Delay and Travel Time Improvements as Related to Traffic Engineering Activities, Staff, and Budget

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There is a large and growing concern with cost effectiveness—with the payoff to be expected from alternative investments. The taxpaying public has recently shown a reluctance to support many local capital improvement programs. Public agencies are under substantial pressure to justify requests for increases in budgets and manpower by showing what benefits can be expected to derive from them.

Measurements of costs versus benefits have usually been made in relation to specific improvements. A good example is the cost-benefit ratio analysis which accompanies recommendations for freeway alignments. Much less work has been done in the area of assessing relative return on investment from different transportation schemes. Almost nothing concrete has been done at the local level to relate budget expenditures to the quality of services received.

This condition holds true in the traffic engineering field as in all others. Specific traffic improvement proposals typically include an estimate of the cost of improvement together with an analysis of expected benefits, usually in terms of increased capacity and safety and reduced travel time and user costs. While few cities routinely conduct travel time studies on a continuing basis, there are many before-and-after studies showing changes in traffic service brought about by some specific traffic improvement.

Little has been done to relate changes in traffic service to such things as increasing the traffic engineering budget and manpower of a community, or rearranging the traffic engineering effort to make it more effective. It has been generally assumed that a community with a traffic engineering organization can probably make more effective use of its streets than one without.

In the last few years, however, the question has been raised: "How much more effective?" Generally, the question is brought up by a city which has never had a formal traffic engineering effort but which may soon have one. These communities really want to know what the optimum traffic engineering activity is for a city of their size and nature. Requests are regularly received by the Institute of Traffic Engineers for information of this sort. There are three approaches that can be taken to give the answer.

One approach is to relate the quality of traffic service in comparable communities to the size of their traffic effort. A second is to survey present practice and assume the upper levels of staffing and budgeting to be adequate. A third approach is to compare changes in traffic engineering staffing and budgeting to changes in travel time within one or two cities over a period of time.

The first stumbling block to relating travel time and traffic engineering effort rests with the way in which travel time is measured in different communities. Some attempts have been made to compare travel time in different communities, but such comparisons offer more questions than conclusions. A recent NCHRP project by Alan Voorhees (1) listed work trip times and distances in 17 North American communities ranging in population from 40,000 to almost 7 million. Average travel speeds varied from 18 to 31 mph.

There was no clear relation between city size and average speed, nor did geographic location seem to make much difference. No information was given on traffic engineering effort in each community, of course. It is interesting to note, however, that the

TABLE 1

TRAFFIC ENGINEERING EFFORT VS TRAVEL SPEED

Metropolitan Area	Population	Travel Speed (mph)	Manpower		Budget ($)
			Total	Prof.	
Washington, D. C.	1, 568, 000	25	315	30	6, 500, 000
Baltimore	1, 600, 000	25			
Minneapolis-St. Paul	1, 377, 000	24	160	10	3, 800, 000
Seattle-Tacoma	1, 360, 000	25	174	13	2, 000, 000

"slowest" community was Pittsburgh, a city generally conceded to be the first ever to acknowledge traffic engineering as a distinct profession. The "fastest" city was Los Angeles, where traffic engineering was not a recognized function until the late thirties, about fifteen years after Pittsburgh had established the title of traffic engineer.

The Voorhees report is one of the very few which presents travel times in different communities. The report provides little substantial basis for a comparison of traffic engineering effort versus quality of traffic flow. Reason alone would suggest that comparing traffic flow in different communities is something like comparing oranges and apples. City age and evolutionary stage, topography, natural physical restraints, rate of population growth, and political climate each probably contribute more to helping or hindering traffic flow than do the size and quality of local traffic engineering effort.

There were five cities listed in the Voorhees report which had comparable populations. Four of them had almost identical average peak-hour speeds, with the fifth quite different. An examination of the staffing and budgeting of the four similar communities fails to show any appreciable consistency, supporting the theory that other forces affect the picture. Data are given in Table 1.

Another complicating feature lies in the fact that "traffic engineering" in one community may be quite different from "traffic engineering" in another. Some city traffic engineers have maintenance responsibilities and others do not. Some control street lighting budgets; others do not. In some, signal control improvements made as part of a large construction project are considered as traffic engineering expenditures. In other cities these expenses are buried in construction budgets.

