Accident Trends in Cities and City Traffic Engineering Staff, Budgets and Responsibilities

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In 1966, urban traffic deaths accounted for 15,900 of the national total of 52,500 killed. The urban toll was only 30 percent of the total, and on a vehicle-mile basis, the urban rate of 3.6 deaths per 100 million vehicle-miles was far below the rural rate of 7.5.

The significant fact, however, is in the trend of urban deaths over the past few years as compared with the situation in rural areas. Table 1 illustrates these trends and clearly points out the emerging importance of the urban accident problem.

The trends in total urban deaths and in the urban death rate are significantly different from those for rural areas. Presumably they are a reflection of the increasing urbanization of the country. This has been adequately reported elsewhere, and it is sufficient to record here that during the decade from 1950 to 1960, the increase of our urban population accounted for more than 100 percent of the total growth of the country. (This was brought about, of course, by a decrease in the rural population.)

The types of accidents resulting in death changed markedly during the last decade. A comparison between 1955 and 1965 shows interesting and significant changes.

The significant points in Table 2 are the major differences in the changes, urban and rural, in two-vehicle and non-collision accidents. The increases in urban accidents of these two types far exceed the changes in rural areas, and are responsible for the fact that the urban mileage death rate remained nearly constant during a period when the rural rate dropped more than 12 percent. Table 3, a comparison by size of city, indicates that the problem is not uniformly distributed.

The comparison of death rates by size groups suggests that the largest cities (over 750,000 population) have experienced the smallest increase in accident rates; in fact their registration rate has actually decreased in the ten years from 1955 to 1965, although it still is higher than for smaller urban places. The largest increases in rates, on the other hand, have taken place in the cities from 100,000 to 750,000 population. Cities below 100,000 population have experienced increases, but not as great.

Non-fatal injuries in urban accidents are greater in total number than those in rural accidents. Three types of accidents account for a large part of the total: pedestrian, two-vehicle and non-collision. The differences between urban and rural experience are given in Table 4. The large number of injuries in urban two-vehicle accidents is immediately apparent. Similarly, although the totals are much smaller, injuries in urban non-collision accidents exceed those in rural non-collision accidents, though the reverse is true for deaths.

Data are not available to permit examination of the type of accident causing deaths and non-fatal injuries by size of city. It may be that the differences in

TABLE 1
MOTOR VEHICLE DEATHS AND MILEAGE DEATH RATES (1955-1965)

Location of Accident	Deaths			Mileage Death Rate		
	1955	1965	Change (%)	1955	1965	Change (%)
Urban	9,390	15,000	+60	3.5	3.6	+3
Rural	29,030	34,000	+17	8.6	7.4	-14
Total	38,420	49,000	+28	6.4	5.6	-12

Source: National Safety Council. Rate is deaths per 100 million veh/mi.

TABLE 2

TYPES OF FATAL MOTOR VEHICLE ACCIDENTS
(1955-1965)

Type of Accidents	Urban Deaths			Rural Deaths		
	1955	1965	Change (%)	1955	1965	Change (%)
Pedestrian	5, 200	5, 700	+10	3, 000	3, 100	+3
Two-vehicle collision	1, 900	4, 700	+148	12, 600	16, 000	+27
Other collision	1, 290	1, 800	+40	2, 330	2, 800	+20
Non-collision	1, 000	2, 800	+180	11, 100	12, 100	+9
Total	9, 390	15, 000	+60	29, 030	34, 000	+17

Source: National Safety Council.

TABLE 3

MOTOR VEHICLE DEATH RATES, POPULATION AND REGISTRATION
(1955-1965)

Urban Population	Deaths per 100, 000 Pop.			Deaths per 10, 000 Veh. Reg.		
	1955	1965	Change (%)	1955	1965	Change (%)
Over 1, 000, 000	10. 3	10. 7	+4	3. 9	3. 4	-13
750, 000-1, 000, 000	10. 3	12. 0	+16	3. 3	3. 0	-9
500, 000-750, 000	9. 8	12. 8	+30	2. 6	3. 0	+15
350, 000-500, 000	11. 1	16. 3	+47	2. 7	3. 1	+15
200, 000-350, 000	10. 1	13. 9	+38	2. 2	2. 5	+14
100, 000-200, 000	9. 5	13. 9	+46	2. 1	2. 5	+19
50, 000-100, 000	9. 0	9. 8	+9	2. 0	1. 9	-5
25, 000-50, 000	8. 9	10. 8	+22	1. 9	2. 0	+5
10, 000-25, 000	9. 0	11. 2	+24	1. 6	1. 9	+19
All cities	9. 8	11. 7	+19	2. 4	2. 5	+4

Source: National Safety Council, based on reports by states and local authorities.

