ACTIVE DESIGN SUPPLEMENT

PROMOTING SAFETY





Hester Street Playground,
Chinatown, Manhattan

ACTIVE DESIGN SUPPLEMENT
PROMOTING SAFETY

AMERICAN INSTITUTE OF ARCHITECTS NEW YORK INTRODUCTION

The City of New York should be commended, anew, for developing a cogent and concise supplement to the *Active Design Guidelines* with a particular focus on safety in our built environment. This document draws upon specific examples to illustrate the most effective design strategies for achieving a more physically active – and safe – way of living in New York City.

The tenets of the *Active Design Supplement: Promoting Safety* draw upon evidence, case studies, and principles visible in New York City where injury prevention strategies increasingly align with Active Design. Through the conscientious integration of these strategies into projects of all scales, design professionals can realize buildings and neighborhoods that seamlessly integrate more healthful and active living with attention to design excellence, sustainability and safety.

The New York Chapter of the American Institute of Architects is dedicated to design excellence, professional development, and public outreach. The City's *Active Design Supplement: Promoting Safety*, produced as a partnership with the Johns Hopkins Center for Injury Research and Policy and the Society for Public Health Education, combines these goals in a well-written addendum that should be used by all architects, designers, and building owners in concert with the *Active Design Guidelines* as both reference and resource.

Joseph Aliotta, AIA
2012 President
AIA New York

Fredric Bell, FAIA
Executive Director
AIA New York

TABLE OF CONTENTS

Preface 004

Executive Summary 006

Chapter 1
Introduction 010

Chapter 2
Urban Design Strategies that Promote Safety 020

Chapter 3
Building Design Strategies that Promote Safety 046

Chapter 4
Conclusion 062

The design strategies identified in this document are for informational purposes only. These strategies are not specific to any particular municipality, and all designs remain subject to case by case review based on established engineering standards and professional judgment, with safety being of paramount importance. The guidance presented in this document does not supersede any existing federal, state or local laws, rules, and regulations.

Please note that any previous versions of this Supplement are superseded by this version currently found online.

PREFACE

The Institute of Medicine (IOM) report, *The Future of the Public's Health in the 21st Century*, outlined a new vision for public health, based in part on the evidence that the health of populations and individuals is shaped by a wide range of factors in the social, economic, natural, built, and political environments. To improve the public's health, the IOM called for, "building a new generation of intersectoral partnerships that draw on the perspectives and resources of diverse communities and actively engage them in health action." [1]

The *Active Design Guidelines Promoting Physical Activity and Health in Design,*[2] has received wide acclaim as an intersectoral partnership effort among the New York City Departments of Health and Mental Hygiene, Design and Construction, Transportation, and City Planning, along with other city agencies, academic partners, private sector partners, and the American Institute of Architects New York Chapter. The Guidelines address ways that the architectural, buildings, landscape, urban design and planning, and transportation sectors can seamlessly encourage more healthful and active living through design, construction and operational improvements to buildings, streets, and neighborhoods, as well as their amenities. The implementation of Active Design in the building and urban realm should also contribute to prevention of injury.

This document, *Active Design Supplement: Promoting Safety*, aims to provide those working in urban design and building design with additional information on how to build in safety to mitigate injuries while also promoting active environments. It serves as a companion to the original *Active Design Guidelines*, and to our knowledge, is the first document that identifies injury prevention strategies that align with Active Design. In total, 18 complementary strategies were identified for Urban Design and 9 strategies for Building Design by drawing on existing studies and well-accepted best practices for maximizing safety. These strategies can be applied to create health-enhancing built environments that also help to reduce the risk of intentional and unintentional injuries.

The multidisciplinary collaboration of the publication's authors - representing multiple sectors of local government, an academic injury research center, and a non-profit professional organization - is yet another example of how collective expertise and efforts are essential to promote both active living and safety. We are grateful to the U.S. Centers for Disease Control and Prevention's Division of Unintentional Injury Prevention and Control for supporting the development and dissemination of this publication.

The active alliance across the fields of architecture, urban planning, building design, injury prevention, behavioral science, and health education represents exciting possibilities for future improvements in the health of our nation. We look forward to additional joint efforts in action, including surveillance, research, and collaboration to help realize the public health goals of the 21st century.

PRIMARY AUTHORS:

Johns Hopkins Center for Injury Research and Policy, Johns Hopkins Bloomberg School of Public Health



Keshia M. Pollack, PhD, MPH
Associate Professor



Maryanne M. Bailey, MPH, CPH
Research Program Manager



Andrea C. Gielen, ScD, ScM
Professor and Director

CONTRIBUTING EDITORS:

New York City Department of Health and Mental Hygiene



Karen K. Lee, MD, MHSc, FRCPC
Director, Built Environment and Healthy Housing



Sarah Wolf, MPH, RD
Community Engagement Coordinator, Built Environment and Healthy Housing

Society for Public Health Education



M. Elaine Auld, MPH, MCHES
Chief Executive Officer

1. Institute of Medicine. (2002). *Who Will Keep the Public Healthy?* National Academy of Sciences, Washington, DC.
2. New York City Department of Health. (2010). *Active Design Guidelines: Promoting Physical Activity and Health in Design*. See also www.nyc.gov/adg.

SUGGESTED CITATION

Johns Hopkins Center for Injury Research and Policy, NYC Department of Health and Mental Hygiene, Society for Public Health Education. *Active Design Supplement: Promoting Safety*, Version 2, 2013.

EXECUTIVE SUMMARY

Creating health-enhancing built environments can both promote health and reduce injuries. Drawing on the latest academic research and best practices in the field of injury prevention, this report aims to provide professionals in urban design and building design with additional information on how to build in safety while promoting active environments. In the U.S., diseases related to obesity and physical inactivity are among the top leading causes of death. Efforts to address these problems must consider the fact that injuries are the leading cause of death for Americans ages 1 to 44, with transportation-related injuries the most common cause. Urban design strategies that address neighborhoods, streets, and outdoor spaces can be implemented to reduce injuries while simultaneously encouraging walking and bicycling and increasing access to public transit. Building design strategies that affect where individuals live, work, and play can be implemented to promote both an active lifestyle and safety.

This supplement to the *Active Design Guidelines* was created to provide additional information for designers, architects, planners, and engineers on implementing Active Design strategies that promote active living and maximize safety. The supplement provides injury prevention strategies for both urban design and building design. Each strategy is linked to the corresponding objectives of the original Guidelines. Where appropriate, recommended injury prevention strategies that are consistent with strategies from the New York City Inclusive Design Guidelines are cited accordingly. The injury prevention strategies were rated according to the strength of the supporting research evidence:

- ★ **Strong Evidence**
- ☆ **Emerging Evidence**
- ◇ **Best Practice**

18 Urban Design Strategies that May Reduce Injury Risk

- ★ 1. Playground Equipment and Surfaces
- ★ 2. Fencing for Swimming Pools and Elevated Play Areas
- ☆ 3. Complete Streets
- ◇ 4. Street Closures for Creating Safe Play Areas
- ★ 5. Traffic Calming
- ★ 6. Pedestrian Islands
- ★ 7. Placement of Bus Stops and Bus Lanes
- ☆ 8. In-Pavement Flashing Lights
- ★ 9. Multi-Way (All Way) Stop Sign Control

★ 10. Traffic Signals
☆ 11. Lighting
☆ 12. Pedestrian Overpasses
☆ 13. Painted, Designated Bicycle Lanes/Boxes/Crossings
◇ 14. Bicycle-Sharing Systems
◇ 15. Bicycle and Bicycle Helmet Storage
★ 16. Crime Prevention through Environmental Design (CPTED)
◇ 17. Signage
☆ 18. Stair Features

