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Maryland Department of Transportation

STATE HIGHWAY ADMINISTRATION

RESEARCH REPORT

STATEWIDE PEDESTRIAN STUDY

PHASE 1 - MARYLAND'S OVERALL PEDESTRIAN ACCIDENT SITUATION

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16. Abstract

This report covers a statewide evaluation of the pedestrian accident situation in Maryland. Nationwide, Maryland was found to have a high accident pedestrian rate on both a 100 MVM and on a 10,000 per population basis. Maryland's pedestrian accident problem falls into two basic situations. In the urban areas of high population densities the number of pedestrian accidents are relatively high, but due to overall lower speeds, the number of fatal accidents is low. In contrast, in the rural areas of the state where the population densities are low, fewer pedestrian accidents occur; but because of higher overall speeds, the number of fatal accidents is higher.

It was assessed that vehicle speed is a significant factor in pedestrian deaths, and speeds generally can be related to the class of roadway and its appropriate assigned speeds. In comparing the injury/fatal ratio (total injury accidents ÷ by the total fatal accidents) of the different systems of highways in Maryland, the following differences were found, state system 8.5, county system 26.8, local system 51.5, and Baltimore City streets, 59.7.

Those state highways, local streets, and sections of roadways that are experiencing high frequence of pedestrian accidents were identified and will be evaluated in phase 2.

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INTRODUCTION

The objectives of the Maryland Pedestrian Study were primarily to: (1) identify sections of highways in Maryland that are experiencing a high incidence of pedestrian accidents; (2) to examine the pedestrian, traffic, and roadway characteristics at these locations to determine what the locations have in common; (3) and to select corrective countermeasures that would enhance pedestrian safety at these locations and identify other measures that might achieve a general improvement in pedestrian safety in Maryland.

Under the prescribed work plan, statewide pedestrian accident data from 1974 to 1979 was used as the basis for the study. In addition, a limited amount of nationwide data was analyzed to measure Maryland's pedestrian situation against the rest of the country.

As the study progressed, it was decided that the results of the study could best be presented in three separate phase reports. This action was felt to be necessary due to the large amount of material being developed in the collection and evaluation of the summary accident statistics and the field data.

Phase 1 deals only with the Maryland pedestrian accident situation in general. A comparison of Maryland's statewide pedestrian accident rate per 100 MVM and per 10,000 population against the other states is presented.

In addition, an injury to fatal ratio was developed for the states and a comparison is also presented.

Phase 1 also compares pedestrian accidents in Maryland by urban and rural areas and by the different road systems. The injury to fatal ratio was developed by road system to enhance this comparison. All highways in Maryland were surveyed over a multiyear period (1974-1979) to identify those roads and sections that are experiencing a high incidence of pedestrian accidents. Listings of these roads and sections of roads are presented in Phase 1 and will provide the groundwork for the research in Phase 2.

Phase 2 will evaluate the individual locations identified in Phase 1. For each location, patterns and causes will be sought. Accident reports will be reviewed. Correlations between accident patterns and roadway conditions will be identified. A detailed study will be made at each site, recording the conditions prevailing, any deficiencies identified, and countermeasures that could be implemented.

Phase 3 will seek common elements between the individual study sites. The pertinent accident and field data will be combined and reviewed to determine what similarities exist. In addition, the Phase 3 report will include the conclusions for the overall study and any recommendations for areas of further research that the study has identified.

MARYLAND PEDESTRIAN STUDY
PHASE I REPORT

Maryland's Overall Pedestrian Accident Situation

1.1 Accident Rate/100 Million Vehicle Miles of Travel (100 MVM)

Over the past years, Maryland has recorded one of the highest pedestrian accident rates in the country based on pedestrian accidents per 100 MVM. In 1979, the pedestrian accident count for Maryland was 143 persons killed and 3,322 persons injured in varying degrees. This accident experience computed to a fatal pedestrian accident rate of 0.54 and a nonfatal, injury rate of 11.93. Fifteen other states recorded a higher fatal rate, but only five states recorded a higher nonfatal, injury rate. The nationwide average fatal pedestrian rate was 0.52, and the nationwide average nonfatal injury rate was 8.64 (see table 1 on pages 2, 3, and 4).

The accident rate/100 MVM is extensively used in measuring the relative hazard of highways and sections of highways. This process is a proven way to compare the relative safety of highway types, and individual roadways or roadway sections within a selected classification.

However, when applying this means of measurement to the pedestrian situation, problems arise as a result of the absence of two important elements: pedestrian exposure and population density. Because there is no practical way of collecting pedestrian volume counts over a highway network to compare with the pedestrian accidents recorded, the accident rate/100 MVM cannot provide a true comparison of a

TABLE 1
STATE TOTALS - 1979 PEDESTRIAN ACCIDENTS

State	Population	Fatal Acc.	Nonfatal Inj. Acc.	Fatal Rate 100 MVM	Nonfatal Inj. Rate 100 MVM	Fatal Rate 10,000 Pop.	Nonfatal Inj. Rate 10,000 Pop.	Inj./Fatal Ratio
Alabama	3,444,165	111	1,134	.38	3.83	.32	3.29	10.22
Alaska	300,382	14	225	.55	8.90	.46	7.49	16.07
Arizona	1,770,900	157	1,400	.80	7.15	.88	7.90	8.92
Arkansas	1,923,295	56	597	.34	3.67	.29	3.10	10.66
California	19,953,134	909	15,170	.57	9.50	.45	7.60	16.69
Colorado	2,207,259	83	1,395	.42	7.07	.37	6.32	16.81
Connecticut	3,031,709	79	1,589	.41	8.18	.26	5.23	20.11
Delaware	548,104	19	366	.46	8.94	.34	6.67	19.26
D. C.	756,510	25	1,131	.75	33.92	.33	14.95	45.24
Florida	6,789,443	656	6,545	.88	8.77	.96	9.63	9.98
Georgia	4,589,575	217	2,244	.50	5.14	.47	4.88	10.34
Hawaii	768,561	43	776	.90	16.30	.55	10.09	18.05
Idaho	712,567	36	239	.48	3.16	.50	3.35	6.64
Illinois	11,113,976	312	11,413	.48	17.58	.28	10.26	36.58
Indiana	5,193,669	143	2,641	.36	6.56	.27	5.08	18.47
Iowa	2,284,376	42	872	.22	4.60	.14	3.08	20.76
Kansas	2,246,578	42	738	.24	4.23	.18	3.28	17.57

