

THE FEASIBILITY OF PROTECTING PEDESTRIANS
ADJACENT TO ROADWAYS

by

Richard L. Hollinger, John Pavlovich, Eugene F. Reilly

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Bureau of Operations Research
New Jersey Department of Transportation

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Summary and Conclusions

The incidence of pedestrian-vehicle accidents is so minimal and scattered that a general policy for installing guiderail or other devices to protect pedestrians adjacent to roadways is unwarranted. This is especially true involving vehicles that run off the roadway. Run-off-road accidents occur more frequently at intersections in urban areas than anywhere else, but guiderail is inappropriate at these locations, because its protective qualities are reduced when it is impacted at large angles of impact.^{1, 2} Guiderail and other appropriate devices could be installed at locations exhibiting hazardous geometric conditions and/or engineering judgment advocates the usage of such devices.

The establishment of improved pedestrian control could possibly eliminate a major portion of the pedestrian-vehicle conflicts that occur on the roadway. A comprehensive pedestrian safety program and strict enforcement of existing pedestrian regulations could achieve such control.³

Introduction

The New Jersey Department of Transportation, Bureau of Operations Research has been requested to investigate the need for guiderail (guardrail) or other devices to protect pedestrians adjacent to the roadway. This research effort encompasses a comprehensive literature search, a review of New Jersey accident data, and an inquiry of selected State Departments of Transportation to review existing policies and available information pertaining to the problem.

This report has accomplished three objectives:

1. the extent and severity of the problem,
2. the extent of previous research in the problem area, and
3. the determination that no formal guidelines for improving the situation are required.

Background

In the fall of 1973, an investigation commenced into the need for warrants pertaining to the installation of guiderail and other devices to protect pedestrians adjacent to roadways.

The literature search was the first step undertaken. The HRIS provided a very limited reference list. This prompted the Bureau to conduct both an in-house search and make an inquiry of selected State Departments of Transportation for relevant unpublished information or established policies.

Finally, a review of New Jersey accident data for 1971 was conducted to determine the extent of pedestrian-vehicle accidents in the State. This review concentrated on accidents in which the vehicle left the roadway and pedestrian movement paralleled the roadway. The following discussion encompasses the findings of that investigation.

Results and Discussion

Literature Search

Research in the utilization of guiderail or other devices to protect pedestrians and property adjacent to roadways has been negligible. Most information on guiderail warrants pertains to protecting the vehicle and its occupants, instead of adjacent property and pedestrians. The pedestrian-vehicle interface has received very little attention, particularly

along suburban-rural roadways. Roadway research has been concerned with impact testing, barrier design, and location criteria of rigid and semi-rigid barriers.^{2, 4}

Guiderails are the major type of semi-rigid barrier. The barrier directs the vehicle back to the travelway with less disruption to the occupants than other barrier types.^{2, 5} But the guiderail could be a roadside hazard and its utilization should be avoided if the need for a protective device can be eliminated in some other manner. Installation is warranted only at locations where the severity of a collision with the roadside obstacle exceeds that of striking the barrier.⁶

Guiderail is relatively ineffective as an interface barrier⁸ and in restraining pedestrians.⁷ The pedestrian-vehicle interface is difficult to define. Rural roads present a particular problem, because shoulders serve a dual function: pedestrian walkway and storage lane for disabled vehicles. Guiderail height is capable of confining vehicles to the roadway, but it offers a negligible deterrent to pedestrians. However, it may prevent a pedestrian from inadvertently encroaching on the roadway while walking parallel to the road.

Physical barriers, in general, present difficulties along suburban and rural roads. They impede routine maintenance operations and increase maintenance costs because the barriers are an obstacle to mechanized equipment.¹⁰ Stopping along eight-foot width shoulders (or less) that are guiderail protected is extremely hazardous. Occupants must egress from the traffic side of the vehicle. To fix flat tires, either the vehicle or the motorist may encroach on the traveled way, depending on whether the flat tire is on the right or left side of the vehicle, respectively.