Information from the Voorhees report has been combined with reports made to the National Safety Council in Table 2, which illustrates the relationship between commuting speed, traffic engineering expenditures on a population basis, and traffic engineering

TABLE 2

COMPARISON OF SPEED, BUDGET, AND POPULATION

City	Speed (mph)	T. E. Budget per Capita ($)[a]	Residents per T. E. Employee[b]
Los Angeles	31	2. 28	5, 460
Fort Worth	31	3. 24	3, 550
Tallahassee	30	1. 87	5, 800
Greensboro	30	2. 37	2, 350
Pensacola	30	1. 61	5, 060
Sioux Falls	25	2. 57	10, 900
Seattle-Tacoma	25	2. 53	4, 850
Baltimore	25	2. 46	4, 050
Washington	25	5. 82	2, 840
Minneapolis-St. Paul	24	1. 41	23, 400
Philadelphia	21	0. 82	11, 050
New Orleans	20	0. 64	13, 600
Chicago	20	1. 39	9, 520
Pittsburgh	18	1. 52	6, 560

[a]Budget for traffic engineering department includes materials, labor and administration.
[b]Includes all men regularly assigned to traffic engineering department, including registered professional, non-registered professional, engineer in training, subprofessional, and others.

TABLE 3

LOS ANGELES TRAFFIC DEPARTMENT

Year	Total Manpower	Budget ($)	Travel Speed[a] (mph)
1957	406	3,600,000	24
1960	421	4,200,000	26
1962	421	5,100,000	30
1965	481	5,800,000	32

[a]Average peak hour.

manpower on a population basis. There is substantial variation in traffic engineering budget per resident in communities with comparable commuting speeds. However, as a group, cities with commuting speeds under 25 mph have a per capita traffic budget of less than half of that found in cities with commuting speeds over 25 mph.

It is also possible to compare staffing in cities of the same size, and make subjective judgments about their travel times. The unpublished report (2) of ITE Technical Committee 2D(63) compared allocation of manpower in eleven cities in three population categories. There was a tremendous range in the traffic engineering effort expended in cities of comparable size. For instance, among three cities in the 125,000 population group, the city with the upper level of total manpower devoted to traffic engineering functions showed 17 times the effort of the lower level city. Even when considering professional manpower alone, the upper level city used over five times the manpower of the lower level one. It is most unlikely that travel times in these communities varied to the same degree.

The third approach to assessing the traffic flow benefits to accrue from increased traffic engineering work is to compare changes in travel time to changes in manpower or budgeting in a single community. There are problems here, as well. There are very few cities in which travel time has been measured over a substantial number of years. Even in those where such information has been collected, it is difficult to come to grips with whose traffic engineering effort is being measured, or to judge the effect of other activities taking place over the same period of time.

For instance, reasonably good travel time data are available for the Los Angeles area from 1957 to 1965. Los Angeles City traffic engineering expenditures are also available for the same period. Trend information is given in Table 3.

Obviously, travel times have improved at the same time that the Traffic Department has expanded. There is nothing to show any direct relation between the two, although we would like to think so, of course. During these same years other important changes were taking place. The freeway system grew from 122 miles to 372 miles. Many smaller cities in the area added to their traffic engineering staffs, and substantial sums of money were spent for local street improvements. Surely all these things also had a substantial effect on movement in the community. It is impossible to single out any one of them and ascribe a quantitative value to its impact.

The City of San Diego has also made travel time studies over a period of time. The average peak-hour speed there improved from 18 mph in 1955 to 39 mph in 1964 (3). The change included an 11-mph improvement from 1961 to 1964 alone. The report on the latest study there ascribed the sudden recent improvement largely or entirely to the completion of 25 miles of freeway. It has not been possible to gage the changes in travel time on local streets, where traffic engineering operational changes generally have the greatest impact.

This last point leads into another area entirely—the definition of traffic engineering. In many minds, traffic engineering is still largely an operational activity in which certain principles of traffic control and regulation are brought to bear on existing streets. If this is a valid point of view, then the measurable effect of traffic engineering on a community will be most pronounced shortly after the traffic organization first comes into existence. Traffic engineering is flashiest when it is new, when the operational skills of the profession can be quickly, cheaply and more or less painlessly applied to an overcrowded street system. In such cases, a single traffic engineer can have a substantial effect with a few simple tools and some political backing. As traffic flow improves, however, it becomes harder to improve upon without making more expensive changes or additions to the road system.