State	Population	Fatal Acc.	Nonfatal Inj. Acc.	Fatal Rate 100 MVM	Nonfatal Inj. Rate 100 MVM	Fatal Rate 10,000 Pop.	Nonfatal Inj. Rate 10,000 Pop.	Inj./Fatal Ratio
Kentucky	3,218,706	132	1,650	.48	6.01	.41	---	12.5
Louisiana	3,643,180	---	---	---	---	---	---	---
Maine	992,048	26	495	.37	6.96	.26	4.98	19.03
*Maryland	4,216,446	143	3,322	.54	11.93	.34	7.87	23.2
Massachusetts	5,689,170	149	4,373	.42	12.43	.26	7.68	29.34
Michigan	8,875,083	319	5,061	.49	7.80	.35	5.70	15.86
Minnesota	3,804,971	117	1,678	.42	6.01	.30	4.41	14.34
Mississippi	2,216,912	101	343	.59	2.00	.45	1.54	3.39
Missouri	4,676,501	128	---	.37	---	.27	---	---
Montana	694,409	17	199	.25	2.97	.24	2.86	11.70
Nebraska	1,483,493	19	724	.16	6.28	.13	4.88	38.10
Nevada	488,738	47	652	.80	11.07	.96	13.34	13.87
New Hampshire	738,681	24	432	.38	6.81	.33	5.86	18.0
New Jersey	7,168,164	301	6,956	.60	13.80	.42	9.70	23.1
New Mexico	1,016,000	115	627	1.01	5.52	1.13	6.17	5.4
New York	18,190,740	610	20,320	.78	26.11	.33	11.20	33.31
North carolina	5,082,059	253	2,144	.60	5.10	.49	4.22	8.47
North Dakota	617,761	7	180	.13	3.44	.11	2.91	25.71
Ohio	10,652,017	323	5,568	.44	7.60	.30	5.22	17.23

*Maryland's nonfatal injury accident total reflects a subtraction of 2,210 accidents that were actually bicycle accidents and 7 fatal accidents that were actually bicycle accidents.

State	Population	Fatal Acc.	Nonfatal Inj. Acc.	Fatal Rate 100 MVM	Nonfatal Inj. Rate 100 MVM	Fatal Rate 10,000 Pop.	Nonfatal Inj. Rate 10,000 Pop.	Inj./Fatal Rate
Oklahoma	2,559,229	71	569	.27	2.13	.27	2.22	8.0
Oregon	2,091,385	82	969	.42	4.96	.39	4.63	11.8
Pennsylvania	11,793,909	351	7,112	.50	10.12	.29	6.03	20.3
Rhode Island	949,723	20	---	.34	---	.21	---	---
South Carolina	2,590,516	153	1,058	.64		.51	4.08	6.9
South Dakota	665,567	16	167	.29	2.97	.24	2.51	10.4
Tennessee	3,924,164	135	1,456	.40	4.27	.34	3.71	10.8
Texas	11,196,730	641	6,078	.58	5.54	.57	5.42	9.5
Utah	1,059,273	79	1,138	.81	11,60	.75	10.74	14.4
Vermont	444,330	15	174	.40	4.08	.33	3.91	11.6
Virginia	4,648,494	170	2,068	.44	5.37	.36	4.44	12.2
Washington	3,409,169	118	1,778	.41	6.11	.34	5.21	15.1
West Virginia	1,744,237	71	910	.61	7.86	.41	5.21	12.8
Wisconsin	4,417,731	118	2,627	.36	7.97	.27	5.94	22.3
Wyoming	332,416	---	---	---	---	---	---	---
Totals		7,815	131,513	.52	8.46			16.8

Source: United States Department of Transportation

state's pedestrian situation.

1.2 Accident Rate/10,000 Population

If we look for a more valid method of comparison, and the population density is interrelated to pedestrian volumes, then accidents/10,000 population may be the more correct test of comparison. [1]In 1979, Maryland had 0.34 fatal pedestrian accidents/10,000 population, and 7.87 nonfatal, injury pedestrian accidents/10,000 population. When comparing these rates to the rest of the country, Maryland again ranks among the highest, but dropped slightly when compared to the accident rate/100 MVM method. When comparing fatal pedestrian accidents, Maryland dropped from 16th to 19th, and for nonfatal, injury pedestrian accidents, Maryland dropped from 6th to 10th. Maryland's fatal rate was slightly lower than the nationwide fatal rate of 0.39, but higher than the nationwide nonfatal, injury rate of 6.61.

Because there are considerable differences in the size and population density of the states, it is felt that by comparing Maryland to a selected number of states with similar urban-rural makeup and population densities it would provide a more credible comparison. The ten other states selected and Maryland are listed in table 2 on page 7, and from this comparison, Maryland ranked 3rd in both fatal accidents and nonfatal, injury accidents on a 100 MVM basis,

[1]Institute of Transportation Engineers, Transportation and Traffic Engineering Handbook (Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1976) p. 60.

and ranked 4th in both categories on a 10,000 population basis.

It could be assumed that the more rural a state is, the higher the fatal rate/10,000 population would be and the lower the nonfatal injury rate would be, and in a more urbanized state just the opposite would be found. This assumption is based on the theory that the more urbanization, the lower the overall speeds. But when correlating the data as presented in table 1, the picture does become somewhat cloudy. For the 20 states in each category, (see table 3 on page 9) the concept generally holds true, but it appears there are other elements, such as each state's own unique urban and rural characteristics that must be considered.

1.3 Injury/Fatal Ratio (I-F Ratio)

One more form of general comparison that was looked at was the I-F ratio. In Maryland during 1979, for every 23.2 pedestrian accidents, one was a fatal. Only five states had a higher (in this sense better) I-F ratio than Maryland (see table 4 on page 10).

Again, as with rate/10,000 population, it would be expected that the more urbanized a state was, the higher the I-F ratio would be. According to table 4, this is the general rule. There are states that would seem to be the exception, but the majority of the pedestrian accidents could have occurred in the urban areas. This would only be an assumption as this data was not available.