Note: Not all cities in the United States are included, but the samples are believed representative. Data for 1955 and 1965 are not necessarily based on identical cities, partly because some cities have moved from one population group to another during the 10 years.

trends in deaths and death rates are related to changes in patterns of accidents.

It is also possible that accident prevention efforts have not been undertaken in all sizes of cities on an equally energetic or effective basis. It must be emphasized here that there have not been any successful attempts to correlate accident experience with the commonly available measures of accident prevention. Thus, there is no opportunity to test an assumption that the largest cities may have carried on better safety programs. Least of all can we say they have had better traffic engineering work, valuable as such a conclusion would be to those devoted to the discussion and encouragement of traffic engineering techniques.

Recht, in his valuable multiple regression study, has demonstrated a correlation between death rates and certain isolated measures of safety work, but the one inescapable conclusion arising from a study of his work is that many of the most logical measures do not show any correlation. Two possibilities exist—we are doing the wrong things, or we have not developed good measuring devices for what we are doing.

To look more closely at the actual situation in cities, ten municipalities were queried on a number of pertinent points. Three cities were selected in the 50, 000 to 100, 000 population range, three in the 100, 000 to 200, 000 range, two in the 500, 000 to 700, 000 range, and two in the 700, 000 to 1, 000, 000 range. In each case, cities were selected which reported a traffic engineer, and also some cities with high activity scores in the National Safety Council's annual inventory program and some with low scores. Responses are given in Table 5.

If any single point stands out, it is that urban accident experience has increased substantially in the past five years. This would of course have been expected on the basis of the earlier report of national trends during the past decade. In only one city—the smallest one examined—did the registration rate fail to rise 25 percent, and several of the increases were 75 percent or more.

TABLE 4

MOTOR VEHICLES DEATHS AND NON-FATAL INJURIES
BY TYPE OF ACCIDENT
(1965)

Type of Accident	Deaths			Non-Fatal Injuries		
	Total	Urban	Rural	Total	Urban	Rural
Pedestrian	8, 800	5, 700	3, 100	140, 000	128, 000	12, 000
Two-vehicle	20, 700	4, 700	16, 000	1, 230, 000	760, 000	470, 000
Non-collision	14, 900	2, 800	12, 100	330, 000	95, 000	235, 000
All others	4, 600	1, 800	2, 800	100, 000	67, 000	33, 000
Total	49, 000	15, 000	34, 000	1, 800, 000	1, 050, 000	750, 000

Source: National Safety Council.

TABLE 5

SAMPLE CITY TRAFFIC DATA

Item	City A		City B		City C		City D		City E	
Population, 1966	53,000		72,000		72,500		172,000		142,130	
MV registration, 1966	17,858		39,754		28,891		72,335		80,000	
Street mileage:										
Freeways	–		7.7 (3%)		–		21.1 (5%)		28[a] (7%)	
Arterials	?		73.4 (25%)		29.2 (16%)		103.2 (23%)		55.3 (15%)	
Others	?		213.4 (72%)		157.3 (84%)		330.7 (78%)		294.7 (78%)	
Total miles	140		294.5		186.5		455.0		378	
	1962	1966	1961	1966	1961	1966	1961	1966	1960	1966
Accident experience:										
Fatal	2	2	4	9	1	4	6	14	10	21
Non-fatal injury	376[b]	696[b]	260	395	?	?	825	1,207	771	715
Property damage	?	?	1,371	1,779	?	?	3,212	4,382	?	?
Total	1,263	1,365	1,635	2,183	2,135	2,540	4,043	5,603	4,362	5,031
Population death rate	4.0	3.7	9.7	17.9	1.5	5.9	4.7	8.9	6.7	14.8[c]
Registration death rate	0.9	0.8	2.0	3.1	0.3	1.0	1.0	1.8	1.7	2.6[c]
Traffic engineer reports to	City Manager		City Manager		City Engineer		Director of Public Works		Director of Public Services	
Professional TE staff	1		2		1		6		2	
TE operating budget	$41,258		$233,870		$30,600		$885,351		$259,152	
Capital improvement budget	$850		$1,140,000		$30,000		$119,000		$49,865	

