Abridgment

Accident Type Designations and Land Use Data in Pedestrian Accident Analysis

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An improved perception of the characteristics of pedestrian accidents is demonstrated through the application of accident type designations. Four accident types accounted for over 75 percent of the accident history: midblock cross, intersection cross, midblock dartout, and intersection dash. The young (ages 1 through 9) were overrepresented in the midblock dartout history, and the elderly (60 and over) were overrepresented in the intersection cross history. Specific accident types were also found to occur more often adjacent to residential and commercial-or-financial land uses. Two thousand pedestrian accidents would be required to generate statistical reliability for the more obscure accident types. The application of accident type analysis at specific sites appears limited to locations with either a large number of accidents or accidents confined to only a few types.

Studies sponsored by the Federal Highway Administration (FHWA) have concluded that pedestrian accident evaluation and the identification of appropriate countermeasures could be significantly improved through the use of accident type designations (*1*, *2*). The use of accident type designations for pedestrian accidents can improve the analyst's perception of events beyond that available using traditional accident data. The use of accident type designations is recommended as the primary resource for the identification of pedestrian accident causes and countermeasures in the FHWA-sponsored guidelines presented in the *Model Pedestrian Safety Program—User's Guide* (*3*).

STUDY OBJECTIVES AND METHODOLOGY

The primary objectives of this study were to demonstrate the application of the accident type designations presented in the Model Pedestrian Safety Program (MPSP) for urban areas. This research also incorporated land-use data into the analysis. The evaluation of accident data in terms of land use adjacent to accident sites has been shown to improve the identification of potential accident risk of various locations (*4*).

The study methodology was an analysis of pedestrian accident records for 556 accidents that occurred within the incorporated city limits of Tucson, Arizona, for the 3-yr period from 1982 through 1984. Information on accident type was extracted from copies of the individual accident reports from the accident diagram and narrative description supplied by the reporting police officer.

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Eighteen accident types were used.The accident type definitions used were those presented in an FHWA report on pedestrian trip-making characteristics and exposure measures by Tobey et al. (*4*). These are virtually the same as the definitions presented in the MPSP User's Guide (*3*) except for the distinction made in the user's guide between midblock dartout and midblock dash accidents. This distinction was virtually impossible to use based on the information in the accident reports. The combination of these accident types into the single midblock dartout, as described in the Tobey study (*4*), was deemed more appropriate for application in this demonstration.

The distinction between the vehicle turn-merge and turning vehicle accident types was also difficult to make for the data collectors. This was resolved through the evaluation of the right-of-way conflict for the turning vehicle. In general, if a vehicle was turning into cross traffic that had the right of way, the accident was considered a vehicle turn-merge type. A turning vehicle accident type was assumed if the vehicle was considered to have the right-of-way over cross traffic and was either turning right or left through gaps in opposing traffic.

Land-use data were collected for each accident location through field visits. Seven major land-use categories were employed and each was initially disaggregated into several subcategories. The data were collected based on the land use immediately adjacent to the accident location on both sides of the roadway. The data were collected for the land use the pedestrian was crossing away from (near side) and toward (far side) based on the travel direction indicated in the police report.

RESULTS

Statistical significance in this presentation is based on either the chi-square test or the z-test of proportions at a 95th percentile level of confidence.

Accident Type

The results of the accident type analysis are shown in Table 1. All but 17 (3.1 percent) of the accidents were capable of being classified by the accident types indicated. Intersection cross,