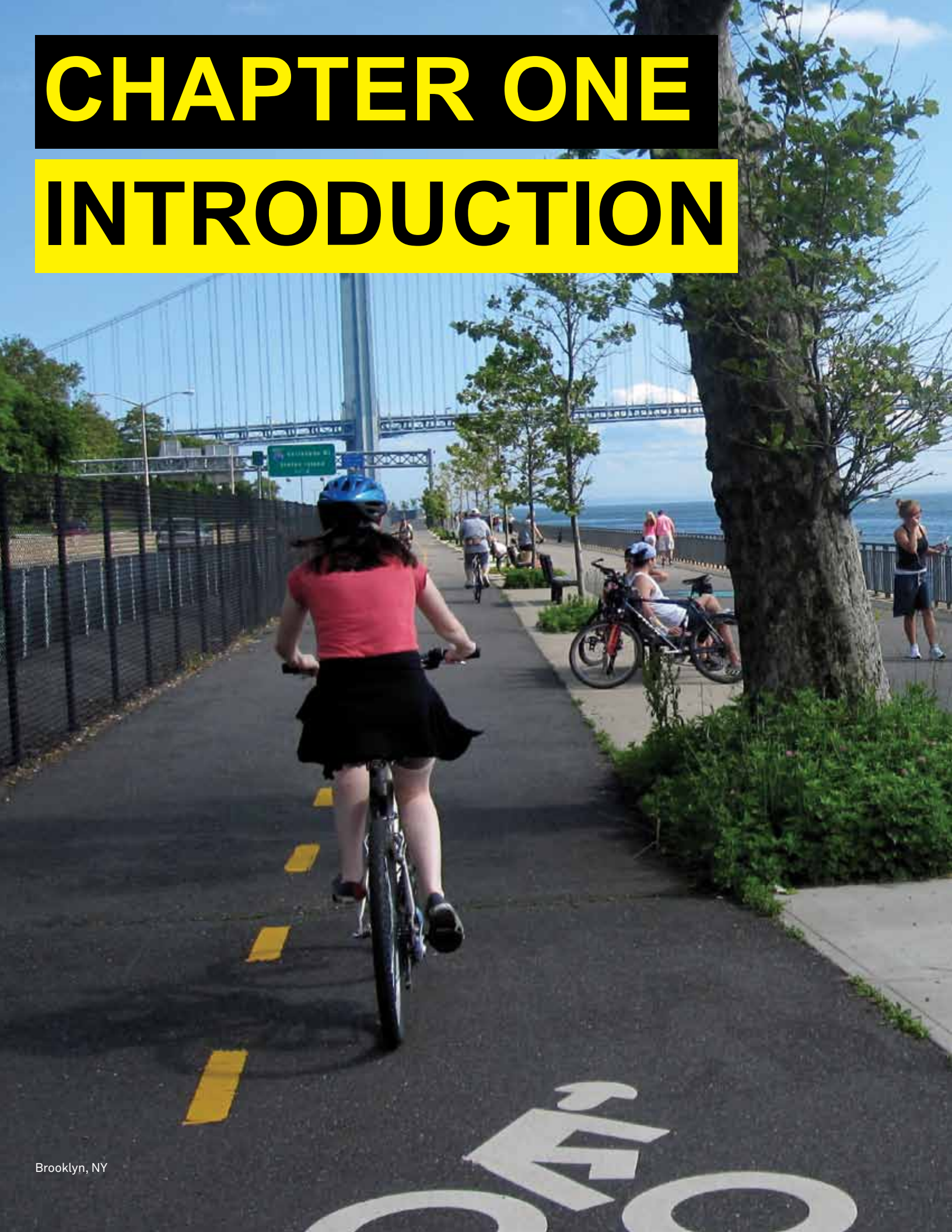
9 Building Design Strategies that May Reduce Injury Risk

★ 1. Stair Features
★ 2. Surfaces in Indoor Play Areas
☆ 3. Indoor Pool Safety
◇ 4. Bicycle and Bicycle Helmet Storage
★ 5. Window Guards and Balcony Railings
◇ 6. Signage
★ 7. Sprinklers
★ 8. Crime Prevention through Environmental Design (CPTED)
☆ 9. Lighting

Several key findings emerged from the evidence reviewed. First, Active Design strategies are often wholly compatible with well-accepted injury prevention principles, for example, where properly built bike lanes offer good street connectivity and are supported with appropriate, well-displayed signage and traffic controls. Second, the safety of multiple Active Design strategies can often be enhanced simultaneously by a single injury prevention strategy, for example, where improved timing of traffic signals benefits pedestrians, bicyclists, and transit users. It is also important to note that motor vehicle drivers and passengers will also be better protected when Active Design strategies that reduce crash risk, such as traffic calming, are implemented. Finally, for several of the Active Design objectives included in this report, there is not yet evidence on the ways in which injury outcomes are involved, and further research is needed.

Three conclusions can be drawn from these findings. First, efficient use of resources demands that highest priority be given to well-studied and cost-effective strategies to mitigate injury risk while promoting active environments. A comprehensive approach to Active Design initiatives should include support for research and evaluation. Second, there should be be opportunities for input from interdisciplinary experts in injury prevention, as well as from the community being served, particularly where the research evidence for safety is lacking. Finally, as communities throughout the world implement creative designs to promote active environments and healthy lifestyles, there should be widespread opportunities for both professionals and the public to share experiences and lessons learned.

CHAPTER ONE
INTRODUCTION



Brooklyn, NY



INTRODUCTION

Drawing on the latest academic research and best practices in the field of injury prevention, this report aims to provide those working in urban design and building design with additional information on how to build in safety to mitigate injury risk while promoting active environments. In the U.S., diseases related to obesity and physical inactivity are among the top leading causes of death. Efforts to address these problems must consider the fact that injuries are the leading cause of death for Americans ages 1 to 44 (see Figure 1), with transportation-related injuries the most common cause. There has been growing recognition that focusing on creating health-enhancing built environments can promote health and reduce injuries.[1,2,3,4] Urban design strategies that address neighborhoods, streets, and outdoor spaces can be implemented to reduce injuries while simultaneously encouraging walking and bicycling and increasing access to transit. Building design strategies that affect where individuals live, work, and play can be implemented to promote both an active lifestyle and safety. It is important to note that many Active Design strategies may reduce injury risk to all people. For example, traffic calming reduces vehicle

FIGURE 1: **TEN LEADING CAUSES OF DEATH WITH INJURY HIGHLIGHTED, UNITED STATES, 2009, ALL RACES, BOTH SEXES.**

	Age Groups										
Rank	<1	1-4	5-9	10-14	15-24	25-34	35-44	45-54	55-64	65+	Total
1	Congenital Anomalies 5,319	Unintentional Injury 1,466	Unintentional Injury 773	Unintentional Injury 916	Unintentional Injury 12,458	Unintentional Injury 14,062	Unintentional Injury 15,102	Malignant Neoplasms 50,616	Malignant Neoplasms 106,829	Heart Disease 479,150	Heart Disease 599,413
2	Short Gestation 4,538	Congenital Anomalies 464	Malignant Neoplasms 477	Malignant Neoplasms 419	Homicide 4,862	Suicide 5,320	Malignant Neoplasms 12,519	Heart Disease 36,927	Heart Disease 67,261	Malignant Neoplasms 391,035	Malignant Neoplasms 567,628
3	SIDS 2,226	Homicide 376	Congenital Anomalies 195	Suicide 259	Suicide 4,371	Homicide 4,222	Heart Disease 11,081	Unintentional Injury 19,974	Chronic Low. Respiratory Disease 14,160	Chronic Low Respiratory Disease 117,098	Chronic Low. Respiratory Disease 137,353
4	Maternal Pregnancy Comp. 1,608	Malignant Neoplasms 350	Homicide 119	Homicide 186	Malignant Neoplasms 1,636	Malignant Neoplasms 3,659	Suicide 6,677	Suicide 8,598	Unintentional Injury 12,933	Cerebro-vascular 109,238	Cerebro-vascular 128,842
5	Unintentional Injury 1,181	Heart Disease 154	Influenza & Pneumonia 106	Congenital Anomalies 169	Heart Disease 1,035	Heart Disease 3,174	Homicide 2,762	Liver Disease 8,377	Diabetes Mellitus 11,361	Alzheimer's Disease 78,168	Unintentional Injury 118,021
6	Placenta Cord. Membranes 1,064	Influenza & Pneumonia 146	Heart Disease 97	Influenza & Pneumonia 122	Congenital Anomalies 457	HIV 881	Liver Disease 2,481	Cerebro-vascular 6,163	Cerebro-vascular 10,523	Diabetes Mellitus 48,944	Alzheimer's Disease 79,003
7	Bacterial Sepsis 652	Septicemia 71	Chronic Low. Respiratory Disease 64	Heart Disease 120	Influenza & Pneumonia 418	Influenza & Pneumonia 807	HIV 2,425	Diabetes Mellitus 5,725	Liver Disease 9,154	Influenza & Pneumonia 43,469	Diabetes Mellitus 68,705
8	Respiratory Distress 595	Chronic Low. Respiratory Disease 66	Benign Neoplasms 40	Chronic Low. Respiratory Disease 59	Complicated Pregnancy 227	Diabetes Mellitus 604	Cerebro-vascular 1,916	Chronic Low. Respiratory Disease 4,664	Suicide 5,808	Nephritis 40,465	Influenza & Pneumonia 53,692
9	Circulatory System Disease 581	Perinatal Period 58	Septicemia 33	Benign Neoplasms 45	Cerebro-vascular 193	Cerebro-vascular 537	Diabetes Mellitus 1,872	HIV 3,388	Nephritis 4,792	Unintentional Injury 39,111	Nephritis 48,935
10	Neonatal Hemorrhage 517	Benign Neoplasms 53	Cerebro-vascular 32	Cerebro-vascular 42	Chronic Low. Respiratory Disease 187	Liver Disease 459	Influenza & Pneumonia 1,314	Influenza & Pneumonia 2,918	Septicemia 4,628	Septicemia 26,763	Suicide 36,909

Data Source: National Vital Statistics System, National Center for Health Statistics, CDC.
Produced by: Office of Statistics and Programming, National Center for Injury Prevention and Control, CDC using WISQARS™.

Centers for Disease Control and Prevention
National Center for Injury Prevention and Control

CS230409

speeds, which in turn reduces injury risks to motor vehicle drivers and passengers, as well as to pedestrians and cyclists. In addition, building design strategies such as adequate lighting in stairwells protect all users.

This document is a supplement to the initial *New York City Active Design Guidelines*, and it follows a similar structure and approach. Injury prevention strategies are provided for both Urban Design and Building Design, and each strategy is linked to the corresponding objectives of the original Guidelines. Where appropriate, recommended injury prevention strategies are consistent with strategies from the New York City Inclusive Design Guidelines, and are cited accordingly. The injury prevention strategies reviewed here were rated according to the strength of the supporting research evidence, using the following criteria:

★ **Strong Evidence:** Indicates design strategies supported by a pattern of evidence from longitudinal or cross-sectional studies, or from the strength of existing research that allows us to identify a strong relationship between the strategy and a reduction in injury risk. Strategies that come from federal agency recommendations are also considered to have strong evidence.