TABLE 2

(Selected data taken from table 1)

State	1980 Population	Fatal Accidents	Nonfatal, Injury Accidents	Fatal 100 MVM	Nonfatal 100 MVM	Fatal 10,000	Nonfatal 10,000
Florida	6,789,443	656	6,545	.88	8.77	.96	9.63
New Jersey	7,364,158	301	6,956	.60	13.80	.42	9.70
California	19,953,134	909	15,170	.57	9.50	.45	7.60
Maryland	4,216,446	143	3,322	.54	11.93	.34	7.87
Pennsylvania	11,793,909	351	7,112	.50	10.12	.29	6.03
Illinois	11,418,461	312	11,413	.48	17.58	.28	10.26
Ohio	10,652,017	323	5,568	.44	7.60	.30	5.22
Massachusetts	5,689,170	149	4,373	.42	12.43	.26	7.68
Michigan	8,875,083	319	5,061	.49	7.80	.35	5.70
Indiana	5,193,669	143	2,641	.36	6.56	.27	5.08

If the population density has a more direct bearing to the number of pedestrian accidents than any other element, the I-F ratio becomes a significant factor. The question is, is the I-F ratio of a state a constant ratio for all highway systems? We think not. Along with the rural-urban mix, each state has different classes of highways and streets, and each class of highway has its own range of posted speeds. Municipal streets are normally placed at 25 MPH; the allowed speeds on county roads vary slightly, but normally range from 25 MPH to 40 MPH with the majority posted at 30 MPH. State highways and interstate highways are historically posted at higher speeds up to 55 MPH. We will examine the I-F ratio further in Section 1.5.

So, in reflection of the summary statistics presented thus far, Maryland indeed does have a relatively high pedestrian rate when compared to the rest of the country. On both a 100 MVM basis and a 10,000 population basis, Maryland ranks near the top. Only on the I-F ratio (if this can be considered a plus) does Maryland fare better than the majority of the states.

1.4 Maryland's Urban and Rural Differences

In an attempt to bring Maryland's pedestrian situation more into perspective, we must now look at Maryland internally, and distinguish the differences between its urban and rural areas and how they relate in regard to pedestrian accidents. Maryland, like most other states, has a complex makeup comprising a variety of terrains, rural and urban

TABLE 3

Accident Rates/10,000 Population
(1979 Accident Data)

(Selected data taken from Table 1)

Fatal Accident Rate		Nonfatal Injury Rate	
New Mexico	1.13	Nevada	13.34
Nevada	.96	New York	11.20
Florida	.96	Utah	10.70
Arizona	.88	Illinois	10.26
Utah	.75	Hawaii	10.09
Texas	.57	New Jersey	9.70
South Carolina	.51	Florida	9.63
Idaho	.50	Arizona	7.90
North Carolina	.49	Maryland	7.87
Georgia	.47	Massachusetts	7.68
Mississippi	.46	California	7.60
California	.45	Alaska	7.49
New Jersey	.42	Delaware	6.67
Kentucky	.41	Colorado	6.32
West Virginia	.41	New Mexico	6.17
Oregon	.39	Pennsylvania	6.03
Colorado	.37	New Hampshire	5.86
Michigan	.35	Michigan	5.70
Maryland	.34	Connecticut	5.23
		Indiana	5.08

TABLE 4

Injury-Fatal Ratio
(1979 Accident Data)
(Selected data taken from Table 1)

Nebraska	38.1	Washington	15.0	New Mexico	5.4
Illinois	36.5	Utah	14.4	Mississippi	3.3
New York	33.3	Minnesota	14.3	D. C.	45.2
Massachusetts	29.3	Nevada	13.8	Louisiana	*
North Dakota	25.7	West Virginia	12.8	Missouri	*
Maryland	23.2	Kentucky	12.5	Wyoming	*
New Jersey	23.1	Virginia	12.1	Rhode Island	*
Wisconsin	22.2	Oregon	11.8		
Iowa	20.7	Montana	11.7		
Pennsylvania	20.2	Vermont	11.6		
Connecticut	20.1	Tennessee	10.7		
Delaware	19.2	Arkansas	10.6		
Maine	19.1	South Dakota	10.4		
Indiana	18.4	Alabama	10.2		
Hawaii	18.0	Georgia	10.2		
New Hampshire	18.0	Florida	9.9		
Kansas	17.5	Texas	9.4		
Ohio	17.5	Arizona	8.9		
Colorado	16.8	North Carolina	8.4		
California	16.6	Oklahoma	8.0		
Alaska	16.0	South Carolina	6.9		
Michigan	15.8	Idaho	6.6		

*No data available

areas, and population densities.

Five urban subdivisions, Baltimore City, Baltimore County, Anne Arundel County, Montgomery County, and Prince George's County contain 72.5% of Maryland's 4.2 million people and 86% of the pedestrian accidents. Baltimore City alone accounts for 48% of the state's pedestrian accidents with only 18.6% of the total population. The remaining 20 counties in Maryland comprise 28% of the state's population and have 14% of the pedestrian accidents.

No attempt was made to compare pedestrian accidents by accident rate/100 MVM. This was not done because of the relatively small number of pedestrian accidents occurring on individual highways in Maryland each year, and in most cases, vehicle counts were not available for county and local roads.

In applying the accident rate/10,000 population to the 24 individual subdivisions in Maryland, the more rural counties generally have a higher than average fatal rate, and the more urban counties generally have a higher than average injury rate (see table 5 on page 12). However, there are some unexpected variations and like the overall rates for the states, factors as yet not identified, are playing a significant role in determining these accident rates. It is difficult to match even two states or subdivisions because of each one's unique characteristics. Baltimore County and Prince George's County are very similar in both size and population and the nonfatal rate for both

TABLE 5

Pedestrian Accident Rate/10,000 Population by Subdivisions
1976 Data

County	Population	Fatal Acc.	Nonfatal, Injury Accidents	Fatal Rate	Nonfatal, Injury Accidents
Allegany	80,413	3	40	0.37	4.97
Anne Arundel	369,914	12	206	0.32	5.57
Baltimore	651,105	24	488	0.37	7.49
Calvert	34,308	1	5	0.29	1.46
Caroline	23,148	0	7	---	3.02
Carroll	96,056	5	26	0.52	2.71
Cecil	60,113	3	19	0.50	3.16
Charles	72,343	4	26	0.55	3.59
Dorchester	30,549	3	7	0.98	2.29
Frederick	111,687	2	40	0.18	3.58
Garrett	26,502	1	8	0.38	3.02
Harford	145,592	7	33	0.48	2.27
Howard	118,443	2	29	0.17	2.45
Kent	16,680	1	2	0.60	1.20
Montgomery	577,596	10	5	0.17	6.11
Prince Georges	657,707	14	489	0.21	7.43
Queen Annes	25,520	0	6	---	2.35
St. Marys	59,799	5	9	0.84	1.51
Somerset	19,041	1	5	0.53	2.63
Talbot	25,496	1	8	0.39	3.14
Washington	112,764	2	67	0.18	5.94
Wicomico	64,917	3	26	0.46	4.01
*Worcester	30,303	3	31	0.99	10.23
Baltimore City	783,320	33	1,937	0.42	23.45
State Total	4,193,378	140	3,768	0.33	8.99
Washington, D. C.	756,510	25	1,131	0.33	14.95

Nationwide rates for 1979, 0.39 and 6.61

*Distorted rate due to Ocean City's fluctuating population.

