
**Reducing Vehicle/Pedestrian Conflicts In Parking Lots**



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## The Accident

Two-year-old Sadie Denor was killed at the entrance of a Blockbuster Video near lake Michigan. It was dark, and she stood outside of the front door holding a balloon. The helium-filled balloon was a bonus on Friday, used to encourage family visits. About one hundred and twenty feet away, a small SUV turned into the parking lot and began to roll slowly down a continuous slope to the tape return box. Just in front of the drop box, there was an area reserved by yellow stripes for the return of video tapes, or so it seemed. The driver stopped and got out. She realized that the car was in neutral, jumped in, and tried to put the car in **PARK**. In her panic, she shifted into **Drive.** The police investigation showed that the car was equipped with a "high idle" feature used to increase engine speed while at rest. Energy generated the car's computer provided momentum for the car to lunge.

In this case, the reserved spot was not for video returns, but a loading area for handicapped vans. No signs identified the handicapped parking place. The driver reasonably concluded that she left her car in the designated spot for the quick return of tapes. Safety accessories which could have prevented this accident were not used. The end of the reserved space was unfinished. No tire stop, or vertical bollard existed to prevent the encroachment or obstruction of the pedestrian way by cars. There wasn't even a curb.

The path to the front door was straight, unobstructed, and sloped toward the building. The original plans for the store included finish details for the disabled parking space, but across the tire stop feature, penciled on the original plans, it said "delete." The smallest degree of pedestrian protection would have prevented this death.

## Anticipate Conflict

Drivers frequently lose control. The use of physical barriers designed to protect pedestrians can prevent injury and death. A review of more than six hundred parking lot incidents shows that the most greatest danger exists where the automobile drives directly toward a pedestrian on the sidewalk and then tries to stop. In many pedestrian/vehicle accidents, ninety degree head in

parking is involved. Every incident of this kind caused property damage, injury, or death. No type of store is free of these run in accidents. They happen at convenience stores, shopping malls, grocery stores, drug stores, video stores, and fast food restaurants. There was even one veterinary hospital. In one case, a driver was found asleep inside the retail store on the morning after the incident.

In each case, these accidents involved some element of driver error or equipment failure. However, the application of simple vehicle management devices can prevent injury, property damage, or death. In our example, a number of things could have been done at the video store. As a minimum response, Blockbuster could have simply marked the parking place as reserved for disabled: two vertical bollards positioned at the head of the reserved handicapped path would have worked best.

**Pedestrian Isolation**

In Europe, where there has always been a shortage of land. In the absence of adequate space, the segregation of vehicles. Municipal codes regulate sidewalk amenities. But in the United States, where land has always been available at a reasonable price, there seemed little need to consider pedestrian protection. In fact, few building authorities regulate parking lot construction except for the location of entry and exit points. Our interest began about twenty five years ago with the construction of a Federally funded project in Birmingham Alabama. There, a project designed to make pedestrians in the downtown area. demonstrated that a walkway can be safe, attractive, and efficient, all at the same time.

Pedestrian protection is cost effective. It is useful to think of pedestrian elements as islands. The design task is to isolate persons using the island from conflict and in most cases, this involves the use of simple barriers like curbs or tire stops. The strength and shortcomings of individual protective measures are well known. So are the general strategies. We can protect pedestrians by isolating their physical space in four ways: (1)Vertical Separation, (2) Horizontal separation (3) Barrier separation or (4) Time separation. In the subject accident, the parking place could have been moved to a neutral area, curb stops could have been used, the sidewalk could have been wider, there could have been a curb, or vertical bollards could be used to prevent intrusion by parking cars. Each tool is chosen to match the dynamics of the parking lot and foreseeable vehicle speeds.

In most safety analysis, risk is proportional to the exposure. The more vehicle interaction, the greater the number of catastrophic accidents. But that is not always the case. Each vehicle approaching a pedestrian island represents a single exposure. One might think that a parking lot with a low volume would not require safety countermeasures, but this is not always true. Accidents are proportional to exposure, but random in occurrence and in some cases, risk must be judged by other factors such as speed, predictable driver impairment, or special use.

Examine points of possible conflict. Ask, does vehicle traffic approach the building from a higher grade or must vehicles turn dramatically away from the building or toward a pedestrian walkway? How many vehicles approach a given point? Does traffic make a 90-degree turn in

order to stop facing a walkway?. Are there places where a predictable loss of vehicle control would create a catastrophic accident?

Businesses like video rental stores, convenience stores, and fast food restaurants usually have an area where the pedestrian is exposed to hundreds, and perhaps thousands of times a day. Most of these spots are near the entry of the building. Almost all quick service stores have individual parking places which are most frequently used. Also, look for places where shoppers wait to cross the parking lot when they leave the store? Remember that in most cases risk increases with exposure. When vehicles approach pedestrian zones in high numbers, the exposure demands the use of some mechanical intervention.

Each physical barrier used to isolate a pedestrians raises new safety concerns which must be considered. Curbs are associated with step and fall accidents. The most common problem happens when a pedestrian steps down an unpredictable distance to an un level surface. In some cases, one steps down eight to ten inches or more. A pedestrian cannot always appreciate the depth when stepping down from a curb, especially at night. It is important that the depth be uniform and flat. An average step should be about 6 inches. The most effective curbs have a flat, uniform, face with a squared upper edge. Painting, can sometimes be useful to show the location of a curb, but there are two words of caution. First, many safety yellow colors are not slip resistant and can cause an accident. Second, if you paint, make sure that you are designating a curb with the paint and not creating camouflage for another defect. Safety cues or warnings do not negate the need for safe design and construction.