☆ **Emerging Evidence**: Indicates design strategies supported by an emerging pattern of research. Existing studies imply that the suggested strategy will likely lead to reduced injury risk, but the evidence is not yet definitive.

◇ **Best Practice:** Indicates design strategies without a formal evidence base. However, principles of injury prevention, theory, common understandings of behavior, and experience from existing practice indicate that these measures will likely reduce injury risk.

A brief summary of the evidence for the strategy is also included with each rating. The document concludes with a number of overarching recommendations and conclusions.



There is evidence that urban design strategies such as separate bike paths can be implemented to reduce injuries while simultaneously encouraging bicycling.
Canal Street, Manhattan

Importance of Injury Prevention

Nearly 180,000 people die each year as a result of unintentional injuries or acts of violence, and 1 in 10 sustain a nonfatal injury serious enough to be treated in a hospital emergency department.[5,6] Lifetime costs associated with the 50 million injuries Americans suffer each year are estimated at $406 billion.[7] Injuries occur at home, at work, at school, on the road, and during play, and the characteristics of these built environments can increase or decrease the risk of injury.

Strategies for Injury Prevention

William Haddon, the father of modern injury epidemiology, introduced the concept that injury results from the interaction between injury-producing agents (for example, kinetic energy transferred to a person when hit by a car), host factors (a young, inexperienced bicyclist without a helmet), and the environment (road surfaces, signs, weather).[8] Haddon developed a framework (Haddon Matrix, see Figure 2) that is valuable for identifying strategies (e.g., bicycle lanes) to help prevent a dangerous event (e.g., a bicycle crash) from happening, to prevent an injury if the event happens (e.g., wearing a helmet), and to minimize the severity of the injury if it does happen (e.g., emergency medical treatment). Environmental factors such as safety infrastructure, traffic calming, safe surfacing, and neighborhood and street design are often highlighted as important strategies for preventing transportation-related injuries.

An important conceptual approach to prevention strategies is to consider the role of engineering and designing the built environment, enforcing laws and policies, and educating individuals—also known as "the Three E's" of injury prevention (see Figure 3). Although the existing scientific literature demonstrates the importance of including behavioral interventions to reduce injury risk,[9] structural and environmental interventions that involve designers, architects, and builders play a key role. Such interventions can ultimately protect individuals (e.g., protected bicycle lanes), and they can make the safer behavior the easier behavior (e.g., improved pedestrian signals). Most often, multiple strategies are needed to provide comprehensive injury prevention solutions (e.g., presence of sidewalks

Figure 2: Haddon Matrix Application to Walking [8]

	HOST (HUMAN)	**VECTOR** (VEHICLE)	**ENVIRONMENT** (PHYSICAL AND SOCIAL)
PRE-EVENT: Prevent a crash	Educate public to use pedestrian walkways. Educate pedestrians about the importance of awareness of motor vehicles, even when in walkways or when having the right of way.	Increase visibility of pedestrians to alert drivers so they can avoid hitting them. Restrict maximum allowable speed of vehicles.	Include traffic calming strategies and separate pedestrians from traffic. Enforce strong traffic safety laws (e.g., driving laws).
EVENT: Prevent an injury when there is a crash	Designs should consider how pedestrian characteristics (e.g., age) affect injury risk. Educate public about first aid and bystander response, including bystander injury avoidance.	Designs should consider how speed at vehicle-pedestrian impact, vehicle size, and hardness and sharpness of contact surfaces affect injury risk.	Designs should consider how road and environmental design policies can reduce injury risk.
POST-EVENT: Reduce the severity of the injury when there is a crash	Educate public about first aid and bystander response.	Design vehicles with fuel system integrity to reduce the risk of a fire.	Install and maintain emergency phones along streets and pedestrians paths. Promote effective trauma system response.



Stairs into the High Line Park, Manhattan, James Corner Field Operations and Diller Scofidio + Renfro

and crosswalks, enforcement of laws keeping cars out of bicycle lanes), making it important for designers, architects, and builders to be prepared to join forces with multidisciplinary injury prevention teams. Understanding key factors influencing the success of each of these types of strategies can facilitate the implementation of both individual and multiple prevention strategies (see Figure 4).

Engineering and environmental change strategies contribute to injury reduction by creating environments and products that reduce the likelihood of individuals being exposed to the sudden release of kinetic or other energy in dangerous amounts. For instance, pedestrian and bike paths that separate people from vehicles virtually eliminate the possibility of collisions with motor vehicles. Energy-absorbing playground surfaces reduce the transfer of harmful energy in the event of a fall from elevated play equipment. Despite advances in technology, however, some protective devices will have limited success when one or more of the "three E" factors are ignored. For instance, the use of four-sided swimming pool fences can be maximized if the public is aware of their need, they are environmentally aesthetic and affordable, and they are required by law.

Education and behavior change strategies are directed toward decreasing the susceptibility of individuals by teaching or motivating them to behave differently or to support environmental or legislative changes. These strategies can be directed toward individuals in selected settings (e.g., efforts to educate school children about safely using pedestrian crossings) or toward the public at large through social marketing campaigns (e.g., mass media promotion of new bicycle paths). Education can also be directed toward encouraging legislators, regulators, designers, architects, planners, and engineers to incorporate injury prevention into their work in ways that protect whole populations. There is rarely an injury prevention issue that does not require a complementary educational component. For instance, public support for four-sided pool fencing regulations can be increased through public education efforts, and individuals with such fences need to ensure that the gate to the pool is always closed.

Legislation and law enforcement strategies have their greatest effect by making the physical environment safer and the socio-cultural environment more supportive of safety. These strategies can require changes in individual behavior or product design, or altering environmental hazards. In each case, there is an opportunity for the legislation and enforcement strategies to work synergistically with the other two strategies. For instance, traffic safety enforcement can result in a social climate that supports increased walking and bicycling and decreased injury risk.

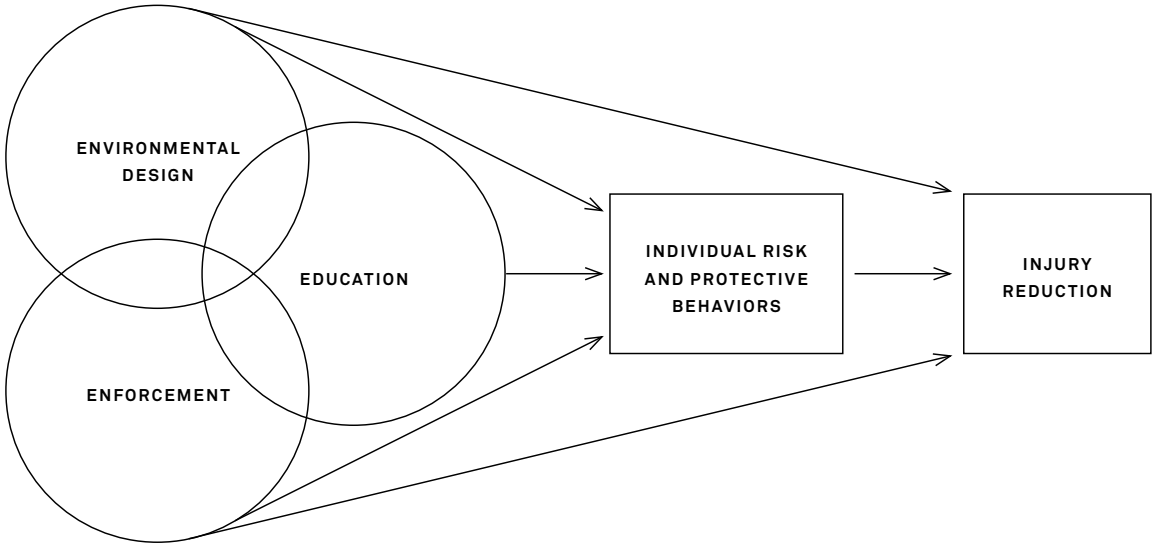


Figure 3: How The Three E's Reduce Injury. Adapted from Gielen, McDonald, and McKenzie, 2012.[10]



Figure 4: Three Injury Prevention Strategies and the Key Factors Needed for the strategies to work.
Adapted from: Sleet and Gielen, 2006.[11]

STRATEGY	KEY FACTORS
ENVIRONMENTAL DESIGN	**Successfully implementing environmental design and engineering strategies that protect large populations requires that:** • The strategy be effective and reliable. • The strategy be acceptable to the public and compatible with the environment. • The strategy results in products that dominate the marketplace. • The strategy be easily understood and properly used by the public.
EDUCATION AND BEHAVIOR CHANGE	**Key factors for education and behavior change strategies to work, are:** • The audience must be exposed to the information. • The audience must understand and believe the information. • The audience must have the resources and skills to make the proposed change. • The audience must derive benefit (or perceive a benefit) from the change. • The audience must be reinforced to maintain the change over time.
LEGISLATION AND ENFORCEMENT	**Key factors in assuring legislation enforcement strategies work are:** • The legislation must be widely known and understood. • The public must accept the legislation and its enforcement provisions. • The probability, or perceived probability, of being caught if one breaks the law must be high. • The punishment must be perceived as swift and severe.