Source: Maryland Automated Accident Reporting System (MAARS)

is very close, 7.49 for Baltimore County and 7.43 for Prince George's County. But when we compare the fatal rate, there is quite a difference, 0.37 for Baltimore County and 0.21 for Prince George's County. Table 6, on page 14 presents a graphic view of this phenomenon (applying total accident rate) and shows probable reasons for the differences.

For those rural counties that contain a fairly large city, i.e., Allegany County, Cumberland; Washington County, Hagerstown; Wicomico County, Salisbury; and Worcester County, Ocean City, the accident rate is higher than the other rural counties. This fact points to a definite correlation between population density and a higher accident rate. The rate for Worcester County however, is a distorted rate. Ocean City is a summer resort with a population that varies between the off season and summer months. The rate was computed using the only population count available (30,303).

When looking at accident numbers only, we found in the 20 rural counties, two distinct differences in where the pedestrian accidents are occurring. In those counties that contain municipalities with a population of 5,000 or more, the majority of the accidents occur in urban areas, but in those counties without such municipalities, the majority of accidents occur in rural areas (see table 7, page 15). However, in all these counties, the majority of fatal accidents occur in rural areas and mainly on state highways.

TABLE 6

Accident Rate/10,000 Population
(All Pedestrian Accidents)

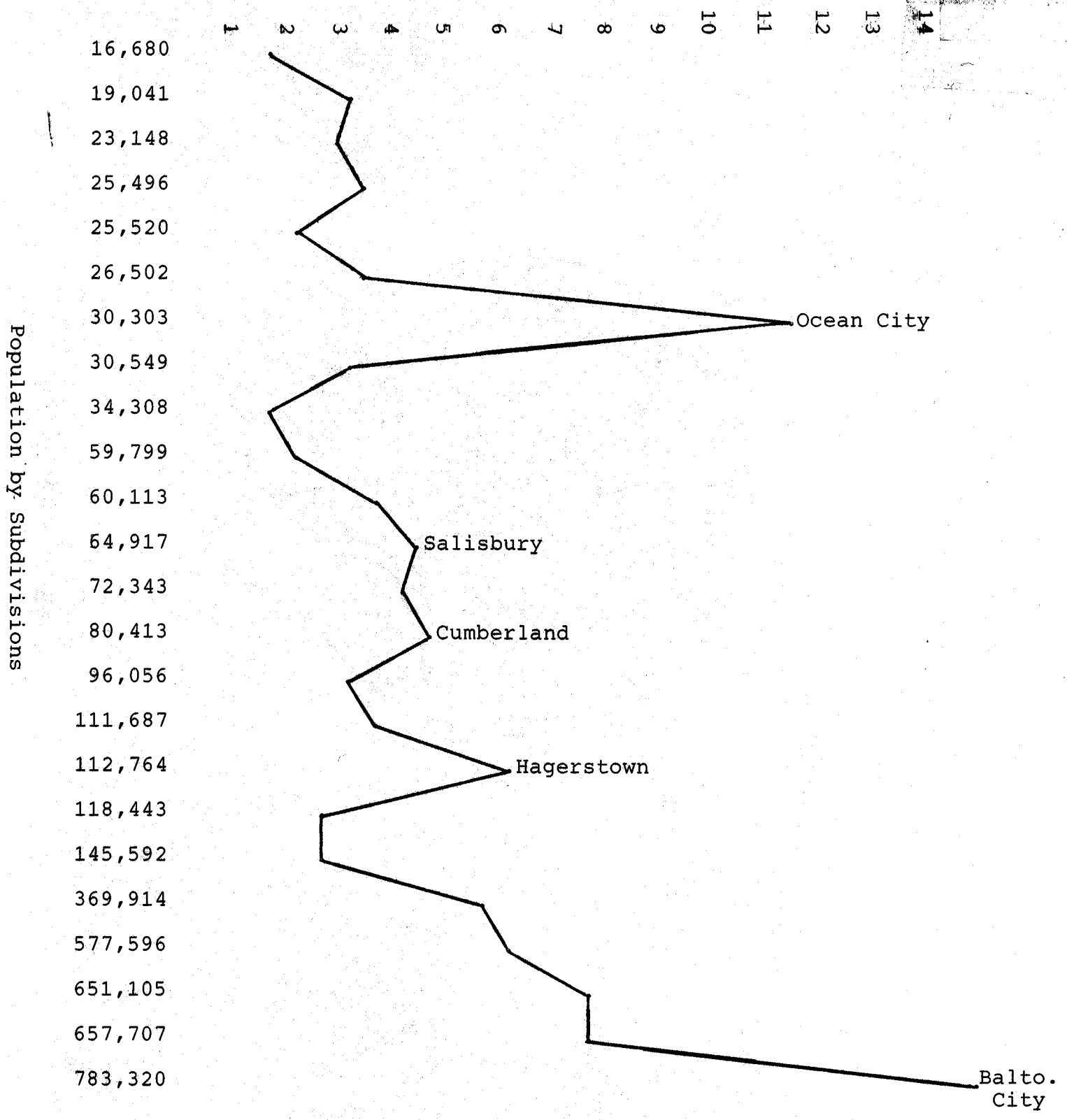

TABLE 7

Rural Counties with Municipalities Over 5,000
(3 Year Accident Totals, 1974-1976)

County	Municipality	Accidents in Rural Area Injury	Fatal	Accidents in Urban Area Injury	Fatal
Allegany	Cumberland	27	10	81	0
Dorchester	Cambridge	9	4	29	0
Frederick	Frederick	42	7	88	1
Talbot	Easton	6	2	12	0
Washington	Hagerstown	30	5	168	3
Wicomico	Salisbury	25	6	51	4
Carroll	Westminster	39	9	38	1
Cecil	Elkton	23	6	23	1
Harford	Belair	97	13	41	1
Worcester	Ocean City	11	3	75	2
		309	65	606	13
		(4.8 I/F Ratio)		(46.6 I/F Ratio)	
Rural Counties with no Municipalities Over 5,000					
Calvert		17	3	5	0
Caroline		7	0	5	0
Charles		61	10	9	1
Garrett		16	3	5	0
Kent		4	5	4	0
Queen Annes		8	3	2	0
St. Marys		26	14	4	0
Somerset		14	3	3	0
*Howard		76	7	--	--
		229	48	37	1
		(4.8 I/F Ratio)			

*Howard County has no incorporated subdivisions
Source: Maryland Automated Accident Reporting System (MAARS)

This data provides strong indication that in rural counties, the pedestrian population is more prone to be killed or more seriously injured if involved in an accident on a rural road than on an urban street. In counties with incorporated towns with populations over 5,000, over the 3-year (1974-1976) period, out of 619 pedestrian accidents in urban areas, 13 pedestrians were killed. In contrast, in the rural areas of these same counties, out of 374 pedestrian accidents, 65 pedestrians were killed. In the rural counties with no incorporated towns with a population over 5,000, only 38 pedestrian accidents, with one fatal accident, were recorded in urban areas over the same 3-year period. In the rural areas of these counties during this period, out of 277 accidents, 48 were fatal accidents. What we see in both categories of these mainly rural counties, is a very poor or "low I-F ratio," in the rural areas compared to the urban areas. This I-F ratio of 4.8 is a stark contrast between the 46.6 ratio found in the urban areas.