TABLE 1 NUMBER OF ACCIDENTS BY ACCIDENT TYPE

Accident Type	Number	Percent	Percent From Other Cities[a]	Significantly Different
Midblock cross	102	18.3	9.4	Yes
Intersection cross	151	27.2	12.1	Yes
Midblock dartout	123	22.1	33.0	Yes
Intersection dash	42	7.6	11.1	Yes
Right turn on red	16	2.9	1.4	Yes
Vehicle turn-merge	10	1.8	4.9	Yes
Multiple threat	22	4.0	2.3	No
Bus-stop related	2	0.4	1.9	Yes
Exit or enter parked vehicle	8	1.4	3.2	No
Trapped by changing light	6	1.1	0.6	No
Disabled vhicle	4	0.7	1.7	No
School-bus related	0	0.0	0.2	No
Hitchhiking	2	0.4	0.1	No
Walk along roadway	21	3.8	8.9	Yes
Playing in roadway	3	0.5	3.7	Yes
Vendor or ice cream truck	7	1.3	1.7	No
Vehicle or vehicle collision	13	2.3	NA	
On sidewalk	7	1.3	3.3	Yes
Other	17	3.1	0.4	
Total	556	100.0	99.9	
Intersection cross + dash	191	34.8	23.2	Yes
Midblock cross + dartout	224	40.4	42.4	No

NOTE: NA = Not available.
[a](4, p. 85)

intersection dash, midblock cross, and midblock dartout represent the four most common accident types. These four types accounted for over 75 percent of the accidents.

Several accident types were indicated to have a significantly different proportion of the accident history than that in an earlier study of five metropolitan areas (4). However, except for the four major accident types, the frequency of accidents for any type was too small in the Tucson sample for the results to be considered reliable. This indicates that 3 yr of accident data are insufficient for the evaluation of most accident types for a city with approximately 200 pedestrian accidents per year.

A comparison of a surrogate pedestrian population distribution presented by Tobey (4) to the accident study population distribution by age group revealed that pedestrians 9 yr of age and younger and those aged 60 and older were significantly overrepresented in the accident history. The data in Table 2 indicate accident problems associated with these age groups and identify some potential problem areas for age groups that were not overrepresented in the general accident history. The results for the vendor or ice cream truck accidents are unreliable due to the small sample size.

Land Use

In the Tobey (4) study, land use adjacent to a roadway was defined on the basis of the proportion of the land given over to specific land uses. However, this type of land-use data is not typically available in a format conducive to application with accident records.

A direct association between pedestrian activity and land use adjacent to the roadway cannot be determined from accident record data. It was extremely rare (less than 1 percent) that an accident report contained information indicating that a pedestrian was crossing to or from a specific land use. Accident locations were typically well defined in terms of the land use on either side of the roadway.

Land-use types were grouped into 7 categories for the aggregate analysis, and 39 categories for the disaggregate analysis. The disaggregate analysis did not yield particularly meaningful results because of the limited data. The number of accidents by aggregate land-use category near side and far side is given in Table 3. Over 88 percent of all accidents had either a commercial-or-financial or a residential land use on at least one side of the roadway. Twenty-nine percent and 19.4 percent of the accidents occurred with commercial-or-financial and residential land use on both sides of the roadway, respectively. Both land use categories have been associated with a high level of pedestrian activity (4).

Vacant land was found to be on at least one side of the roadway at over 23 percent of the accident locations. Open or undeveloped land has been associated with a high level of hazard for pedestrian activities at intersection locations (4).

Accidents adjacent to residential land uses were concentrated in areas with single-family dwellings. Single-family dwelling was the land-use type on the near side of the roadway for over 75 percent of the accidents where residential land existed on the near side. It was also the land use on the far side for over 78 percent of the accidents where residential landexisted on the far side. Nearly 15 percent (83 cases) of all

TABLE 2 NUMBER OF ACCIDENTS BY ACCIDENT TYPE AND AGE OF PEDESTRIAN

	Age Group							
Accident Type	1–4	5–9	10–14	15–19	20–29	30–59	60+	Total
Midblock cross	1	7	4	12	21	28	15	88
Intersection cross	0	5	12	12	28	40	41[a]	138
Midblock dartout	10[a]	32[a]	7	16	18	22	7	112
Intersection dash	2	2	10[a]	6	7	10	2	39
Walk along roadway	0	0	1	2	10[a]	1	5	19
Vendor or ice cream truck	3[a]	2	0	0	0	0	0	5
All others	2	4	11	6	23	31	20	97
Total	18	52	45	54	107	132	90	498

[a]Value that is significantly higher than expected based on z-test of proportions at the 95th percentile level of confidence in comparison to the total accident-type distribution.