[a] Under construction.
[b] Non-fatal injuries.
[c] Estimated.

Greatest needs in the field of traffic engineering:

City A - Getting parking off main streets to improve flow. Wider streets (arterial and main) and traffic signals at several locations to permit arterial street vehicles to cross main streets. Adequate street lighting system on main and arterial streets.

City B - Construction of additional major street systems together with traffic control to improve the flow of traffic. Also, several street intersections need improving by channelizing for more capacity.

City C - Creation of a separate traffic engineering department with a staff; separate budget; full responsibility and authority to initiate and put into effect regulations improving traffic safety. Funds be made available for inter-connection and coordination of traffic signals, all of which are isolated at present. That the City Council and Mayor be made aware of the importance of applying traffic engineering techniques, and give the traffic engineer their support.

City D - More rigid enforcement of traffic regulations. Functioning safety council. Street lighting on arterial streets in outlying and intermediate areas.

City E - One of the problems encountered is the availability of qualified personnel (especially on the sub-professional level). Feel that more undergraduate courses should be offered in the field of traffic engineering.

Item	City F		City G		City H		City I		City J	
Population, 1966	131,000		500,000		670,000		713,214		940,000	
MV registration, 1966	37,000		230,000		207,000		377,498		238,000	
Street mileage:										
Freeways	15.2 (2%)		15 (1%)		9 (1%)		98.5 (4%)		17 (1%)	
Arterials	109.3 (16%)		200 (20%)		265 (19%)		223 (10%)		450 (32%)	
Others	566.6 (82%)		800 (79%)		1,126 (80%)		1,963 (86%)		933 (67%)	
Total miles	691.1		1,015		1,400		2,285		1,400	
	1961	1966	1961	1966	1961	1966	1961	1966	1961	1966
Accident experience:										
Fatal	15	31	42	73	58	89	50	89	84	118
Non-fatal injury	653	1,233	2,114	2,634	4,458	8,121	2,910	4,537	5,952	8,708
Property damage	2,475	3,140	19,796	23,029	15,174	23,215	11,602	16,422	11,504	15,357
Total	3,143	4,404	21,952	25,736	19,690	31,425	14,562	21,048	17,540	24,183
Population death rate	11.5	25.4	8.8	15.7	9.6	13.3[a]	9.5	14.1	9.7	13.3
Registration death rate	2.5	5.3	2.0	3.4	3.2	4.3[a]	2.4	3.4	2.7	3.4
Traffic engineer reports to	Mayor		Director of Public Utilities		Director of Streets		City Manager		Mayor and City Council	
Professional TE staff	4		12		4		6		17	
TE operating budget	$275,000		$320,000		$436,284		$478,890		$3,000,000	
Capital improvement budget	$30,000		$300,000		$110,000		$51,105		$160,000	

[a] Estimated.

Greatest needs in the field of traffic engineering:

City F - The greatest need in the field of traffic engineering is the acquisition and the retention of professional traffic engineers.

City G - More adequate financial and personnel resources for expanded program of upgrading, standardization, and improved maintenance of traffic control devices.

City H - To expand the scope and depth of present operations which would require an increase of staff and additional funding. Although the division is engaged in all aspects of traffic engineering, much more could be accomplished if more time and talent were available.

City I - Probably the greatest weakness is the inadequacy of the arterial street signal system. Much work needs to be done in providing progressive signal systems along the major arteries. We have surpassed or are rapidly approaching the absolute capacity of most major arteries. Widening and dividing these arteries is necessary to add more capacity and widening cannot be accomplished without acquiring more right-of-way. The Urban Transportation Study recommends a construction program of $145 million for freeways and $205 million for major arteries to provide a system that would be adequate until 1985. All we really need is money.