1.5 Injury-Fatal (I-F) Ratio

Speed of the vehicles then becomes a very important factor (briefly touched on in Section 1.3), and the class of highway normally determines the speeds allowable by law. Looking at the different classes of highways in Maryland and the impact of each on the pedestrian situation, Maryland has a total road system of 26,402 miles, with 5,241 state maintained highways, 17,246 miles of county roads, 2,030 miles

of urban streets (excluding Baltimore City), and 1,885 miles or urban streets within Baltimore City. The allowable posted speeds on state roads range from 25 MPH to 55 MPH, depending on the location, but normally provide higher function and are posted higher than any other road systems. County roads are normally posted at 30 MPH, and municipal streets are normally posted at 25 MPH.

In table 8 on page 18, we see the stark difference in the I-F ratio for the different road systems. Statewide, if struck on a state road, a pedestrian has a three times less chance of survival than if he were struck on a county road, and six times less chance than if he were struck on a municipal street. This is a very significant difference, and when you realize the ratio in the 20 rural counties showed a 4.8 ratio, this factor becomes even more significant.

The data presented in this section and in section 1.4, now begins to provide a better understanding of Maryland's overall pedestrian situation. The I-F ratio at least places the problem into perspective. In relation to road systems, the state highway system with its higher speeds, constitutes a greater threat of death or serious injury to a pedestrian if struck. On the other hand, in Baltimore City due to its high population density, but lower speeds, a greater number of pedestrians will be hit, but fewer deaths will result.

This data suggests, that from a probability standpoint, the chances of reducing fatal pedestrian accidents would be greater on the state highway system than on the other three

TABLE 8

Pedestrian Accidents and
Injury-Fatal Ratio by Road Systems

8.1 State, County, Municipal, and Baltimore City
(3 Year Totals, 1974-1976)

System	Total Mileage	Injury Accidents	Fatal Accidents	Injury-Fatal Ratio
State	5,241	1,867	244	7.7
County	17,246	1,856	67	27.7
Municipal	2,030	587	9	65.2
Baltimore City	1,885	5,375	90	59.7*

*1978, 1979, 1980 data, no data available for years 1974-1976

8.2 Injury-Fatal Ratio by Road Systems

Statewide (all systems)

Year	Injury/Fatal	I/F Ratio
1980	3036/150	20.24
1979	3322/143	23.23
1978	3321/155	21.42
1977	3351/162	20.68

State System

Year	Injury/Fatal	I/F Ratio
1980	815/97	8.40
1979	807/89	9.07
1978	846/95	8.90
1977	723/84	8.61

**County-Municipal-OP

Year	Injury/Fatal	I/F Ratio
1980	884/24	36.83
1979	1033/31	33.32
1978	1027/19	54.05
1977	945/20	47.25

Baltimore City

Year	Injury/Fatal	I/F Ratio
1980	1712/29	59.03
1979	1829/25	73.16
1978	1834/36	50.94

**Further breakdown was not available

Source: Maryland Automated Accident Reporting System (MAARS)

road systems. Theoretically, statewide, for every reduction of nine pedestrian accidents on the state system one life could be saved. In the 20 rural counties, the odds would be even better, one life saved for every five accidents reduced. On the other hand, on the county system it would take the reduction of 27 pedestrian accidents to save one life, and on the municipal street system it would take the reduction of 65 accidents and in Baltimore City 60 accidents to save one life.

It is felt that the I-F ratio difference between the different classes of highways is a significant factor and may provide the direction in developing countermeasures that can produce positive results through reduced pedestrian accidents. But because the pedestrian accident is normally a rare and isolated event, in those areas where the number of accidents is low but the severity of the injuries is high, harsh realities may have to be faced. It may be unrealistic to believe that these accidents can be reduced or eliminated through traffic engineering countermeasures.

1.6 Identification of Pedestrian Accidents by Subdivision and by Road System

In an attempt to identify those highways, streets, and sections of roadways that are experiencing high frequency of pedestrian accidents, all roads in Maryland were surveyed over a multiyear period. The following lists are the result of that effort.

Municipal Street System

Table 9 on page 21, presents all pedestrian accidents for the three year period 1974-1976, for the state's subdivisions (except Baltimore City) by road system. The municipal system (excluding Baltimore City) experienced 587 pedestrian accidents, of which 9 were fatals, over the three year period 1974-1976. The majority of the accidents occurred within those counties with municipalities of 5,000 or more population.

In surveying the municipal street system in an attempt to identify streets experiencing above normal pedestrian accident incidences, 18 streets were identified that had four or more accidents (see table 10 page 22).

These 18 streets experienced 106 injury accidents and three fatal accidents and comprise 18% of the total injury accidents and 33% of the total fatal accidents on the municipal street system. For these 18 streets, three additional years (1977-1979) of accident data were collected to determine if the accident patterns were continuing. Eleven streets were found to have eight or more pedestrian accidents over the six year period. A limited evaluation of these 11 streets will be made in phase 2 of the study to assess each's pedestrian problem, and to develop a pedestrian and street profile for the municipal street system.