The installation of guiderail along urban streets may create a hazard to occupants of parallel-parked vehicles. The drivers would exit from the left side of the vehicle or the traffic-exposed side, causing an added hazard with passing motorists. Proper guiderail installation requires that the end sections be flared in order to utilize the full safety potential of guiderail for preventing run-off-road accidents,² but flaring would reduce walkway widths and impose a hazard to senior citizens or young pedestrians.¹²

The existence of State Policies in regard to guiderail installations to protect pedestrians is virtually non-existent. A review of State Transportation/Highway Departments (Table 1) indicates a "situation-evaluation" rather than a general policy.

Discussions with the Chairmen of relevant Transportation Research Board committees has substantiated the findings up to this point, namely, that no known work has been undertaken to use barriers on a large scale to protect pedestrians from vehicles.^{13, 14}

Accident Data

Pedestrian casualties occur at various locations within the road right-of-way and adjacent walkway areas. Table 2 is a summary of the 1971 New Jersey pedestrian-vehicle accidents grouped according to pedestrian action.

There are two categories of pedestrian-vehicle accidents which relate directly to the area of investigation: (1) Not in Road, and (2) Walking in Road. These categories encompass accidents in which the vehicle either runs off the road or to the side of the road, and the pedestrian movement is parallel to the highway. The pedestrian movements of "Crossings the roadway at intersection" and "Crossing or entering roadway - not at intersection" were

TABLE 1
SUMMARY OF STATE TRANSPORTATION DEPARTMENTS
BARRIER USE TO PROTECT PEDESTRIANS OR
PROPERTY ADJACENT TO ROADWAY

<u>State</u>	<u>Remarks</u>
California	No blanket policy; General policy where special cases exist; Considering use of barriers to separate bike and auto traffic.
Connecticut	No policy; Negative search.
Delaware	Negative search; Engineering judgment; No policy.
Florida	Negative search; Recommend use of buffer zones.
Illinois	No standards or guidelines; Individual site appraisal.
Massachusetts	No firm policies; Local action taken on high accident urban streets.
Michigan	No quantitative warrants; Engineering judgment for each case; Specific guardrail designs are noted.
New York	Standards for access controlled roads; No special treatment on non-controlled roadways.
Ohio	No design criteria other than at bridges.
Oregon	No policy; GM barrier used sparingly.
Pennsylvania	No published information; Rely on engineering judgment.
Texas	No warrants; Acknowledge problem is increasing; Use of flex beam and chain link fence.
Virginia	No policy; No definite criteria.
Washington	No overall policy; Tentative design criteria for "trails" and bike paths.

TABLE 2 - SUMMARY OF 1971 MOTOR VEHICLE TRAFFIC ACCIDENTS

PEDESTRIAN ACCIDENTS

<u>Pedestrian Actions</u>	<u>Killed</u>	<u>Total Injured</u>
1a. Crossing Or Enter Roadway at Intersection	106	2,454
1b. Same - Not at Intersection	130	2,145
2a. Walking in Road - With Traffic	28	217
2b. Same - Against Traffic	-	-
3. Standing in Road	19	231
4. Getting On or Off Other Vehicle	1	68
5. Working in Road	3	98
6. Playing in Road	7	192
7. Other in Road	8	61
8. Not in Road	20	154
9. Coming From Behind Parked Car	<u>18</u>	<u>1,117</u>
TOTALS	340	6,737

excluded from the analysis, because guiderail is considered unsuccessful in discouraging such pedestrians actions. Guiderail is considered a vehicle protective barrier and not a pedestrian restricting one. Pedestrian-vehicle conflicts that are pedestrian caused require restraining barriers that present a physical obstacle to the pedestrians entry to the travelway.

The pedestrian actions of "Walking in Road" and "Not in Road" are relevant to the investigation and are subdivided into three general categories:

- (1) vehicle run-off-road,
- (2) pedestrian in road, and
- (3) pedestrian in shoulder.

These categories are quantified in Table 3.