TABLE 3 NUMBER OF ACCIDENTS BY AGGREGATE LAND-USE NEAR SIDE VERSUS LAND-USE FAR SIDE

Near Side	Commercial or Financial	Manufacturing	Residential	Education or Religious	Medical	Recreational	Vacant Land
Commercial or financial	161	0	32	6	5	1	28
Manufacturing	0	1	2	0	0	0	2
Residential	23	1	108	16	4	7	9
Educational or religious	11	0	13	5	0	0	16
Medical	4	0	4	1	2	0	0
Recreational	3	0	15	0	0	1	1
Vacant land	29	0	12	12	4	0	17
Total	231	2	186	40	15	9	73

TABLE 4 FREQUENCY OF ACCIDENTS BY ACCIDENT TYPE WHERE COMMERCIAL-OR-FINANCIAL OR RESIDENTIAL LAND USE EXISTED ON BOTH SIDES OF THE ROADWAY

Accident Type	Commercial or Finance		Residential		Total	Commercial or Financial Significantly Different
	Number	Percent	Number	Percent		
Midblock cross	26	16.1	17	15.7	43	
Intersection cross	49	30.4	19	17.6	68	Higher
Midblock dart	30	18.6	33	30.6	63	Lower
Intersection dash	18	11.2	2	1.9	20	Higher
Right turn-on-red	9	5.6	1	0.9	10	
Vehicle turn-merge	4	2.5	0	0.0	4	
Multiple threat	8	5.0	2	1.9	10	
Bus stop–related	0	0.0	0	0.0	0	
Exit or enter parked vehicle	0	0.0	3	2.8	3	Lower
Trapped by changing light	4	2.5	0	0.0	4	
Disabled vehicle	0	0.0	2	1.9	2	
School bus–related	0	0.0	0	0.0	0	
Hitchhiking	1	0.6	1	0.9	2	
Walk along roadway	2	1.2	10	9.3	12	Lower
Play in roadway	1	0.6	2	1.9	3	
Vendor or ice cream truck	0	0.0	6	5.6	6	Lower
Vehicle or vehicle collision	4	2.5	4	3.7	8	
On sidewalk	3	1.9	3	2.8	6	
Other	2	1.2	3	2.8	5	
Total	161	99.9	108	100.0	269	

accidents occurred with single family residential land adjacent to both sides of the roadway.

Land Use and Accident Type

The data in the cross tabulation of aggregate land-use type versus accident type were too sparse for meaningful statistical analysis across the entire matrix. The majority of accidents were concentrated in the four major accident types and the two dominant land-use categories.

The accident-type distribution was significantly different for those accidents where commercial-or-financial or residential land use existed on both sides of the roadway as shown in Table 4. Accident types that were significantly higher in areas of commercial or financial land use included both intersection cross and intersection dash. Accident types that had a significantly higher incidence in residential areas included midblock dartout, exit or enter parked vehicle, walk along roadway, and vendor or ice cream truck. The results for exit or enter parked vehicle, walk along roadway, and vendor or ice cream truck are not considered reliable because of the low frequency of these accident types.

SUMMARY AND CONCLUSIONS

The use of accident type designations, as prescribed in the MPSP user's guide (*3*), does supply enhanced perceptive capability to the evaluation of pedestrian accidents. Accident type application to pedestrian accidents can be accomplished with relative ease using the narrative description and diagram typically supplied on accident reports. Care must be taken when interpreting and applying certain accident type definitions.

The major drawback to the use of accident type analysis is that it requires several years of data beyond the 3 yr typically used in accident studies to maintain statistical credibility. This is due primarily to the rarity of events. Approximately 1,000 to 2,000 events would appear necessary in order to generate sufficient frequency of occurrence to effectively evaluate the less frequent accident types.

The inclusion of aggregate land-use data supplies limited useful information in pedestrian accident analysis. The land use immediately adjacent to accident locations can be used to gain some general knowledge on the relationship with accident type, and these data can be collected relatively easily. However, a

direct cause-and-effect relationship between land use and accident type is difficult to justify.

REFERENCES

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