REFERENCES

1. Sleet DA, Naumann R, Baldwin G, Dinh-Zarr TB, Ewing R. Eco-friendly Transportation and the Built Environment. In: Friis R, ed. Praeger *Handbook of Environmental Health*. Vol 1. Santa Barbara: Praeger; 2012: p. 427–440.
2. Sleet DA, Naumann R, Rudd R. Injuries and the Built Environment. In: *Making Healthy Places: Designing and Building for Health, Well-Being, and Sustainability.* Dannenberg AL, Frumkin H, Jackson R., eds. Washington, DC: Island Press; 2011: p. 77–90.
3. Pollack KM, Kercher C, Frattaroli S, Peek-Asa C, Sleet D, Rivara F. Toward environments and policies that promote injury-free active living—it wouldn't hurt. *Health and Place*. 2012;18(1): p. 106–14.
4. Dannenberg A, Frumkin H, Jackson R. *Making Healthy Places: Designing and Building for Health, Well-being, and Sustainability*. Washington, DC: Island Press; 2011:77-90.
5. National Center for Injury Prevention and Control. Web-based Injury Statistics Query and Reporting System (WISQARS): Injury Mortality Report 2007a. Atlanta: Centers for Disease Control and Prevention. 2011. www.cdc.gov/ncipc/wisqars.
6. National Center for Injury Prevention and Control. Web-based Injury Statistics Query and Reporting System (WISQARS): Non-Fatal Injury Report 2009. Atlanta: Centers for Disease Control and Prevention. 2011. www.cdc.gov/ncipc/wisqars.
7. Corso P, Finkelstein E, Miller T, Fiebelkorn I, and Zaloshnja E. Incidence and lifetime costs of injuries in the United States. *Injury Prevention*. 2004;12(4): 212-218.
8. Haddon W., Jr. The changing approach to the epidemiology, prevention an amelioration of trauma: the transition to approaches etiologically rather than descriptively based. *American Journal of Public Health and the Nation's health.* 1968;58: p.1431-1438.
9. Gielen AC, Sleet DA, DiClemente R, eds. *Injury and Violence Prevention: Behavioral Science Theories, Methods, and Applications.* San Francisco: Jossey-Bass; 2006: p. 83–104.
10. Gielen AC, McDonald EM, McKenzie LB. Behavioral Approaches. In: *Injury Research*. Li G, Baker S, eds. New York: Springer; 2012: p. 549–569.
11. Sleet DA, Gielen AC. Injury Prevention. In: Gorin S, Arnold J, eds. *Health Promotion in Practice.* San Francisco: Jossey-Bass; 2006: p. 361–391.



Florida Avenue Park,
Washington DC

CHAPTER TWO

URBAN DESIGN STRATEGIES THAT PROMOTE SAFETY



5th Avenue, Manhattan



PS*/2.1 PLAYGROUND EQUIPMENT AND SURFACES

Applicable to *Active Design Guidelines*
Objectives: 2.1, 2.3, 2.4, 2.5.

★ **Design playgrounds to meet or exceed the requirements published in the "Public Playground Safety Handbook" issued by the U.S. Consumer Product Safety Commission (CPSC)[1] and the American Society for Testing and Materials (ASTM)'s "Standard Consumer Safety Performance Specification for Playground Equipment for Public Use."[2] Play area design and construction should also incorporate accessibility for children of all abilities by complying with the "Guide to ADA Accessibility Guidelines for Play Areas."[3] Playground surfacing and surface materials should be tested to meet the criteria of the latest issue of ASTM using the Standard Test Method for Shock-Absorbing Properties of Playing Surface Systems and Materials.[4]**

Evidence shows the important role of playground design in preventing injuries among children, including and especially head injuries. For example, type and height of playground equipment and type of impact-absorbing surfaces beneath it are among the important considerations. [5,6,7,8,9,10,11,12,13] Playground-related injuries at North Carolina childcare centers were reduced by 22% after a law passed that required new playground equipment and surfacing in childcare facilities to follow the U.S. CPSC guidelines. [14]

ADDITIONAL INFORMATION:

Unitary materials are available from a number of different manufacturers, many of whom have a range of materials with differing shock absorbing properties. Those wishing to install a unitary material as a playground surface should request test data from the manufacturer identifying the critical height of the desired material. The critical height value should equal or exceed the height of the highest designated play surface of the equipment.

✲ Promoting Safety (PS)



Playgrounds with safety surfacing such as rubber tiles under equipment can help prevent injuries to children and can significantly reduce major fractures.
New York, NY

PS/2.2 FENCING FOR SWIMMING POOLS AND ELEVATED PLAY AREAS

Applicable to *Active Design Guidelines* Objectives: 2.1, 2.3, 2.4, 2.12.

★ **Use four-sided isolation fencing that encloses only the pool and not the entire area around the pool to prevent drownings. The fence should be made of material that is difficult to climb and have self-latching gates.** [15] **Although there are no studies evaluating whether fencing is effective at reducing falls from high surfaces, it is obvious that elevated play areas for children (as suggested in Objective 2.4) need to be properly protected from fall risks by installing and maintaining adequate fencing.**

Evidence shows that four-sided isolation fencing (enclosing the pool only and not the entire area around the pool) for swimming pools is effective in preventing drownings. [16,17,18] Restricted access to unsafe swimming areas, the use of lifeguards, and the availability of life jackets have proven promising interventions for drowning prevention.

Four-sided isolation fencing that encloses only the pool is effective in preventing drowning.



PS/2.3 COMPLETE STREETS

Applicable to *Active Design Guidelines*
Objectives: 2.2, 2.3, 2.6, 2.7, 2.8, 2.9.

☆ **Design and operate Complete Streets, which are streets that provide for safe, convenient, efficient and accessible use by all users, including pedestrians, bicyclists, motorists, and transit riders of all ages and abilities.** [19] **Complete Streets designs may be implemented as new road construction or reconstruction proceeds and need not be costly. They may also be implemented as retrofits. Although there is no single approach to designing Complete Streets, they often include using inexpensive materials such as roadway markings, and multiple strategies such as raised medians or pedestrian islands, a reduction in the number of mixed traffic lanes, enhanced traffic organization, signals, bus lanes, curb extensions, frequent and safe crossing opportunities, and bicycle lanes. Since Complete Streets designs vary widely, and not all contain elements that result in measurable reductions in injuries, incorporating multiple strategies will likely have the greatest impact on injury risk. NYC Inclusive Design Guidelines are available for consideration when designing safe and inclusive streets for users of all ages, abilities, and mobility devices.** [20]

An evaluation of Complete Streets designs showed that roads with a raised median or pedestrian islands, signalized and redesigned intersections, curbs, and sidewalks can reduce vehicle speed, pedestrian exposure risk, and vehicle volume and improve driver predictability—the ability of pedestrians and bicyclists to best predict the speed and actions of drivers. [21] Complete Streets seem to be most effective when designed to fit a community's context, so modifications should account for volume and use of the roadways.

An evaluation of Complete Streets showed that roads with a pedestrian island, signalized intersections, curbs, and sidewalks can reduce vehicle speed and increase pedestrian safety. Complete Street with dedicated lanes for various modes of transportation, Manhattan



PS/2.4 STREET CLOSURES FOR CREATING SAFE PLAY AREAS

Applicable to *Active Design Guidelines*
Objectives: 2.3, 2.4, 2.5, 2.8, 2.9, 2.10.

◇ **Use temporary street closures, where appropriate, to provide children and adults in urban areas with safe, open areas to play, where appropriate.**

Street Closures for play have been successfully implemented throughout the U.S. and other countries. [22,23,24,25] Best practices reported from Street Closure programs indicate that it is a cost-efficient and effective way to provide adults and children with a safe, open area to play.[22,23] Specific areas are designated for children's play, along with safety-related activities, including opportunities for children to try out their cycling skills and learn how to ride safely with assistance from local bicycle shops and bicycling advocacy organizations.[23]

Play Street, Dream Charter School,
Harlem, Manhattan



PS/2.5 TRAFFIC CALMING

Applicable to *Active Design Guidelines* Objectives: 2.8, 2.9, 2.11, 2.12.

★ **Incorporate traffic calming in area-wide road safety management to increase safety for bicyclists and pedestrians.** [26,27] **Use traffic calming, intended to reduce motor vehicle traffic or the speed of motor vehicles, particularly in areas where there is potential for pedestrians and/or bicyclists to interact with motor vehicles. In addition, implementing traffic engineering measures to reduce the risk of pedestrian-motor vehicle crashes may also improve perceptions regarding traffic safety and, in turn, increase walking.** [28]

Traffic calming strategies such as speed humps, road narrowing, multi-way stop intersections, and single-lane roundabouts have been found to reduce road traffic crashes resulting in fatal and non-fatal injuries as well as pedestrian/bicycle-motor vehicle collisions.[26,28,29,30] Speed humps alone have been found to increase speed limit compliance and significantly reduce crashes resulting in injuries. [31,32]

Traffic calming strategies such as speed bumps have been found to reduce road traffic crashes. Speed Bump, Bolton Avenue, Bronx



PS/2.6 PEDESTRIAN ISLANDS

Applicable to *Active Design Guidelines*
Objectives: 2.1, 2.2, 2.3, 2.6, 2.7, 2.8, 2.9.

★ **Install pedestrian islands (raised areas placed in the roadway separating lanes of traffic and slotted along the pedestrian path) on wide streets, where appropriate. NYC Inclusive Design Guidelines are available for consideration when designing pedestrian islands for users of all ages, abilities, and mobility devices.** [33]

Pedestrian islands are highly effective in reducing the risk of pedestrian injuries, particularly for wide streets and for an aging population that needs more time to cross the street.[28, 34, 35]

Pedestrian islands and timed signals reduce the risk of pedestrian injuries, particularly on wide streets.
Houston Street, Manhattan



PS/2.7 PLACEMENT OF BUS STOPS AND BUS LANES

Applicable to *Active Design Guidelines*
Objectives: 2.2, 2.5, 2.6, 2.8, 2.11, 2.12.

