

Key Questions:

Safety



Metropolitan Design Center

Version 2.0

DESIGN FOR HEALTH is a collaboration between the University of Minnesota and Blue Cross and Blue Shield of Minnesota that serves to bridge the gap between the emerging research base on community design and healthy living with the every-day realities of local government planning. This Safety Key Question is part of a series with a focus on identifying and interpreting evidence-based research linking public health with planning.

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Overview

In terms of public health, safety is a term, used both generously and generally, applying to safe water, roadways, air, workplaces, or other. Some of these dimensions are covered in other aspects of the Design for Health project (namely water and air). This safety sheet highlights public-health aspects that directly relate to aspects of the built environment, specifically addressing safety by reducing transportation-related crashes (i.e., reducing crashes between vehicle and vehicle or bike/pedestrian and vehicle), crime and overall violence. Given the widely differing orientation of each, we review key questions in four different sections: (1) transportation-related safety, (2) pedestrian/bicycle crashes, (3) crime, and (4) violence.

Transportation-related safety

Legend has it that when the world's first road traffic death happened in 1896, the coroner was brought to the scene and exclaimed, "this must never happen again." More than a century later, such an occurrence is, unfortunately, commonplace. Statistics from the National Highway Transportation Safety Administration reveal that during 2003 in the United States:

- more than 40,000 deaths occurred as a result of car crashes,
- 4749 pedestrians were killed in traffic crashes,
- 70,000 pedestrians were injured in traffic crashes,
- 622 cyclists were killed in traffic crashes (23 percent of whom are under 16), and
- 46,000 cyclists were injured in traffic crashes.

Source: National Highway Transportation Safety Administration 2003

There are generally two elements to transportation-related safety: vehicle-to-vehicle interactions and vehicle-to-pedestrian/cyclist interactions (World Health Organization (WHO) 2004).

Things for certain (or semi-certain)

- Speed is the quintessential traffic safety issue. The risk of a fatality begins to rise when the change in speed at moment of impact exceeds 30 mph (48 km/h) and is more than 50 percent likely to be fatal when the change exceeds 60 mph (96 km/h). The probability of death from an impact speed of 50 mph (80 km/h) is 15 times the probability of death from an impact speed of 25 mph (40 km/h) (Transportation Research Board 1998).
- Speed limits on roadways are set based on the context of the environment; where exceeded, drivers pose considerable risk to society. The absolute speed deviation of crash-involved vehicles from the average traffic speed is positively related to crash probability, especially for rural arterial highways and Interstate highways (Transportation Research Board 1998).

Things up in the air

- There is ample, but not unequivocal, evidence indicating crash involvement rates rise with speed of travel. Across all types of roads, however, crash involvement rates do not necessarily rise with the average speed of traffic, because the average traffic speed is highly correlated with the design speed of different road classes (and other conditions). That is, Interstates do not necessarily have a higher crash rate, largely because they are designed to accommodate fast-moving traffic.



Pedestrian-refuge island, Taree, Australia

Pedestrian/Bicycle Crashes

Pedestrian and bicycle crashes are a topic of intense interest to this project; there are a variety of remedies available to address a variety of behaviors.

Things for certain (or semi-certain)

- The speed of car and pedestrian/bicycle crashes is an important predictor of severity of injury. Best estimates suggest that 5 percent of pedestrians who are struck at 20 mph (30 km/h) are killed, 45 percent at 30 mph (50 km/h) and 85 percent at 40 mph (65 km/h) (Ashton and Mackay 1979).
- Intersection crashes account for more than 45 percent of all reported crashes, and 21 percent of fatalities.
- Marked crosswalks, particularly those well designed (e.g., raised medians) and noticeable by drivers, significantly reduce pedestrian crashes (Zegeer et al. 2001).
- When motorists and bicyclists are on initial parallel paths, either in the same direction or opposing directions, the three most frequent categories of crashes are:
 - motorist turning or merging into the path of a bicyclist (12.1 percent of all crashes). Almost half (48.8 percent) of this type of crash involves a motorist making a left turn in front of a bicyclist approaching from the opposite direction;
 - motorist overtaking a bicyclist (8.6 percent of all crashes). Of these crashes, 23 percent appeared to involve a motorist who misjudged the space required to safely pass the bicyclist; and
 - bicyclist turning or merging into the path of a motorist (7.3 percent of all crashes). Within this category, 60 percent involved a bicyclist making a left turn in front of a motorist traveling in the same direction (NHTSA 1997).

Traffic calming is most often applied on residential streets that otherwise receive a great deal of through traffic; designing for complete streets is a close cousin to this strategy. But both strategies may also be appropriate for shopping streets where a more pedestrian-oriented realm is desired, while vehicles remain. .