City J - Our greatest need would be the improvement of inter-departmental relationships. At times, it seems like we go around and around the same circle and never arrive at a decision. Another very important need would be a streamlined method of communicating with the Federal agencies, particularly in those areas which result in financial support. Lastly, we need some more vocal citizens speaking for the motorists. The anti-highway people manage to assemble very vocal groups, whereas with the exception of the motor club, there are very few groups who will stand up to be counted when highway plans are being fought over.

TABLE 6

ACCIDENT RATES, STAFF, AND OPERATING BUDGETS IN SELECTED CITIES

Item	City									
	A	B	C	D	E	F	G	H	I	J
Population death rate										
1961	4.0[a]	9.7	1.5	4.7	6.7[b]	11.5	8.8	9.6	9.5	9.7
1966	3.7	17.9	5.9	8.9	14.8[c]	25.4	15.7	13.3[c]	14.1	13.3
Change, %	-8	+85	+294	+89	+121	+121	+78	+39	+49	+37
Registration death rate										
1961	0.9[a]	2.0	0.3	1.0	1.7[b]	2.5	2.0	3.2	2.4	2.7
1966	0.8	3.1	1.0	1.8	2.6[c]	5.3	3.4	4.3[c]	3.4	3.4
Change, %	-11	+55	+233	+80	+53	+112	+70	+34	+42	+26
Traffic engineering professional staff, 1966, No.	1	2	1	6	2	4	12	4	6	17
Per 100,000 population	1.9	2.8	1.4	3.5	1.4	3.1	2.4	0.6	0.8	1.8
TE operating budget, 1966 ($1,000's)	41	234	31	885	259	275	320	436	479	3,000
Per capita, $	0.77	3.25	0.43	5.15	1.83	2.10	0.64	0.65	0.67	3.19

[a]1962.
[b]1960.
[c]Estimated.

Increases generally occurred in fatals, non-fatal injury accidents, and in property damage cases, suggesting that the changes were actually in accident frequency rather than in accident severity. The data reenforce the conclusion that the urban accident problem is becoming more serious, and rapidly so.

Professional staff to cope with these problems is distressingly meager. On the average, these ten cities report 1.6 professional traffic engineers per 100,000 population, with the highest rate being 3.5 per 100,000. Two are below 1.0 per 100,000.

Traffic engineering budgets are similary weak. On a per capita basis, the average for operating funds is $1.72. Table 6 indicates these relationships for each of the ten cities.

CONCLUSIONS

The significance would appear to be in the rather low levels of staff and budget. This conclusion is strengthened by the comments of the responsible traffic engineering people in each city in answer to the question: "What do you consider the greatest needs in your city in the field of traffic engineering?" The answers could probably be summarized as: money, men, and authority to use them.

Addendum

TORONTO, ONT.

Correlation of Pedestrian Fatalities and Vehicle Registration

In regard to the request concerning correlation, it was found that vehicle registration is so recorded that it would be an impractical task to separate those for the City of Toronto from those in the rest of "Metro." Accordingly, statistical analysis was applied to a correlation in all of Metro.