TABLE 9
Maryland Pedestrian Accidents
(1974-1976)

County	State		County		Municipal	
	Injury	Fatal	Injury	Fatal	Injury	Fatal
Allegany	50	8	3	2	55	0
Anne Arundel	272	32	250	11	54	2
Baltimore	385	51	702	17	--	--
Calvert	15	3	4	0	3	0
Caroline	6	0	3	0	3	0
Carroll	42	8	19	1	16	1
Cecil	30	5	10	2	7	0
Charles	47	11	22	0	1	0
Dorchester	11	4	4	0	23	0
Frederick	58	4	14	3	58	1
Garrett	12	2	8	1	1	0
Harford	74	12	28	2	36	0
Howard	37	7	39	0	--	--
Kent	4	4	1	1	3	0
Montgomery	315	15	268	7	69	0
Prince Georges	304	42	435	14	74	2
Queen Annes	9	3	1	0	0	0
St. Marys	22	14	6	0	2	0
Somerset	11	3	4	0	2	0
Talbot	6	1	0	1	12	0
Washington	72	6	13	1	113	1
Wicomico	26	4	19	4	31	2
Worcester	59	5	3	0	24	0
	1,867	244	1,856	67	587	9

Source: Maryland Automated Accident Reporting System (MAARS)

TABLE 10

Pedestrian Accidents on Municipal Streets
*(1974-1976)
**(1977-1979)

	*	**
Allegany Co.		
MU 2630 Cumberland Old Town Rd.	7/0	2/0
MU 3690 Cumberland Virginia Ave.	7/0	9/1
Anne Arundel Co.		
MU 0610 Annapolis Oak Ave.	5/0	0/0
Carroll Co.		
MU 0220 Westminster Grosvenor	4/0	0/0
Frederick Co.		
MU 0570 Frederick East St.	4/0	0/0
Montgomery Co.		
MU 0930 Takoma Park Maple Ave.	4/0	5/0
Prince Georges Co.		
MU 0020 Dist. Hgts. Alpine St.	5/0	4/0
MU 0055 Laurel Bowie Rd.	5/0	3/0
MD 0100 Seat Pleasant F St.	6/1	2/0
MU 0120 Berwyn Hgts. Quebec St.	5/0	2/0
MU 0130 Seat Pleasant Fresno St.	6/0	4/0
MU 0150 Seat Pleasant Greig Ct.	6/0	1/0
MU 0160 Seat Pleasant Greig St.	9/1	1/0
MU 0170 Hyattsville Jamestown Rd.	6/0	0/0
MU 0230 Laurel Main St.	4/0	4/0
Washington Co.		
MU 0300 Hagerstown Warner Hollow Rd.	6/1	4/0
MU 0910 Hagerstown (name unknown)	4/0	0/0
MU 2000 Hagerstown Apple Tree Rd.	14/0	16/0

County Road System

The county road system experienced 1,856 pedestrian accidents, of which 67 were fatal accidents, over the three year period. The majority of the accidents occurred in the four urban counties, Anne Arundel, Baltimore, Montgomery and Prince George's. As indicated previously, these four counties accounted for 1,655 injury accidents (89% of the total) and 49 fatal accidents (73% of the total accidents). Although the majority of the accidents occurred in the four urban counties, the I-F ratio is higher in these counties, 33.78, to 11.17 in the 20 rural counties.

In surveying the county road system, statewide we identified 68 roads that had four or more accidents (see table 11, on page 23). These roads experienced 440 injury accidents (24% of the total) and 13 fatal accidents (19% of the total fatal accidents).

As on the municipal system, three additional years (1977-1979) of accident data were collected for the 68 roads to determine if the accident patterns were continuing. Twenty-five roads were found to have 15 or more pedestrian accidents over the six year period. And as on the municipal system, a limited evaluation of the 25 roads will be made in phase 2.

TABLE 11

County Roads
*3-Year Totals 1974-1976
**3-Year Totals 1977-1979

Anne Arundel Co.	*	**
Co 698 Aquahart Rd.	4/0	2/1
Co 1008 Pioneer Dr.	4/0	4/0
Co 1398 Elvaton Rd.	5/0	4/0
Co 1477 Benfield Rd.	4/0	5/0
Co 1513 Jumpers Hole Rd.	4/0	2/0
Co 2099 Earleigh Hgts. Rd.	4/1	1/0
Co 2495 Log Inn Rd.	4/0	2/0
Co 2749 Riva Rd.	4/0	4/0
Baltimore Co.		
Co 799 Church La.	4/0	4/0
Co 810 Timonium Rd.	5/0	4/0
Co 1400 Joppa Rd.	11/0	24/0
Co 1700 Old Court Rd.	8/0	13/0
Co 1900 Windsor Mill Rd.	4/0	15/0
Co 2000 Rolling Rd.	8/0	11/0
Co 2400 Security Blvd.	11/0	9/0
Co 2501 Woodlawn Dr.	4/0	7/0
Co 2600 Edmondson Ave.	6/0	11/0
Co 2621 Ingleside Ave.	7/2	6/0
Co 2700 Winters La.	5/0	8/0
Co 3071 Sulphur Spring La.	5/1	6/0
Co 3200 Hammonds Ferry Rd.	4/0	8/0
Co 3239 Hollins Ferry Rd.	11/0	7/0

Baltimore Co.	*	**
Co 3413 Hillsway Ave.	6/0	4/0
Co 3481 Taylor Ave.	6/0	5/0
Co 3482 Putty Hill Ave.	9/0	6/1
Co 4465 Middle River	6/0	5/1
Co 4582 Kingston Rd.	6/0	3/0
Co 4728 Stemmers Run Rd.	5/0	10/0
Co 4758 Eastern Ave.	12/1	12/0
Co 4775 S. Marlyn Ave.	8/1	15/1
Co 4875 Middleborough	5/0	3/0
Co 4967 Back River Neck	11/0	9/0
Co 5033 Mace Ave.	5/0	4/0
Co 5212 Holabird Ave.	15/0	12/0
Co 5237 Dundalk Ave.	8/0	7/0
Co 5248 Main St.	4/0	2/0
Co 5460 Merritt Blvd.	6/1	15/3
Co 5560 Wise Ave.	10/1	17/1
Co 5600 Lynch Rd.	11/0	19/0
Co 5619 Jasmine Rd.	4/0	1/0
Co 5628 Kavanagh Rd.	4/0	7/0
Howard Co.		
Co 1077 Main St.	4/0	2/0
Montgomery Co.		
Co 76 Bonifant Rd.	4/1	1/0

TABLE 11 cont'd

Montgomery Co.	*	**
Co 144 Montrose Rd.	6/1	1/0
Co 212 Shady Grove Rd.	4/0	3/0
Co 352 Battery La.	4/0	1/0
Co 684 Ellsworth Dr.	4/0	2/0
Co 1592 Parkland Dr.	4/0	4/0
Co 1659 Randolph Rd.	4/0	12/0
Prince George's Co.		
Co 42 Good Luck Rd.	4/0	14/0
Co 75 Sheriff Rd.	16/1	25/0
Co 81 Suitland Rd.	4/0	10/0
Co 302 Riverdale Rd.	10/0	19/0
Co 351 Addison Rd.	9/1	10/0
Co 366 Addison Rd.	4/0	9/0
Co 599 Brandywine Rd.	4/0	4/1
Co 662 Kennebec St.	4/0	1/0
Co 680 23rd Ave.	4/0	6/0
Co 828 Larchmont Ave.	4/0	8/0
Co 1192 Iverson St.	5/0	11/0
Co 1202 Livingston Rd.	9/0	7/0
Co 1203 Livingston Rd.	6/0	9/0
Co 1291 Rhode Island Ave.	6/0	1/0
Co 1488 83rd Ave.	5/0	0/0
Co 2251 Oakcrest Dr.	5/0	1/0
Co 2277 Cleveland St.	5/0	0/0