There are a variety of techniques for traffic calming. They include:

- altering the terrain vertically with speed bumps, speed humps, speed tables, raised crossings, undulations, or road texture/material;
- altering the terrain horizontally with traffic circles and roundabouts, curb extensions (bulb-outs, neckdowns, chokers, chicanes/lateral shifts), median or pedestrian-refuge islands or edgelines to narrow a wide roadway in order to create a bicycle lane, parking lane or shoulder; and
- altering the terrain linearly via full closures or cul-de-sac conversion, half closures (closing one direction), diverters (barriers at intersection to prohibit or require certain movements), or realignment of intersections.
- Area-wide urban traffic-calming schemes reduce the number of injury accidents by about 15 percent on average. The largest reduction in the number of accidents is found for residential streets (about 25 percent); a somewhat smaller reduction is found for main roads (about 10 percent) (Zein et al. 1997);
- In areas with traffic-calming, drivers “read” the potential hazards of the road environment and adjust their behaviors in response, thereby resulting in fewer crashes.

Sources: County of Montgomery 1996, Dumbaugh 2005, Elvik 2001, U.S. Federal Highway Administration 2001, Zein et al. 1997

Things up in the air

- There is considerable debate within the cycling community regarding the overall safety of off-street bicycle paths (Forester 2001; Pucher 2001). Some contend that, by virtue of being separated from traffic, cyclists are safer. Opponents suggest, however, that off-street trails create unnecessary and unanticipated conflict when and where they cross streets; furthermore, they falsely foster a sense of secure riding when such facilities are not available. Unfortunately, there is little empirical research to clearly guide thinking on such matters.

Working associations to be aware of

- High travel speeds, without proper design considerations, increase the likelihood of crashes.
- Traffic calming and context sensitive design can mitigate the extent to which autos speed.
- Be on the lookout if the proposal is close to an intersection or requires cyclists to turn left to access the facility.



Underpass with good visibility, Almere, Netherlands

Crime

Crime is often considered a topic restricted to the province of the police, courts and penal system. A public-health approach concentrates on preventing violence and fear of violence, and aims to provide additional services for victims. At that point, the professions of medicine, nursing and the health-related social services come forward.

Perceptions

People avoid areas with high levels of crime or even areas with a perception/fear of high levels of crime. There is less community watchfulness (e.g., “eyes on the street”) and such patterns affect people’s mobility (i.e., they don’t want to go there).

Things for certain

- Sensitively deployed street lighting can lead to reductions in crime and fear of crime, and increase pedestrian street use after dark (Painter 1996).

Things up in the air

- Some studies suggest that higher crime areas are also less physically active. Such findings, however, have also been refuted. Often older neighborhoods with many “urbanist” features are exactly the types of urban form relied on to foster transportation-related physical activity (Hoehner et al. 2005).

Violence

In other cases, matters of crime have a more direct affect on matters of public health. Violence can be self-directed, interpersonal or collective (e.g., elder abuse and child abuse, rape and sexual assault, spousal abuse, child sexual abuse, and assault and homicide. Each invariably results in injuries and/or psychological stress). In the U.S., it has grown to be an epidemic in home,

school and the public realm. Annually, over the five-year period from 1998 to 2002, teachers were the victims of approximately 234,000 total nonfatal crimes at school, including 144,000 thefts and 90,000 violent crimes (rape, sexual assault, robbery, aggravated assault, and simple assault) (U.S. Bureau of Justice 2004).

With its emphasis on prevention of disease or injury, the public-health approach to violence offers an appealing alternative to an exclusive focus on rehabilitation. Primary prevention identifies behavioral-, environmental- and biological-risk factors associated with violence and takes steps to educate individuals and communities, and protect them from these risks.

Working Thresholds for HIA

In terms of increasing safety, research suggests that people often avoid areas with high levels of crime or even areas where they perceive or fear high levels of crime. Crime or perceived crime may be associated with a lack of street activity and may affect people's likelihood of using the space. We suggest all circulation corridors should have adequate lighting.

Secondly, relative to balancing the needs of multiple users, there are a variety of remedies available to address pedestrian and bicycle crashes. Traffic-calming features may include raised medians, painted crosswalks, curb extensions (e.g., bulb-outs, chicanes, neckdowns), pedestrian refuge islands, woonerfs, roundabouts, edge lines to narrow roadway for bike or parking lane. Complete streets ensure that the entire right of way is routinely designed and operated to enable safe access for all users. We suggest that the plan or project adequately accounts for safe circulation patterns for all modes.

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