★ **Relocate bus stops from the near side to the far side of intersections, where appropriate. Bus safety design guidelines and tools that detail factors and scenarios for consideration when designing safe bus stops, bus lanes, and bus routes have been created by state and federal transportation authorities, administrations, and research organizations and made available online.** [36,37,38,39]

Evidence shows that the relocation of bus stops from the near side to the far side of intersections significantly decreases the percentage of pedestrians who step in front of a stopped bus at signal controlled intersections. [28]

Relocate bus stops from the near side to the far side of the intersection to decreases the percentage of pedestrians who step in front of a stopped bus at signal controlled intersections.



PS/2.8 IN-PAVEMENT FLASHING LIGHTS

Applicable to *Active Design Guidelines*
Objectives: 2.6, 2.7, 2.8, 2.9, 2.10.

☆ **Where appropriate, use in-pavement flashing lights that are automatically activated by the presence of pedestrians to alert motorists and prompt them to reduce their speed, particularly in areas where there is potential for a large number of pedestrians to intersect with roads and motor vehicles, and where there are not enough intersections controlled with traffic lights. In addition, implementing traffic engineering measures to reduce the risk of pedestrian-motor vehicle crashes may also improve perceptions regarding traffic safety and, in turn, increase walking.**[28]

The use of in-pavement flashing lights has been found to be promising in reducing vehicle speed and conflicts at pedestrian-motor vehicle crossings, increasing the number of drivers who slow and stop for pedestrians, and improving safety among pedestrians.[28,40,41]

The in-pavement flashing lights in this crosswalk allow this couple to safely cross the busy street.
Healdsburg, CA



PS/2.9 MULTI-WAY (ALL WAY) STOP SIGN CONTROL

Applicable to *Active Design Guidelines*
Objectives: 2.8, 2.9.

★ **Use multi-way stop signs in place of traffic signals at intersections with low vehicle traffic volume, where appropriate. *The Manual on Uniform Traffic Control Devices* (MUTCD) provides guidance on traffic control devices installed on all public streets, highways, bikeways, and private roads open to public traffic.** [42]

A review of evidence-based traffic engineering measures to reduce vehicle-pedestrian collisions concluded that multi-way stop sign control relative to traffic signals at low-vehicle-traffic-volume urban intersections is effective in reducing vehicle-pedestrian collisions.[28] Multi-way stop sign control produces lower vehicle speeds near intersections when compared to traffic signals and two-way stop sign control.[28]



Use multi-way stops with crosswalks to reduce vehicle-pedestrian collisions at low-vehicle-traffic-volume urban intersections.
Manhattan

PS/2.10 TRAFFIC SIGNALS

Applicable to *Active Design Guidelines* Objectives: 2.8, 2.9.

★ **Install pedestrian countdown signals, combined with accessible (for example, audible) signals where appropriate for an increasingly aging population.**[35] **Adequately timed yellow and all-red clearance signals are necessary at traffic signals to ensure that drivers have sufficient time to clear the intersection before pedestrian walk signals are displayed.**[28] **A walking speed of 1.0 meter per second is recommended when determining the pedestrian clearance interval at intersections with traffic signals and high concentrations of elderly pedestrians.**[28] **There are other recommendations for intersection signal control during high-alcohol hours at signalized intersections located near licensed premises to reduce vehicle-pedestrian conflicts and improve safety for pedestrians.**[43,44] **The MUTCD provides guidance on traffic control devices installed on all public streets, highways, bikeways, and private roads open to public traffic.**[42] **NYC Inclusive Design Guidelines are available for consideration when determining traffic signal factors in order to create a safe environment for people of all ages and abilities.**[45]

There is an increased risk to older pedestrians at intersections with crosswalk markings and no traffic signal or stop sign.[46] The risk of pedestrian and bicycle crashes at intersections has been shown to be significantly reduced through the installation of traffic signals (especially at high-speed intersections), adequately timed yellow and all-red clearance signals, and exclusive traffic signal phasings (i.e., stopping all vehicle traffic for part or all of the pedestrian crossing signal).[28, 47] Pedestrian countdown signals significantly decrease vehicle-pedestrian crashes.[48] Experience in other countries supports using priority signaling and bicyclist-activated signals for bicyclists at key intersections, as well as pedestrian-activated signals at both intersections and mid-block crosswalks.[34] Separate traffic signal phases for bicycles at intersections have also proven cost-effective.[49]



Pedestrian countdown signals significantly decrease vehicle-pedestrian crashes. Brooklyn

PS/2.11 LIGHTING

Applicable to *Active Design Guidelines*
Objectives: 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9, 2.10, 2.11, 2.12, 2.13.

☆ **Consider using lighting to increase the visibility of cyclists and pedestrians in areas of interaction with vehicles to reduce collisions, as well as in front of workplaces and in parking facilities to reduce crime and increase safety. Outdoor lighting is a key component of a comprehensive bicycle and pedestrian safety strategy and a multifaceted crime reduction strategy. More extensive information about lighting principles, lighting design, and industry standards and practices is available online [50] and included in a recently published review article. [51]**

Evidence shows that street lighting in combination with other infrastructure interventions, like paved surfaces, improves pedestrian and cyclist safety. [52] Workplaces with bright exteriors and bright lighting are less likely to experience homicides. [53] Preventive strategies for minimizing the risk of workplace violence include good lighting. [54] Lighting is considered to be the most important security feature in a parking facility and is effective in reducing parking facility crime. [55] Consistent with Crime Prevention through Environmental Design (CPTED) principles, lighting should be part of a comprehensive approach to improving the built environment and increasing safety.

Refer to Strategy PS/2.16 Crime Prevention through Environmental Design (CPTED) on page 35 for more information on use of lighting and other design interventions to promote safety.



Consider using lighting to increase the visibility of cyclists and pedestrians in areas of interaction with vehicles to reduce collisions.

PS/2.12 PEDESTRIAN OVERPASSES

Applicable to *Active Design Guidelines*
Objectives: 2.1, 2.2, 2.3, 2.6, 2.7, 2.9.

☆ **Consider pedestrian overpasses where on-street crossings are not feasible, particularly at very wide crossings and those with high traffic speeds. Establish safe and convenient access points for overpasses. Adequate lighting throughout the overpass and at the entrances can help create a safer environment. Consider the NYC Inclusive Design Guidelines when designing safe and inclusive overpasses for users of all ages, abilities, and mobility devices.**[33]

Evidence shows that pedestrian overpasses can reduce the risk of pedestrian crashes and conflicts; however, factors such as cost and those associated with pedestrian benefits of use and non-use need to be considered.[28]



Where on-street crossings are not feasible, pedestrian overpasses can reduce the risk of pedestrian conflicts.
British Columbia

PS/2.13 PAINTED, DESIGNATED BICYCLE LANES/BOXES/ CROSSINGS

Applicable to *Active Design Guidelines* Objectives: 2.1, 2.3, 2.5, 2.6, 2.7, 2.11, 2.12, 2.13.

☆ **Use colored, painted markings at bicycle-motor vehicle crossings, bike boxes (a.k.a., advanced stop lines) at signalized intersections, and designated bicycle lanes/routes to reduce conflicts between cyclists and motorists and to decrease the risk of injury to bicyclists.**[27,28,52]

Studies show that providing separated bicycle tracks or lanes reduces vehicle-bicycle collisions, deaths, and injuries among cyclists.[26,34,56,57,58] Evidence also shows that greater numbers of motorists yield to cyclists in bike boxes, reducing conflicts, and that vehicles also slow or stop before entering painted crossings.[59,60]



Bicycle boxes can reduce vehicle-bicycle conflicts because motorists are more likely to yield to cyclists in boxes, and vehicles also slow or stop before entering painted crossings. Bicycle Box, NYC

PS/2.14 BICYCLE-SHARING SYSTEMS

Applicable to *Active Design Guidelines*
Objectives: 2.2, 2.3, 2.5, 2.11, 2.13.

◇ **Establish bicycle-sharing systems to increase access to bicycles and possibly reduce the risk of crashes compared to private bicycles.**

Data from international and national bicycle-sharing programs indicate that bicycle-sharing riders have a lower incidence of crashes than private bicycle riders.[61]

Bicycle-sharing systems increase access to bicycles.



PS/2.15 BICYCLE AND BICYCLE HELMET STORAGE

Applicable to *Active Design Guidelines*
Objectives: 2.1, 2.3, 2.5, 2.6, 2.7, 2.11, 2.12, 2.13.

◇ **Create public facilities for bicycle helmet storage which may increase the use of helmets. Bicycle helmets can prevent head and brain injuries, which represent the most serious type of bicycle-related injury. Create bicycle parking facilities in open areas with adequate lighting to maximize safety. Refer to the NYC Inclusive Design Guidelines for guidance on creating inclusive bicycle (as well as scooter and tricycle) storage and parking for people of all ages and abilities.**[20]

Provisions for bicycle helmets complement an infrastructure that promotes cycling. [62] Research supports making space available for helmet storage in public places. [63] A study that looked at determinants of helmet use among adolescents found that helmet users believed that access to helmet storage would increase the use of helmets. [64] Helmets, when worn properly, effectively reduce bicycle-related head and brain injuries for bicyclists of all ages and involved in all types of crashes, including those with motor vehicles.[65,66] Bicycle helmet storage areas could be placed alongside bicycle storage units and bicycle racks. In addition to reducing the risk of traumatic brain injuries, helmets also reduce the risk of serious facial injuries.[67,68,69] Although there is no evidence or literature for improving bike storage safety, strategies described for improving safety in parking facilities, such as good lighting, can be incorporated to ensure safety at bicycle storage locations.