Most traffic engineers would be reluctant to limit their professional work to operations. In analyzing traffic engineering functions in cities of 80,000 to 200,000 population, ITE Technical Committee 2H(60) defined eight major areas of interest (4).

1. Surveys and studies related to transportation planning,
2. Transportation planning and programming,
3. Surveys and studies related to traffic operations,
4. Traffic controls and driver aids,
5. Parking and standing,
6. Street use,
7, Design, and
8. Miscellaneous functions.

In cities of this size category, traffic engineers were actually responsible for only slightly more than 50 percent of these essential activities. Traffic engineers were indeed most strongly oriented toward operations, having about 80 percent of the responsibility in this category of work. They had fewest responsibilities in design and planning.

All this suggests that the contributions of traffic engineers, while undoubtedly related to size of organization and budget, are also related to positioning in a municipal agency. This has been particularly well pointed out in another unpublished report (5), that of ITE Committee 2A(62), on the rule-making authority of city traffic engineers. This committee investigated traffic engineering authority in the narrow field of traffic regulation—at the heart of traffic operational activity. In this one area, where traffic engineers might be expected to have established themselves, they had regulatory authority over traffic only 40 percent of the time. In none of the 21 sub-categories in the field of traffic regulation did traffic engineers have authority as much as two-thirds of the time.

The report went on further to point out that the traffic engineering function could be found in any one of at least five positions within city hall, and the traffic engineer himself might report to any one of five different people, ranging from the mayor to the chief of police.

A broader view of traffic engineering holds that there is a wide variety of skills and experiences that a traffic engineer can bring to bear on existing and potential traffic problems. Operational contributions are important, but by no means predominant. Traffic engineering viewpoints brought to bear at the planning stage of road work or land-use change obviously offer many advantages in the interests of efficient traffic flow, although the payoff may lie years ahead and be difficult to relate to manpower at the time of improvement. Another difficulty with measuring the traffic effect of traffic planning activities lies in the fact that many, if not most of these effects, result in problems not arising, rather than in the correction of those that do. In times of great urban growth, unchanging travel times in the face of population increase may signify a substantial traffic improvement.

While traffic engineers still have largely a peripheral impact on highway design, usually in advice relating to channelization and intersection control, the traffic engineering attitude may be seen at work even when a traffic engineer is absent. This attitude reflects a substantial history of feedback from observations of traffic behavior under a variety of conditions. The feedback may be formal, in the form of reports, or informal, in the form of casual observations shared by inquisitive people.

While the traffic engineer should be so positioned in city government that he has an opportunity to comment on highway design work, he seldom if ever has the final decision to make. His success will depend on the traffic orientation of the designer. To this extent, traffic flow is a function of nontraffic engineers, whose attitudes are harder to measure than their budgets.

Once the first flush of traffic engineering success is achieved in a community where traffic engineering is a new experience, the traffic engineer's positioning becomes as important as the size of his staff. The next stage of traffic improvement involves the spending of highway funds where they will have the greatest traffic impact. To be effective in this area, the traffic engineer needs to have a prominent place in establishing capital improvement priorities. Ideally he will help to construct the basic priority system, if any, and will thereafter be responsible for measuring relative traffic needs. This requires staff for measuring purposes, obviously. More importantly, it requires that there be substantial political and technical support for the concept that traffic improvements are among the most important justifications for highway construction.

CONCLUSIONS

The importance of positioning and municipal interrelationships as they affect traffic engineering and its measurable products suggests that hard and fast rules of staffing, budgeting and activities may be a secondary concern. It is conceivable, for instance, that traffic can flow smoothly even in the absence of any formal traffic engineering unit, if traffic engineering skills are basic in other engineering, planning and enforcement groups.

What is important is that those responsible for reviewing and approving land-use changes understand the traffic impact of their decisions, that estimated traffic benefits be a significant factor in decisions on where to spend highway funds, that highway designs reflect a clear understanding of the known interrelationships among road, car, driver and pedestrian, and that traffic regulations and controls should reflect observed and measured conditions.

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