Builders sometime use speed bumps to lower the average speed of vehicles. While this may be necessary in many situations, speed bumps should be avoided whenever possible. Speed bumps can create many hazards including the loss of vehicle control . The greatest hazard lies in the possibility that a pedestrian will trip or slip. If lowering the speed of vehicles in this way is important, be sure the speed bump meets certain minimum requirements.

1.Use cut-through or side isles to maintain a pedestrian path.

2. The approach and exit of a speed bump should be ramped with a slope no greater than 1:12

3. Mark the speed bump slip resistant yellow paint.

4. Use signs to alert the pedestrian if other objects compete for attention.

Tire stops can help. A tire barrier will stop a rolling car from speeds of about two and a half miles per hour. A six inch curb will do the same thing. Their combination can be expected to provide protection from a little over five miles per hour. Another common accident source is created by tire stops that are improperly placed. If you include tire stops, try to follow these guidelines.

1.Don't allow tire stops to obstruct a pedestrian path.

2. Maintain visual contrast with surroundings. Consideration the use of color contrast, and the light available on the surface.

3. Don't use wheel stops longer than 6' and place them in the center of the parking space.

4. Maintain a clear path of 36" between the ends of the tire stops.

5. Limit wheel stop heights to 6.5 inches.

5. Always use side striping designate the parameters of the parking spaces.

6. Use vertical bollards to limit vehicle movement instead of tire stops when possible.

The use of, eight inch thick wall steel pipe, filled with concrete, make good isolation devices. Thick wall steel pipe filled with concrete can stop a vehicle from a considerable speed. Sd Its effectiveness will depend on the sub soil conditions and the size of the concrete mounting bed. We frequently see bollards where roadway traffic makes turns a pedestrian paths such as pick-up areas at the entry of grocery stores. They are sometimes used to create pedestrian islands at intersections. The choice of size and the depth of planting for the barrier is set by the anticipated vehicle speeds. In some cases, a bollard can stop a vehicle from speeds of 20 miles per hour or greater.. Its slowing effects are equally important since in an emergency, additional time for escape is necessary. In order to prevent fall accidents, bollards would be placed at the center of parking places and must sit at least 3' 6" above the surface. They must be marked to increase visibility.[(1)] The space between bollards is established by the site conditions.

**Architectural Response**

The use of mechanical devices to isolate pedestrians from vehicles is no longer considered a curiosity. Neither does the installation need to be unattractive. For example, there are, more than two hundred web sites which offer bollards, planters, and cubes designed to stop vehicles. Designers now make attractive products. Some pedestrian barriers double as light pedestals. Many actually improve the site appearance.

Consider the potential strength of the devices you use. Some are just meant to be decorative. One manufacturer plans on his devices breaking away at five miles per hour, while an English manufacturer builds his device to withstand intentional vehicle penetration.. No uniform tensile strength characteristic has evolved as an acceptable value.. Manufactured barriers must be examined to determine what forces the designer had in mind

When considering pedestrian protection, look at three factors. First, find points of possible conflict. . Then, judge the possible speed of vehicles which loose control. A simple study with a radar gun might be useful. Finally, match the correct response to the possible loss. A six inch curb will slow a vehicle by two and one half miles per hour. A curb and a tire stop doubles that amount. A bollard can be expected to stop a vehicle moving from five to fifteen miles per hour depending on its size. Planters can stop a vehicle from any speed. But, use caution. An immediate stop from a speed greater that fifteen miles per hour can kill vehicle occupants.

Speeds greater than ten miles per hour should be handled differently. Soft construction, which can only be briefly discussed here, is used to dissipate forces by extending them over a larger period of time. This principle (soft construction) is used in the design of the vehicles themselves. A common example is the automobile seat belt. The seat belt changes the energy absorbed by occupants by allowing the occupants to absorb it on parts of their body best able to withstand the force and by extending the time of the impact. With barriers, this can be done in several ways. It is better to use several devices that are weaker, for example, rather than to stop the vehicle instantly.

## Conclusion

Vehicles sometimes lose control and kill pedestrians in parking lots. This happens for a number of reasons. About two percent of all motor vehicle accidents are caused by bad brakes, for example. Some drivers are inexperienced, prone to panic, or suffering from undiagnosed diabetes or other conditions. It would be nice if one could absolutely isolate pedestrians and vehicles, but we cannot. The pressure of real estate value and the need for high customer volume frequently makes complete isolation impossible. It is imperative to evaluate points of possible pedestrian conflict in advance. Points to consider include high traffic areas, and those which require difficult vehicle movements, or vehicle operation where there are distractions.

Safety intervention protects both pedestrians and property and can improve the appearance of the property. Insurance coverage is a poor substitute for accident prevention. The installation and maintenance of isolation devices is now common. Curbs, tire stops, vertical bollards are common responses where the mix of persons and vehicles can not be prevented. Bollards are increasingly the device of choice. New companies have opened in the last decade to provide bollards that are both decorative and practical.

Make sure that the safety devices you choose do not create another hazard. Painted surfaces must be slip resistant and paint must not hide some unusual surface characteristic. Tire stops must be carefully placed to prevent tripping and obstruction of access isles. Speed bumps must be ramped and painted. Signs are desirable. Sidewalks must be a standardized height and the lot surface must be consistent.

## References

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