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# INTERIM MATERIALS ON HIGHWAY CAPACITY

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**U.S. NUCLEAR REGULATORY COMMISSION**

**EXHIBIT No.** 11

**Applicant** ✓ **Staff** ____ **Intervenor** ____

**Identified** ✓ **Received** ✓ **Rejected** ____

**Date:** 2/23/84

**Reporter:** Mary Simons

estimating capacity, and includes a numerical example.

The computations in Table 1 indicate that very little variation exists in the value used for capacity of a standard 12 foot wide (3.7 m) lane at an urban signalized intersection with ideal traffic conditions (no trucks, buses, or turning motions). Three of the models shown give capacities of approximately 900 pch for a green time/cycle time (G/C) ratio of 0.5. The British method, which has been known to give considerably higher computed values for capacity than North America methods, shows a computed capacity 12 percent higher. The 1965 HCM yields a capacity value of 805 pch (G/C = 0.50), or about 10% below the other methods.

Because of the close agreement between Berry-Gandhi (8), Capelle-Pinnell (2), Messer-Fambro (5), and Bellis-Reilly (11, 12, 13), an average value of 1800 passenger cars per hour of green (pchg) for a 12 foot (3.7 m) through traffic lane--with no trucks, buses, turns, or pedestrian interference--can be used as a base value for capacity in the critical movement analysis technique. It should be noted that the British capacity procedures use--for a 13 foot (4.0 m) wide lane--a capacity of 1860 pchg.

The factors which are considered of prime importance in modifying the capacity value of 1800 pchg for a single 12 foot (3.7 m) lane are as follows:

1. Lane Width
2. Buses and Trucks
3. Bus Stop Operations
4. Left Turns
5. Right Turns and Pedestrian Activity
6. Parking Activity
7. Peaking Characteristics (Peak Hour Factor)

Other factors--such as vertical grade and type of driver using the intersection--may be of importance in modifying the capacity value, but little research has been accomplished in these areas. Also, field measurement of saturation flow allows the HCM user to establish a capacity value for any intersection approach or lane without explicitly defining each modifying factor.

1. Lane Width. The critical movement procedure proposed by Messer and Fambro (5) includes a reduction in calculated capacity of 10 percent for lane widths between 9.0 and 9.9 feet (2.7 m and 3.0 m). For lanes 10.0 feet (3.0 m) or wider, no adjustment in capacity is made. Note that these adjustments increase the passenger car volume (PCV) rather than reduce capacity.

Using the Australian procedures (9, 10), capacity adjustments are made for lanes not falling in the 10.0 to 12.0 foot (3.0 m to 3.7 m) range. Adjustments for the value of capacity are:

| | | | | | |
|---|---|---|---|---|---|
| Lane Width (feet): | 8.0 | 9.0 | 13.0 | 14.0 | 15.0 |
| Lane Width (meters): | 2.4 | 2.7 | 4.0 | 4.3 | 4.6 |
| Adjustment Value: | -12% | -7% | +3% | +4½% | +6% |

Application of the 1965 HCM, with the assumed conditions used in Table 1, gives adjustment values of - 29% for the equivalent of a 9 foot (2.7 m) lane and + 10% for the equivalent of a 14 foot (4.3 m) lane. Table 2 combines these concepts into a readily applied set of values. These adjustments rely principally on the Messer-Fambro work, but include upward adjustments in capacity for wide traffic lanes as included in most other methods.

One important concept to note is that under peak traffic conditions, lane widths in the 10 to 13 foot (3.0 to 4.0 m) range have little effect on saturation flow or capacity. However, it is likely that if comfort and safety were to be considered in intersection level of service (LOS), lane width differences would have a greater impact on LOS than they will in the proposed new HCM; with its emphasis on mobility rather than quality of flow.

2. Buses and Trucks. Trucks, and buses not having a designated stop at the intersection under analysis (called "through" buses), reduce capacity because the time headway of these vehicles tends to be longer than the 2.0 second average implied by a capacity set at 1800 pchg.

There are two means available for including the effects of trucks and buses. First, each truck or bus can be converted to an equivalent number of passenger cars, and the volume used in the analysis

Table 2. Lane Width Adjustments

| Reference | Adjustment Factors to Capacity for Lane Width (ft.) 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|---|---|---|---|---|---|---|---|---|---|
| Berry-Gandhi (8) | (Suggest use of Australian factors) | | | | | | | | |
| Messer-Fambro (5) | NA[a] | 1.10 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | NA |
| Australian (9), (10) | 1.12 | 1.07 | 1.00 | 1.00 | 1.00 | 0.97 | 0.96 | 0.94 | --[b] |
| Recommended[c] Adjustment Factors | 8.0-9.9 feet W = 1.10 | | 10.0-12.9 feet W = 1.00 | | | | 13.0-15.9 feet W = 0.90 | | |

[a]NA denotes data not available.

[b]For 16-foot wide approaches, two 8-foot lanes would be assumed.

[c]Recommended for use in Critical Movement Analysis (OPERATIONS AND DESIGN Application, Step 8)

Source: As cited above and W.R. Reilly (NCHRP Project 3-28) (1 foot = .305 meter)