Prince George's Co.	*	**
Co 2277 Cleveland St.	5/0	0/0
Co 3074 (Old MD 4) Marlboro Pike	24/1	34/0

State Highway System

The state highway system experienced 2,111 pedestrian accidents, of which 244 were fatal accidents, over the three year period. Like the county road system, the majority of the pedestrian accidents on the state highway system occurred in the four urban counties. The four counties accounted for 1,276 nonfatal injury accidents (68% of the total) and 140 fatal accidents (57% of the total). Again, like on the county system, we found quite a difference in the I-F ratio: 9.11 in the four urban counties and 5.68 in the 19 rural counties. When you subtract those pedestrian accidents in the rural counties that happened on state roads located in municipalities, the difference is even greater, 4.8 (see table 7 on page 15).

Listed below in table 12 on page 27 are the top 20 most hazardous state highways (based on accident totals only) when considering pedestrian accident involvement. These highways account for only 24% of the total nonfatal accidents, but 41% of the total fatal accidents.

Three additional years (1977-1979) of accident data were collected. A limited evaluation will be done on these highways in phase 2. Extensive evaluation will be done on sections of these roads that are identified as high pedestrian accident sections (see table 15 on page 32).

TABLE 12

Pedestrian Accidents on State Highway System

	(1974-1976) I/F	*(1977-1979) I/F
MD 2 A.A. Co.	77/12	78/10
US 1 P.G. Co.	47/10	92/4
MD 355 Mont. Co.	46/6	81/2
US 40 Balto. Co.	33/15	47/5
MD 150 Balto. Co.	44/4	53/6
MD 528 Wo. Co.	38/1	85/3
US 1 Balto. Co.	28/4	38/4
MD 450 P.G. Co.	24/3	35/0
US 40 H. Co.	19/4	34/11
MD 704 P.G. Co.	19/3	27/0
I-695 Balto. Co.	13/8	32/7
I-495 P.G. Co.	13/5	5/2
MD 202 P.G. Co.	13/5	28/2
MD 151 Balto. Co.	11/4	21/4
US 301 Ch. Co.	11/4	11/0
US 11 W. Co.	12/3	9/2
MD 3 A.A. Co.	8/6	14/3
MD 235 S.M. Co.	7/4	14/4
MD 5 S.M. Co.	3/6	17/7
US 301 P.G. Co.	2/3	10/2
Total	468/110	731/78

*In 1977, it was impossible to differentiate between pedestrian and bicycle accidents on the computerized accident listing and, therefore, reflects an incorrect total on those highways that historically have recorded bicycle accidents.

Source: Maryland Automated Accident Reporting System (MAARS)

Baltimore City Street System

Pedestrian accident counts for Baltimore City were available for the four year period 1977-1980. Listed below in Table 13 are all streets (78) that averaged four or more pedestrian accidents per year. Listed on Table 16 on page 28 are the remaining accident numbers by total accidents and by number of streets. Further evaluation will be done on the Baltimore City Street system in phase 2 of the study.

TABLE 13

Baltimore City Pedestrian Accidents on Major Streets (1977-1980)

North Ave.	231/2	Frederick Ave.	68/2
Greenmount/York Rd.	189/2	Monroe St.	65/0
Park Hgts. Ave.	156/2	Monument St.	63/0
Reisterstown Rd.	154/2	Lafayette St.	57/0
Baltimore St.	153/3	Saratoga St.	57/0
Edmondson Ave.	152/0	Franklin St.	54/0
Fayette St.	138/2	Hilton St.	53/0
Lombard St.	125/2	Belvedere Ave.	50/2
Harford Rd.	113/0	Garrison Blvd.	50/0
Eastern Ave.	110/6	Washington Blvd.	49/0
Fulton Ave.	100/3	Preston St.	47/0
Liberty Hgts. Ave.	92/3	Patapsco Ave.	45/2
Charles St.	87/0	Falls Rd.	42/2
Pratt St.	87/0	Sinclair La.	42/2
Orleans St.	84/4	Carey St.	42/0
Howard St.	79/0	Hanover St.	42/0
Broadway	72/2	Lexington St.	42/0

TABLE 13 Cont'd

Patterson Park Ave.	39/0	Chase St.	26/0
Wilkens Ave.	39/0	Eager St.	26/0
Light St.	38/0	Clifton Ave.	25/2
The Alameda	37/0	Mulberry St.	25/0
Pennsylvania Ave.	37/0	Forest Park Ave.	24/0
Druid Hill Ave.	36/3	Bloomingdale Rd.	23/2
St. Paul St.	36/3	Mount St.	23/0
Caroline St.	35/0	Gwynns Falls Pkwy.	23/0
Freemont Ave.	33/0	N. Milton St.	22/0
Gilmore	33/0	Kirk Ave.	21/0
Loch Raven	33/0	Park Ave.	20/0
Pimlico Rd.	33/0	McCulloh St.	19/0
Edmondson Ave.	33/0	Whitelock St.	19/0
Asquith St.	32/0	Barclay St.	18/0
Poplar Grove St.	30/0	I-895	17/2
Gay St.	30/0		16/0
Fort Ave.	29/0		16/0
Cherry Hill	29/0	Total	4182/51
Washington St.	29/0	I/F Ratio 82.0	
Chester St.	28/0		
Wolfe St.	28/0		
25th St.	27/2		
Baker St.	27/0		
Eutaw Pl.	27/0		

Source: Maryland Automated Accident Reporting System (MAARS)

TABLE 14

Baltimore City Pedestrian Accidents on Minor Streets
(1977-1980)

No. of Sts.	Total Acc. 4 Yr. Per.	Total Acc. 4 Yr. Per.	Fatal 4 Yr. Per.	Inj/Fatal Ratio
490	1	490	3	
116	2	232	1	
85	3	255	4	
50	4	200	1	
38	5	190	2	
26	6	156	2	
20	7	140	2	
13	8	104	--	
14	9	126	1	
9	10	90	--	
10	11	110	--	
11	12	132	4	
15	13	195	3	
8	14	112	1	
1	15	15	--	
906		2,547	24	106.13

Source: Maryland Automated Accident Reporting System (MAARS)

High Pedestrian Sections

In an attempt to further define the pedestrian situation into an area that could possibly be addressed through the application of countermeasures, all highways (excluding Baltimore City) were surveyed on a 1/2 mile sliding scale basis. It was arbitrarily decided that any section experiencing six or more pedestrian accidents in the three year period (1974-1976) would be tallied. Fifty-six (56) sections were identified. Three more years accident data (1977-1979) were collected for the 56 locations to determine if the pedestrian accident patterns were continuing. Those locations (38) that experienced 12 or more accidents over a six year period are listed in Table 15 starting on page 32.