ADDITIONAL INFORMATION:

When combined with public education, bicycle helmet legislation, which has primarily addressed children, appears to effectively increase helmet use and decrease the head injury rate in the population. [53,70,71]

PS/2.16 CRIME PREVENTION THROUGH ENVIRONMENTAL DESIGN (CPTED)

Applicable to *Active Design Guidelines*
Objectives: 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9, 2.10, 2.11, 2.12, 2.13.

★ **Consider implementing CPTED, a multifaceted approach to crime prevention through environmental design that incorporates tactics such as indoor and outdoor lighting, access control, and surveillance.** [72] **CPTED has potential benefits in delivering safer environments, which also support active living and walkable communities, and should be incorporated into design.** [73] **There are three overlapping strategies in CPTED: natural access control (to decrease crime opportunity), natural surveillance (to keep potential intruders under observation), and territorial reinforcement (the concept that physical design can contribute to a sense of territoriality whereby users develop a sense of proprietorship and potential offenders perceive that territorial influence). Access control (e.g., locks, guards) and surveillance (e.g., lighting, windows) contribute to a sense of territoriality, making CPTED effective for crime prevention.** [72]

CPTED includes an array of strategies that together provide a comprehensive approach to improving safety. Evidence shows that CPTED is effective in reducing crime,[74] specifically robbery[75] and violent crime and robbery among high-risk businesses.[76] Several states in the U.S. have reported a significant reduction in crime and drive-through drug trafficking as a result of implementing CPTED principles and plans. [77] Built environment features that increase watchful observation, such as windows with clear views of the street and uniform and appropriate outside lighting, are effective at decreasing crime. Access control consists of environmental features that limit access to and escape routes from potential crime targets.[78, 79] Locks, fencing, alarm systems, and building entrances that require electronic identification are examples of effective types of access control.[78,79] For external security, bushes should be kept below 3 feet in height and lower tree limbs should be cleared to a height of 6 feet to maintain natural surveillance.[79,80]

** Refer to Strategy PS/2.11. Lighting on page 30 for more information on use of lighting to promote safety.*



Transparency and light emanating through windows contribute to visibility and a sense of security on this sidewalk. Harlem Children's Zone. Manhattan

PS/2.17 SIGNAGE

Applicable to *Active Design Guidelines*
Objectives: 2.3, 2.5, 2.6, 2.7, 2.8, 2.9.

◇ **Install signs such as "Yield to Cyclist," "State Law: Yield to Pedestrians in Crosswalk," and "Stop for Pedestrians in Crosswalk," where appropriate and as part of a comprehensive pedestrian and bicyclist safety strategy to encourage motorists to yield to pedestrians and cyclists.**[60,81,82]

The MUTCD provides guidance on traffic control devices installed on all public streets, highways, bikeways and private roads open to public traffic. The evidence for traffic signs related to speed, hazards, etc. is robust, and general estimates value them as effective. Evidence shows that the use of signage as part of an overall pedestrian and bicyclist safety strategy increases the number of vehicles yielding to pedestrians and cyclists and decreases collisions.[60,81,82] There is limited evidence on the effectiveness of signs for other behaviors unrelated to driving.



Signage should be used as part of a comprehensive pedestrian and bicyclist safety strategy.
Manhattan

PS/2.18 STAIR FEATURES

Applicable to *Active Design Guidelines*
Objectives: 2.1, 2.2, 2.3, 2.4, 2.9, 2.10.

☆ **Maximize safe stair use. Larger goings (the horizontal distance between two consecutive nosings) can increase stair safety and decrease the potential number of incidents on stairs. Stair safety is also improved by the presence of handrails, adequate lighting, and the even depth and height and non-skid surfaces of stairs. Consider the NYC Inclusive Design Guidelines when designing safe and inclusive stairways for users of all ages and abilities.** [83]

Evidence shows that serious stair injuries can be prevented by improving stair design, specifically by avoiding risers that are too great or using larger goings (runs) to decrease risk of missteps and falls. [84]

Stair design features such as handrails increase stair safety.
Seattle, WA



ACTIVE DESIGN OBJECTIVES LINKED TO SAFETY PROMOTING STRATEGIES: URBAN REALM

Active Design Objectives	Safety Promoting Strategies							
	PLAYGROUND EQUIPMENT AND SURFACES	FENCING FOR SWIMMING POOLS AND ELEVATED PLAY AREAS	COMPLETE STREETS	STREET CLOSURES FOR CREATING SAFE PLAY AREAS	TRAFFIC CALMING	PEDESTRIAN ISLANDS	PLACEMENT OF BUS STOPS AND BUS LANES	IN-PAVEMENT FLASHING LIGHTS
2.1 LAND USE MIX Maintain and, where possible, enhance existing diverse mix of land uses.	X	X				X		
2.2 TRANSIT AND PARKING Increase physical activity by improving access to public transit.			X			X	X	
2.3 PARKS, OPEN SPACES, AND RECREATIONAL FACILITIES Locate and design parks, open spaces, and recreational facilities to encourage physical activity.	X	X	X	X		X		
2.4 CHILDREN'S PLAY AREAS Provide children with access to outdoor space and recreational facilities.	X	X		X				
2.5 PUBLIC PLAZAS Create public spaces such as plazas that are easily accessible to pedestrians and bicyclists.	X			X			X	
2.6 GROCERY STORES AND FRESH PRODUCE ACCESS Increase access to fresh food options.			X			X	X	X
2.7 STREET CONNECTIVITY Encourage walking by maintaining a network of interconnected streets and sidewalks.			X			X		X
2.8 TRAFFIC CALMING Promote walking and improve the overall pedestrian experience through traffic calming measures.			X	X	X	X	X	X
2.9 DESIGNING PEDESTRIAN PATHWAYS Encourage walking through the design of pedestrian pathways and sidewalks.			X	X	X	X		X
2.10 PROGRAMMING STREETSCAPES Encourage walking by creating attractive, engaging street environments that can accommodate artwork and events.				X				X
2.11 BICYCLE NETWORKS AND CONNECTIVITY Encourage bicycling by creating a continuous network of bikeways.					X		X	
2.12 BIKEWAYS Increase bicycling by designating bikeways that are appropriate to the street context.		X			X		X	
2.13 BICYCLING INFRASTRUCTURE Increase bicycling in the city by providing facilities such as indoor and outdoor bicycle parking, signals, and stair rails, and by instituting a bicycle share program.								

	MULTI-WAY STOP SIGN CONTROL	TRAFFIC SIGNALS	LIGHTING	PEDESTRIAN OVERPASSES	PAINTED, DESIGNATED BICYCLE LANES/BOXES/ CROSSINGS	BICYCLE-SHARING SYSTEMS	BICYCLE AND BICYCLE HELMET STORAGE	CRIME PREVENTION THROUGH ENVIRONMENTAL DESIGN (CPTED)	SIGNAGE	STAIR FEATURES
2.1			X	X	X		X	X		X
2.2			X	X		X		X		X
2.3			X	X	X	X	X	X	X	X
2.4			X					X		X
2.5			X		X	X	X	X	X	
2.6			X	X	X		X	X	X	
2.7			X	X	X		X	X	X	
2.8	X	X	X					X	X	
2.9	X	X	X	X				X	X	X
2.10			X					X		X
2.11			X		X	X	X	X		
2.12			X		X		X	X		
2.13			X		X	X	X	X		