TABLE 3 - COMPARATIVE BREAKDOWN OF PEDESTRIAN-VEHICLE ACCIDENTS

	Vehicle Run-Off Road			Pedestrian In-Road			Pedestrian In-Shoulder		
	Sidewalk	No Sidewalk	Total	Sidewalk	No Sidewalk	Total	e Sidewalk	No Sidewalk	Total
At Intersection	33	4	37	13	1	14	5	-	5
In-Between ^a	42	19	61	26	45	71	4	46	50
Pedestrian Traversing Road ^b not at Intersection				27	13	40			
Pedestrian at Curbside ^c							17	-	17
Other ^d	-	4	4	16	22	38	10	23	33
TOTALS	75	27	102	82	81	163	36	69	105

a: Includes all accidents in which pedestrian movement occurs outside of the intersection and its immediate approaches.

b: Pedestrian movement involving any attempt to cross the roadway.

c: Includes pedestrians who are sitting, standing, or walking along the curb, who are struck by vehicles that do not leave the roadway.

d: Includes single type events: vehicle crossing center of undivided highway, vehicle hitting guiderail, with the latter striking the pedestrian, etc.

e: Includes pedestrians standing in marked parking spaces where no parked vehicles were present.

1. Vehicle Run-Off-Road Category

Vehicle run-off-road accidents involve vehicles that completely leave the roadway and infringe on sectors devoted exclusively to pedestrians or roadside functions and comprise about 28 percent of the relevant accidents. Sixty-one accidents occurred between intersections and 37 at an intersection (refer to Table 3). In between intersections, only 19 accidents occurred where there were no sidewalks, and 42 involved vehicles mounting the sidewalk. Guiderail and similar devices are used to confine the vehicle to the roadway, but may be unsuitable for the urban area at intersections and at curbside. Curbside guiderail installation or other physical barrier would hamper egress from a vehicle, garbage collection, freight delivery, and other public services.

The layout of intersections makes physical barrier installation impractical as a preventive measure. Meter posts may be appropriate, but with only 37 vehicle-pedestrian intersection accidents for the entire State for the year, the selection of appropriate locations for posts would be difficult.

2. Pedestrian-In-Road Category

Pedestrian-in-road accidents involve pedestrian movements in the roadway parallel to the direction of traffic, and account for 44 percent of the relevant accidents. It is difficult to shield the pedestrian from the vehicle, especially where there are no sidewalks. Shelter can be provided outside the shoulder with the installation of guiderail, but the occurrence of preventable incidents is rare. Pedestrian-in-road accidents have a higher frequency than the other two categories, but the frequency remains insignificant to justify erecting any form of barrier. Guiderail, in particular, is a poor means of achieving restraint, and accident prevention could better be achieved through

the implementation of a pedestrian control campaign. A comprehensive pedestrian safety program and strict enforcement of existing pedestrian regulations could achieve such control.

3. Pedestrian-In-Shoulder Category

A pedestrian-in-shoulder accident occurs in the region that is immediately adjacent to the outside lane (either designated or assumed) in a "grey" area. Both the vehicle and the pedestrian utilize the shoulder thus causing conflicts to occur. This category comprises about 28 percent of the relevant accidents. In the absence of sidewalks, pedestrians compelled to use the shoulder are afforded no barrier protection because vehicles must always have access to the shoulder.

It should be noted that pedestrians walking on the shoulder are partially responsible for many pedestrian-in-road accidents, since pedestrians have a tendency to stray into the roadway while walking.

The review of accident reports produced the following conclusions:

1. There are no concentrated accident locations involving vehicles running off the roadway and injuring pedestrians. (102 accidents for the year 1971, including 7 fatalities).
2. More accidents result from the pedestrian walking in the roadway than the vehicle running-off-the-road.
3. Of the pedestrian-vehicle accidents, 50 percent occurred during daylight conditions.

Guiderail installation could reduce the number of accidents which occur between intersections and possibly save pedestrian lives, but the severity and frequency of run-off-road accidents could increase. It can be assumed that a relatively significant number of run-off-road accidents which produce no vehicle damage are never reported. The installation of guiderail at locations experiencing "safe" run-off-road incidents could produce vehicle occupant casualties

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and damage. The transformation of "safe" run-off-road incidents into accidents would negate the benefit sought by providing the pedestrian protection. Guide-rail installation may indicate that the "safe" accident frequency exceeded the pedestrian casualties, thus creating a more hazardous situation.