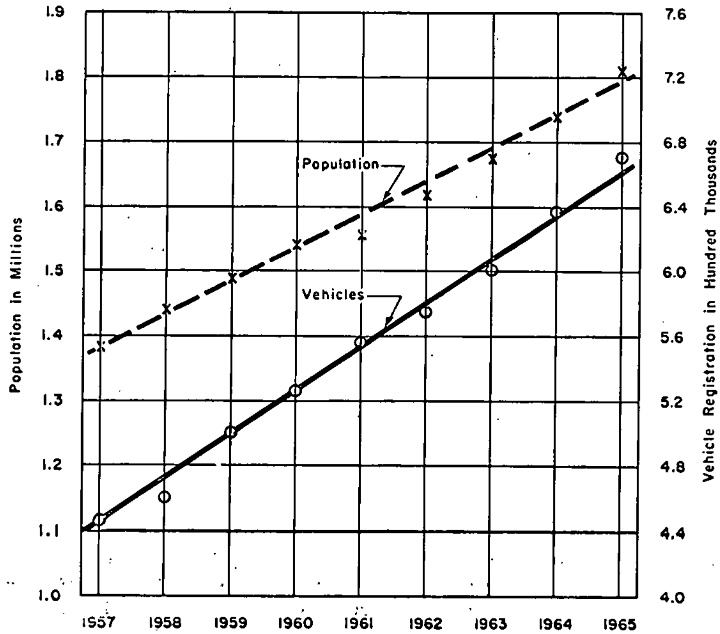

Figure 1. Population growth and vehicle registration.

The first test was to determine whether the change in pedestrian fatalities following the introduction of crossovers was a product of pure change or if the change was significant. In the city, the average number of fatalities in the 20 years prior to the introduction of crossovers was 51. 2 per year. Following the introduction of crossovers, the average has dropped to 35. 9 per year, a decrease of 15. 3 per year or a decrease

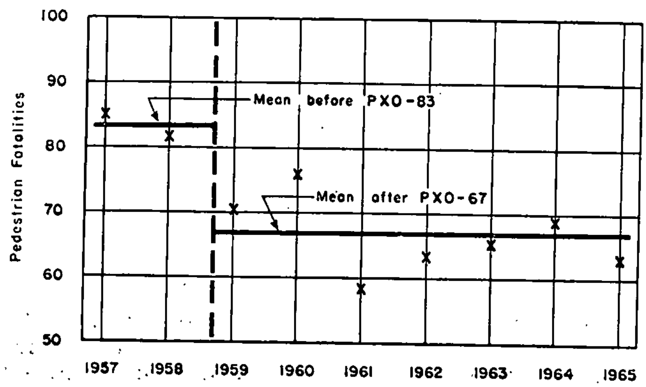

Figure 2. Pedestrian fatalities.

TABLE 7

COMPARISON OF FATALITIES, MOTOR VEHICLE REGISTRATION AND POPULATION IN METROPOLITAN TORONTO

Year	Fatalities	Motor Vehicle Registration	Population
1957	85	453, 000	1, 380, 775
1958	81	463, 000	1, 429, 031
1959	71	499, 583	1, 487, 348
1960	77	524, 562	1, 527, 105
1961	58	558, 618	1, 566, 231
1962	63	575, 376	1, 618, 787
1963	65	600, 000	1, 677, 708
1964	69	639, 187	1, 741, 411
1965	63	671, 146[a]	1, 802, 006

[a]Estimate.

of approximately 30 percent. Applying the t-test indicates that this change is highly significant with a probability of only 1 chance in 2, 000 that it had occurred by chance.

A similar test of fatalities for all of Metro similarly disclosed that the change was significant at the 5 percent level.

Demonstrating the relative change in population and vehicle registration as compared to pedestrian fatalities, Figure 1 shows the growth of population and vehicle registration. Between 1957 and 1964, motor vehicle registration increased by approximately 40 percent, while population increased about 26 percent. Indications are that this linear increase will continue for some years to come.

However, an analysis of pedestrian fatalities indicates (Fig. 2) that the number of pedestrian fatalities is neither increasing nor decreasing but varying about the average. To test this, a regression analysis was applied which indicated that, unless some innovation occurs, such as happened in 1959 when pedestrian crossovers were introduced, we can reasonably expect the number of pedestrian fatalities to vary only within the standard deviation about the present mean.

Since the number of automobiles is increasing linearly and the number of pedestrian fatalities remains constant, the rate of pedestrian fatalities as related to the automobile registration has been declining at the same proportion that registration is increasing, or about 40 percent between 1957 and 1964 (see Tables 7 and 8).

TABLE 8

PEDESTRIAN TRAFFIC FATALITIES (Total)

Area	Year Before Crossovers																					After Crossovers						
	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965
City of Toronto	50	44	60	70	48	81	63	73	53	49	50	42	44	43	55	47	52	48	46	46	52	39	46	27	37	32	35	35
Metro Toronto																				85	81	71	77	58	63	65	69	63