be provided in outlying or residential areas, with a continuous parking lane on each side for a total pavement width of 40 to 44 ft. Table E-1 of this policy states in principle that two moving lanes with parking on one side only should not be considered.

This study was made for the purpose of investigating the operating characteristics of secondary arterial streets 23 to 32 ft wide, when operated with parking on one side only. It was reasoned that if a secondary arterial street will operate satisfactorily with parking on one side, and if restricting parking to one side will adequately take care of the parking demand, then perhaps some secondary arterial streets might be improved by widening to some width less than 40 to 44 ft.

Field studies were made of operating characteristics of secondary arterial streets of several different widths in Evanston, Ill. Factors studied included the following:

1. Lateral placement of moving vehicles as they approached and passed vehicles parked on one side of the arterial streets;

Paper sponsored by Committee on Geometric Highway Design and presented at the 43rd Annual Meeting.

2. Speeds of these vehicles traveling in both directions when approaching and passing the parked cars; and
3. The change in speed resulting from two vehicles about to meet each other at a point abreast of the parked car. On the narrower pavements, one driver may wait for the other to proceed, especially when one of the vehicles is a bus, or a truck.

PROCEDURE

A time-lapse movie camera, operating at 300 frames per minute was used to collect data at each of seven locations. At each test location, target boards 8 ft long were placed temporarily on both sides of the street at three transverse stations to provide the scale for lateral placement. The three stations were the center of the parked car and 44 ft ahead and behind that station.

After the target boards were photographed, the boards were removed, and the camera was operated each time a vehicle approached the test location. An average of approximately 8 seconds of exposure was used for each car.

LOCATIONS

An attempt was made to find sections of the selected locations where all conditions were comparable except for street width. It was not possible to get completely comparable conditions—there was some variation in cross slope of the pavement, parking conditions varied somewhat in the parking lane, and some of the streets studied were not arterial streets. Data are reported here for two locations, both in a section where the street serves as a secondary arterial street with a bus line which has about eight buses per off-peak hour. Parking was on one side only, with an average of only one parked car per 100 ft.

DATA COLLECTION

Data were taken off the films for speed and for lateral position, as follows:

1. The vehicle placement, defined as the horizontal distance from the right curb of the pavement to the outside edge of the right wheel of the moving car was determined for each direction of travel.
2. The meeting clearance, or the horizontal distance between the bodies of meeting vehicles, was computed.

Comparative data were tabulated for vehicles in the three following groups:

1. "Free-Moving" vehicles—those that passed or met the parked car at least 6 sec after any preceding vehicle traveling in the same direction, and at least 5 sec after and 10 sec prior to any vehicle traveling in the opposite direction.
2. "Meeting" vehicles—those that were spaced more than 6 sec behind any other vehicle traveling in the same direction and either had met, or were to meet, a vehicle traveling in the opposite direction within 1.5 sec of the time the vehicle passed the parked car.
3. "Other" vehicles.

ANALYSIS

Consider that two vehicles, A and B, moving in opposite directions meet opposite parked vehicle C. With the latter at the right, X is the distance from the curb at left to vehicle A (the oncoming vehicle) and Y is the distance from the curb at the right to vehicle B (the vehicle adjacent to the parked vehicle). Average lateral placement values (X and Y) for moving vehicles passing a parked car at a 23-ft section street and at a 29-ft section are given in Table 1.

For the 23-ft section it is apparent that meeting vehicles pass the parked car at lateral placements quite different from the free-moving vehicles. In four of twelve meeting maneuvers, one vehicle waited for the other to pass the parked vehicle.

TABLE 1

AVERAGE LATERAL PLACEMENT

Lateral Dimension	Free Moving	Meeting
(a) 23-Ft Street		
X	4.3	1.9
Y	11.2	9.0
W - (X + Y)	7.5	12.1
Avg. speed, mph	26.7	22.8
(b) 29-Ft Street		
X	4.3	3.0
Y	11.9	10.8
W - (X + Y)	12.8	15.2
Avg. speed, mph	29.7	27.0

In contrast, average lateral placement values at a 29-ft section of the same street changed only 1.1 to 1.3 ft because of the meeting maneuver. No vehicles during the field studies refused to meet another vehicle opposite the parked vehicle.

Table 1 also shows values of W - (X + Y) for the two widths of streets. The average width of pavement used for both directions of free-moving vehicles at the 23-ft section was only 7.5 feet, whereas this path width was 12.8 ft for the 29-ft section. Lateral placement for vehicles on the 29-ft section was not affected nearly as much by a meeting maneuver as on the 23-ft section.

Table 1 also indicates that average speeds are affected somewhat less by a meeting maneuver on a 29-ft pavement than on a 23-ft pavement.

Possible criteria for selecting optimum width are as follows:

1. All drivers "accept" a meeting maneuver (or 95 percent accept).
2. Most drivers keep same lateral position, regardless of whether free-moving or meeting.
3. Travel speeds are not substantially lower, as compared with a wider street.
4. Other constraints: snow removal problems, standing of delivery vehicles, demand versus supply of curb space.

More data are needed for applying these criteria with positive assurance. However, these two cases do indicate that a width of 29 ft was adequate for all observed drivers to accept a meeting maneuver opposite a parked car, whereas some drivers would not accept a meeting maneuver in the 23-ft section.

The second criterion (drivers holding the same lateral placement regardless of whether free moving or meeting) was not entirely satisfied by a 29-ft width. Extrapolation indicates a 31-ft width as optimum.

The third criterion, dealing with changes in travel speeds, needs more data for application.

More cases should be analyzed to permit a more positive determination of optimum widths of secondary arterial streets with parking on one side. However, this preliminary study indicates that the optimum width is in the 28- to 32-ft range for passenger vehicles.