1. U.S. Consumer Product Safety Commission. Public playground safety handbook. Washington, DC: US Consumer Product Safety Commission; 2010. http://www.cpsc.gov/cpscpub/pubs/325.pdf.
2. American Society for Testing and Materials. *Standard Consumer Safety Performance Specification for Playground Equipment for Public Use;* 2011. http://www.astm.org/Standards/F1487.htm.
3. U.S. Access Board. Accessible Play Areas: *A Summary of Accessibility Guidelines for Play Areas*. Washington, DC; 2005. http://www.access-board.gov/play/guide/guide.pdf.
4. American Society for Testing and Materials.F355 Standard Test Method for Impact Attenuation of Playing Surface Systems and Materials; 2010. http://www.astm.org/Standards/F355.htm.
5. Huang TJ, Chang LT. Design and evaluation of shock-absorbing rubber tile for playground safety. *Materials and Design*. 2009;30(9): p. 3819–3823.
6. Norton C, Nixon J, Sibert JR. Playground injuries to children. *Archives of Disease in Childhood*. 2004;89(2): p. 103–108.
7. Jafari HR, Salehi E, Sadeghi Naeini H. Playground safety: An approach to environmental planning. *Journal of Environmental Studies*. 2011;36(56): p. 13–24.
8. Fiissel D, Pattison G, Howard A. Severity of playground fractures: Play equipment versus standing height falls. *Injury Prevention*. 2005;11(6): p. 337–339.
9. Sherker S, Ozanne-Smith J, Rechnitzer G, Grzebieta R. Out on a limb: Risk factors for arm fracture in playground equipment falls. *Injury Prevention*. 2005;11(2): p. 120–124.
10. Howard AW, Macarthur C, Rothman L, Willan A, Macpherson AK. School playground surfacing and arm fractures in children: A cluster randomized trial comparing sand to wood chip surfaces. *Public Library of Science Medicine*. 2009;6(12): e1000195.
11. Laforest S, Robitaille Y, Lesage D, Dorval D. Surface characteristics, equipment height, and the occurrence and severity of playground injuries. *Injury Prevention*. 2001;7(1): p. 35–40.
12. Chalmers DJ, Marshall SW, Langley JD, Evans MJ, Brunton CR, Kelly AM, Pickering AF, et al. Height and surfacing as risk factors for injury in falls from playground equipment: a case-control study. *Injury Prevention*. 1996;2(2): p. 98–104.
13. Mott A, Rolfe K, James R, Evans R, Kemp A, Dunstan F, Kemp K, Sibert J. Safety of surfaces and equipment for children in playgrounds. *Lancet*. 1997;349(9069): p. 1874–1876.
14. Kotch J, Hussey J, carter A. Evaluation of North Carolina child care safety regulations. *Injury Prevention* 2003;9(3): p. 220–225.
15. Schnitzer PG. Prevention of unintentional childhood injuries. *American Family Physician*. 2006;74(11): p. 1864–1869.
16. Quan L, Bennett EE, Branche C M. Interventions to Prevent Drowning. In: Doll L, Bonzo SE, Mercy JA, Sleet DA, eds. *Handbook of Injury and Violence Prevention*. New York: Springer; 2006: p. 81–96.
17. Brenner RA. Prevention of drowning in infants, children, and adolescents. *Pediatrics*. 2003;112: p. 440–445.
18. Thompson DC, Rivara FP. Pool fencing for preventing drowning in children. *Cochrane Database of Systematic Reviews*. 2000(2): CD001047.
19. National Complete Streets Coalition. *Complete Streets FAQ*. http://www.completestreets.org/complete-streets-fundamentals/complete-streets-faq/.
20. Piccolo R, ed. *Inclusive Design Guidelines, New York City*. New York: Mayor's Office for People with Disabilities; 2010: p. 27–79.
21. King MR, Carnegie JA, Ewing R. Pedestrian safety through a raised median and redesigned intersections. *Transportation Research Board Record No. 1828, Pedestrians and Bicycles*. 2003;1828: p. 56–66.
22. KaBOOM! Play Matters: A study of best practices to inform local policy and process in support of children's play. Washington, DC; 2010. http://kaboom.org/docs/documents/pdf/playmatters/Play_Matters_New_York.pdf.
23. The Alliance for Biking and Walking and Open Plans. *The Open Streets Guide.* Washington, DC; 2012. http://peoplepoweredmovement.org/site/images/uploads/Open%20Streets%20Guide%20For%20Print-2-16-12.pdf. Gomez Feliciano L, McCreary LL, Sadowsky R, Peterson S, Hernandez A, McElmurry BJ, Park CG. Active Living Logan Square: joining together to create opportunities for physical activity. *American Journal of Preventive Medicine.* 2009;37(6S2):S361–367.
24. Sarmiento O, Torres A, Jacoby E, Pratt M, Schmid TL, Stierling G. The Ciclovía-Recreativa: A mass-recreational program with public health potential. *Journal of Physical Activity and Health*. 2010;7(S2): p. S163–180.
25. Pucher J, Dill J, Handy S. Infrastructure, programs, and policies to increase bicycling: an international review. *Preventive Medicine*. 2010;50(Suppl. 1): p.106–125.
26. Peden M, Scurfield R, Sleet D, Mohan D, Hyder A, Jarawan E, Mathers C, eds. *World Report on Road Traffic Injury Prevention*. Geneva, Switzerland: World Health Organization; 2004.
27. Retting RA, Ferguson SA, McCartt AT. A review of evidence-based traffic engineering measures designed to reduce pedestrian-motor vehicle crashes. *American Journal of Public Health*. 2003;93(9): p. 1456–1463.
28. Elvik R. Area-wide urban traffic calming schemes: a meta-analysis of safety effects. *Accident Analysis and Prevention*. 2001;33: p. 327–336.
29. Bunn F, Collier T, Frost C, Ker K, Roberts I, Wentz R. Area-wide traffic calming for preventing traffic related injuries. *Cochrane Database of Systematic Reviews*. 2003;(1): CD003110.
30. Cottrell W, Kim N, Martin P, Perrin HJ. Effectiveness of traffic management in Salt Lake City, Utah. *Journal of Safety Research*. 2006;37: p. 27–41.
31. Tester JM, Rutherford GW, Wald Z, Rutherford MW. A matched case-control study evaluating the effectiveness of speed humps in reducing child pedestrian injuries. *American Journal of Public Health*. 2004;94(4): p. 646–650.
32. Piccolo R, ed. *Inclusive Design Guidelines, New York City. New York*: Mayor's Office for People with Disabilities; 2010: p. 27–62.
33. Pucher J, Dijkstra L. Making walking and cycling safer: Lessons from Europe. *Transportation Quarterly*. 2000;54: p. 25–50.
34. AARP Public Policy Institute. *Planning Complete Streets for an Aging America*. Washington, DC; 2009.
35. Transportation Research Board. Transit Cooperative Research Program. *Transit Bus Safety & Security Program, Bus Stop Safety and Design Guidelines*. Washington, DC: Federal Transit Administration; 2012. http://www.tcrponline.org/.

36. Federal Transit Administration. *Transit Bus Safety & Security Program, Bus Stop Safety and Design Guidelines*. Washington, DC: Federal Transit Administration; 2011. http://bussafety.fta.dot.gov/show_resource.php?id=3406.

37. TriMet *Bus Stop Guidelines*. Portland, OR; 2010. http://trimet.org/pdfs/publications/bus-stop-guidelines.pdf.

38. North Jersey Transportation Planning Authority. *Pedestrian Safety at and Near Bus Stops Study*. Trenton, NJ; 2011.

39. Hakkert AS, Gitelman V, Ben Shabat E. An evaluation of crosswalk warning systems. *Proceedings of the 80th Annual Meeting of the Transportation Research Board*. Washington, DC: Transportation Research Board; 2001.

40. Prevedouros PD. Evaluation of in-pavement flashing lights on a six-lane arterial pedestrian crossing. *Proceedings of the 71st Annual Meeting of the Institute of Transportation Engineers*. Washington, DC: Institute of Transportation Engineers; 2001.

41. US Department of Transportation. *Manual on Uniform Traffic Control Devices*. Washington, DC; 2009. http://mutcd.fhwa.dot.gov.

42. Archer J. Effectiveness of the dwell-on-red signal treatment to improve pedestrian safety during high-alcohol hours. *Road safety 2008: Safer Roads,Safer Speeds, Safer People, Safer Vehicles: Australasian Road Safety Research Policing Education Conference*. Adelaide, Australia; 2008.

43. Lenné MG, Corben BF, Stephan K. Traffic signal phasing at intersections to improve safety for alcohol-affected pedestrians. *Accident Analysis and Prevention*. 2007;39(4): p. 751-756.

44. Piccolo R, ed. *Inclusive Design Guidelines, New York City*. City of New York, Mayor's Office for People with Disabilities. 2010: Chapters 4, 5, and 7.
Koepsell T, McCloskey L, Wolf M, Moudon AV, Buchner D, Kraus J, Patterson M. Crosswalk markings and the risk of pedestrian-motor vehicle collisions in older pedestrians. *Journal of the American Medical Association*. 2002;288(17): p. 2136–2143.

45. Bechtel AK, MacLeod KE, Ragland DR. Pedestrian scramble signal in Chinatown neighborhood of Oakland, California: An evaluation. *Transportation Research Record*. 2004;(1878): p. 19–26.

46. Pulugurtha SS, Desai A, Pulugurtha NM. Are pedestrian countdown signals effective in reducing crashes? *Traffic Injury Prevention*. 2010;11(6): p. 632–641.

47. Korve MJ, Niemeier DA. Benefit-cost analysis of added bicycle phase at existing signalized intersection. *Journal of Transportation Engineering-ASCE*. 2002;128: p. 40–48.

48. Illuminating Engineering Society of North America. New York; 2012. http://www.ies.org/.

49. Kitsinelis S, Zissis G. Road lighting: A review of available technologies and appropriate systems for different situations. *Journal of the Australian College of Road Safety*. 2012;23(1): p. 49–51.

50. Reynolds CC, Harris MA, Teschke K, Cripton PA, Winters M. The impact of transportation infrastructure on bicycling injuries and crashes: a review of the literature. *Environmental Health*. 2009;8: p. 47–66.

51. Dannenberg A, Frumkin H, Jackson R. *Making Healthy Places: Designing and Building for Health, Well-being, and Sustainability*. Washington, DC: Island Press; 2011: p. 77–90.

52. Rai S. Preventing workplace aggression and violence: A role for occupational therapy. Work. 2002;18(1): p. 15–22.

53. Smith, MS. *Crime Prevention Through Environmental Design in Parking Facilities, Research in Brief.* Rockville, MD: American Institute of Architects; 1996.

54. Herrstedt L. Planning and safety of bicycles in urban areas. *Proceedings of the Traffic Safety on Two Continents Conference*. Linkoping, Sweden: Swedish National Road and Transport Research Institute; 1997: p. 43–58.
Garder P, Leden L, Pulkkinen U. Measuring the safety effect of raised bicycle crossings using a new research methodology. *Transportation Research Record*. 1998;1636:64–70.

55. Lott DF, Lott DY. Effect of bike lanes on ten classes of bicycle-automobile accidents in Davis, California. *Journal of Safety Research*. 1976;8(4): p. 171–179.