Extensive evaluation will be done on these locations in phase 2 of the study.

1.7 Conclusion

The research in phase 1 has provided a better understanding of Maryland's overall pedestrian situation. The research has identified the scope of the problem along with significant factors that may provide the direction in the development of effective countermeasures.

Maryland does have a relatively high pedestrian rate when compared to the rest of the country. However, any comparison between states is difficult because two important elements are normally not known - pedestrian exposure and population density. Also, data relating to pedestrian

TABLE 15

High Pedestrian Accidents Sections
(1974-1979)

County	Route	Location by Milepoint	1974-1976 Acc.	1977-1979 Acc.	Total Acc.
Anne Arundel	MD 2	35.89 to 36.70	12/2	11/0	23/2
Anne Arundel	MD 2	40.34 to 41.43	30/5	24/2	54/7
Anne Arundel	MD 450	12.24 to 12.48	11/1	12/0	23/1
Anne Arundel	MD 648 (E)	0.50 to 1.60	10/1	9/0	19/1
Baltimore	Back River Neck Rd.	0.06 to 0.56	6/0	6/0	12/0
Baltimore	Holabird Ave.	0.30 to 0.32	8/0	4/0	12/0
Baltimore	Lynch Ave.	0.06 to 0.52	7/0	5/0	12/0
Baltimore	MD 26	6.15 to 6.59	7/0	8/0	15/0
Baltimore	MD 45	1.95 to 2.20	13/0	11/0	24/0
Baltimore	MD 144	3.40 to 3.90	14/0	17/0	31/0
Baltimore	MD 144	4.05 to 4.33	7/0	5/0	12/0
Baltimore	MD 147	1.59 to 1.92	9/0	3/0	12/0
Baltimore	MD 150	1.05 to 1.24	6/0	6/0	12/0
Baltimore	MD 150	3.04 to 3.39	7/0	6/0	13/0
Baltimore	MD 150	4.71 to 5.17	10/2	6/0	16/2
Baltimore	MD 150	5.30 to 5.68	6/0	8/1	14/1

TABLE 15 cont'd

County	Route	Location by Milepoint	1974-1976 Acc.	1977-1979 Acc.	Total Acc.
Baltimore	US 1	3.91 to 4.52	9/0	4/0	13/0
Baltimore	US 40 (E)	5.14 to 5.92	11/5	14/0	25/5
Montgomery	MD 97	0.07 to 0.58	7/0	5/0	12/0
Montgomery	MD 185	0.10 to 0.58	6/0	7/0	13/0
Montgomery	MD 320	1.80 to 2.37	11/0	5/0	16/0
Montgomery	US 29	0.01 to 0.95	19/0	20/0	39/0
Prince George's	CO 75	4.69 to 4.95	9/0	3/0	12/0
Prince George's	CO 302	1.41 to 1.96	5/0	9/0	14/0
Prince George's	CO 3074	1.63 to 1.19	14/1	7/0	21/1
Prince George's	MD 201	3.61 to 3.94	6/0	7/0	13/0
Prince George's	MD 202	11.52 to 11.90	6/1	7/0	13/1
Prince George's	MD 214	1.17 to 1.65	7/0	6/0	13/0
Prince George's	MD 704	0.36 to 0.86	8/0	7/0	15/0
Prince George's	MD 704	2.16 to 2.59	6/2	10/1	16/3
Prince George's	US 1	3.55 to 3.87	6/1	18/1	24/2
Prince George's	US 1	4.44 to 4.78	12/0	16/0	28/0
Prince George's	US 1	4.98 to 5.57	11/5	14/2	25/7

TABLE 15 cont'd

County	Route	Location by Milepoint	1974-1976 Acc.	1977-1979 Acc.	Total Acc.
Washington	MU 2000	1.76 to 2.53	11/0	14/0	25/0
Washington	US 40	37.97 to 38.50	18/1	15/1	33/2
Worcester	MD 378	0.18 to 0.59	6/1	10/0	16/1
Worcester	MD 528	0.41 to 0.91	5/1	7/0	12/1
Worcester	MD 528	3.74 to 4.77	10/0	17/1	27/1
			366/29	363/9	729/38

accidents is very limited, and any comparison made on a nationwide basis would just be too broad and too general.

In Maryland, the pedestrian problem falls into two basic situations. In the larger urban areas that contain high population densities, the number of pedestrian accidents is high, but due to lower overall speeds, the number of pedestrian fatals is low. On the other hand, in the rural areas of the state where the population densities are low, fewer pedestrian accidents occur, but because of higher overall speeds, the number of fatal accidents is higher. (This would also include urban interstate highways.)

The injury to fatal (I-F) ratio becomes a significant factor. It places the pedestrian situation into perspective in relation to road systems and their associated speeds. It also established a base for understanding the impact of the problem in relation to the probability of reducing fatal accidents. Based on the I-F ratios, the best opportunity for reducing fatal accidents would be on the state highway system. Theoretically, on state highways in rural areas, for every five pedestrian accidents reduced, there is the probability of saving one life. On the state highways located in urban areas, and for the local road systems, the I-F ratio becomes higher and, therefore, requires a greater reduction in the total number of accidents to theoretically save one life.

The basic question remains however; by the very nature

of the pedestrian accident, the fact that it is a rare and isolated event, what control can the traffic engineer have in preventing these accidents? This question will be dealt with further in phase 2. The state highways, local streets, and sections that were identified in phase 1 as experiencing high frequency of pedestrian accidents will be evaluated in an attempt to provide basic answers to this question. It will be the objective of phase 2 to identify those highway elements that contribute to a high risk factor to pedestrian movement and to attempt to seek out a correlation between accident patterns and roadway conditions. It is hoped, from this evaluation, effective countermeasures can be developed that will provide Maryland's pedestrian population with a safer walking environment.

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