56. Dill J, Monsere CM, McNeil N. Evaluation of bike boxes at signalized intersections. *Accident Analysis and Prevention*. 2012;44(1): p. 126–134.

57. Hunter WW, Harkey DL, Stewart JR, Birk, ML. Evaluation of blue bike-lane treatment in Portland, Oregon. *Transportation Research Record: Journal of the Transportation Research Board*. 2007;1705: p. 107–115.

58. Kazis N. *From London to DC, Bike Sharing is Safer Than Riding Your Own Bike*. StreetsBlog: 2011. http://www.streetsblog.org/2011/06/16/from-london-to-d-c-bike-sharing-is-safer-than-riding-your-own-bike/.

59. The Royal Society for the Prevention of Accidents. *The Effectiveness of Cycle Helmets: A Synopsis of Selected Research Papers and Medical Articles*. Birmingham, UK: The Royal Society for the Prevention of Accidents; 2003.

60. Thompson NJ, Sleet D, Sacks JJ. Increasing the use of bicycle helmets: lessons from behavioral science. *Patient Education and Counseling*. 2002;46(3): p. 191–197.

61. O'Callaghan FV, Nausbaum S. Predicting bicycle helmet wearing intentions and behavior among adolescents. *Journal of Safety Research*. 2006;37(5): p. 425–431.

62. Rivara F, Thompson D, Patterson M, Thompson R. Prevention of bicycle-related injuries: helmets, education, and legislation. *Annual Review of Public Health*. 1998;19: p. 293–318.

63. Lee RS, Hagel BE, Karkhaneh M, Rowe BH. A systematic review of correct bicycle helmet use: how varying definitions and study quality influence the results. *Injury Prevention*. 2009;15(2): p. 125–131.

64. Thompson DC, Nunn ME, Thompson RS, Rivara FP. Effectiveness of bicycle safety helmets in preventing serious facial injury. *Journal of the American Medical Association*. 1996;276: p. 1974–1975.

65. Thompson DC, Rivara FP, Thompson RS. Effectiveness of bicycle safety helmets in preventing head injuries. A case-control study. *Journal of the American Medical Association*. 1996;276: p. 1968–1973.

66. Thompson DC, Rivara FP, Thompson R. Helmets for preventing head and facial injuries in bicyclists. *Cochrane Database of Systematic Reviews*. 1999;(4): CD001855.

67. Dannenberg AL, Gielen AC, Beilenson PL, Wilson MH, Joffe A. Bicycle helmet laws and educational campaigns: an evaluation of strategies to increase children's helmet use. *American Journal of Public Health*. 1993;83(5): p. 667–674.

68. Macpherson A, Spinks A. Bicycle helmet legislation for the update of helmet use and prevention of head injuries. *Cochrane Database of Systematic Reviews*. 2008;(3): CD005401.

69. Crowe T. *Crime Prevention through Environmental Design: Applications of Architectural Design and Space Management Concepts*. 2nd ed. Woburn, MA: Butterworth-Heinemann; 2000.

70. Cozens P. Public health and the potential benefits of Crime Prevention Through Environmental Design. *New South Wales Public Health Bulletin*. 2007;18: p. 232–237.

71. Cozens PM, Saville G, Hillier D. Crime prevention through environmental design (CPTED): a review and modern bibliography. *Property Management*. 2005;23(5): p. 328–356.

72. Casteel C, Peek-Asa C. Effectiveness of crime prevention through environmental design (CPTED) in reducing robberies. *American Journal of Preventive Medicine*. 2000;18(4): p. 99–115.
Casteel C, Mineschian L, Erickson R, Kraus JF, Peek-Asa C. Compliance to a Workplace Violence Prevention Program in Small Businesses. *American Journal of Preventive Medicine*. 2004;26(4): p. 276–283.

73. Krehnke M. Crime Prevention Through Environmental Design. In: Atlas RI, ed. *21st Century Security and CPTED: Designing for Critical Infrastructure Protection and Crime Prevention*. New York: Auerbach Publications; 2008.

74. Peek-Asa C, Zwerling C. Role of environmental interventions in injury control and prevention. *Epidemiological Review*. 2003;25: p. 77–89.

75. Doll LS, Bonzo S, Mercy JA, Sleet DA, eds. *Handbook of Injury and Violence Prevention*. New York: Springer; 2007: p. 257–275.

76. Paton D, Johnson D, eds. *Disaster Resilience - an integrated approach*. Springfield, Il: Charles C Thomas, Publisher Inc.; 2006:66-86.

77. Huang H, Zegeer C, Nassi R. Effects of innovative pedestrian signs at unsignalized locations: Three treatments. *Transportation Research Record*. 2000;1705: p. 43–52.

78. Malenfant L, Houten RV. Increasing the percentage of drivers yielding to pedestrians in three Canadian cities with a multifaceted safety program. *Health Education Research*. 1990;5(2): p. 275–279.

79. Piccolo R, ed. *Inclusive Design Guidelines, New York City. New York*: Mayor's Office for People with Disabilities; 2010: p. 63–79.

80. Roys MS. Serious stair injuries can be prevented by improved stair design. *Applied Ergonomics*. 2001;32(2): p. 135–139.

CHAPTER THREE

BUILDING DESIGN STRATEGIES THAT PROMOTE SAFETY



Via Verde, Bronx,
Dattner Architects



PS*/3.1 STAIR FEATURES

Applicable to *Active Design Guidelines*
Objectives: 3.1, 3.2, 3.3, 3.4.

★ **Maximize safe stair use. Stairwell doors are required by many municipal building codes to be unlocked from the egress side. From the stairwell side, stairwell doors should also be unlocked and freely accessible, whenever compatible with security measures.[1] Improve the visibility of stairs so that they become the regular means of access. Familiarity with stair location can also facilitate quick egress in the event of an emergency when elevator use is prohibited.[2] Larger goings (the horizontal distance between two consecutive nosings) can decrease the potential number of incidents on stairs.[3] Stair safety is also increased by the presence of handrails, adequate lighting, and even depth and height and non-skid surfaces of stairs. In individual homes with children younger than two, stair gates should be installed at the top and bottom of accessible stairs.[4] Consider using the NYC Inclusive Design Guidelines when designing safe and inclusive stairways for users of all ages and abilities.[5]**

A study that reviewed case law found that accessible stairwells do not appear to pose a greater risk of liability to property owners than other common areas within a building.[6] Evidence shows that serious stair injuries can be prevented by improving stair design, specifically by avoiding risers that are too great or using larger goings (runs) to decrease the risk of missteps and falls.[3] Evenness in the depth and height of stairs and the use of non-slip surfaces are best practices for reducing the risk of falls and injuries. Systematic reviews of the evidence show that minor modifications, such as installation of handrails and improved lighting, are promising interventions for reducing the risk of falls among older adults.[7] Stair safety features such as dimensions of risers and runs, evenness, and presence of handrails are often addressed in building codes, such as NYC's Building Code. Consideration should also be given to younger stair users; individual homes with stairs that have children younger than 2 years should have stair gates at the top and bottom of the stairs to prevent falls.[4]

ADDITIONAL INFORMATION:

There have been no reported studies to date that compare the injury risk of stair use versus escalator and elevator use. However, studies have reported on the rates of escalator and elevator injuries in high-risk populations such as children and those aged 65 and older and made recommendations for reducing this risk. These recommendations include longer delays on elevator door closings to reduce injuries and reducing the gap between the steps and sidewall or shield on escalators to decrease entrapment risk.[8,9,10,11,12]

✲ **Promoting Safety (PS)**



2 Gotham, Queens



Stern School of Business,
New York University,
Manhattan

PS/3.2 SURFACES IN INDOOR PLAY AREAS

Applicable to *Active Design Guidelines*
Objectives: 3.9.

★ **Design indoor areas to meet or exceed the requirements published in the "Public Playground Safety Handbook" issued by the U.S. Consumer Product Safety Commission (U.S. CPSC),[13] and the American Society for Testing and Materials (ASTM)'s "Standard Consumer Safety Performance Specification for Playground Equipment for Public Use."[14] Play area design and construction should also incorporate accessibility for children of all abilities by complying with the "Guide to ADA Accessibility Guidelines for Play Areas".[15] Playground surfacing and surface materials should be tested to meet the criteria of the latest issue of ASTM using the Standard Test Method for Shock-Absorbing Properties of Playing Surface Systems and Materials.[16]**

To reduce the likelihood of injuries from a fall, especially head injuries, facilities with indoor play areas should consider using a material specifically designed and tested as playground surfacing. Evidence suggests that the current impact attenuation testing standard for playgrounds represents a desirable standard for protecting children from falling off playground equipment, whether indoors or outdoors.[17] Numerous studies have shown that playgrounds built with certain types of safety surfacing prevent overall injuries to children and can significantly reduce severe child head injuries.[18,19] Playground-related injuries at North Carolina childcare centers were reduced by 22% after a law passed that required new playground equipment and surfacing in childcare facilities to follow the U.S. CPSC guidelines.[20]

ADDITIONAL INFORMATION:

Unitary materials are available from a number of different manufacturers, many of whom have a range of materials with differing shock absorbing properties. Those wishing to install a unitary material as a playground surface should request test data from the manufacturer identifying the critical height of the desired material. The critical height value should equal or exceed the height of the highest designated play surface of the equipment.

To reduce the likelihood of injuries from a fall, surfacing under indoor play structures from which children may fall should use materials that meet safety guidelines and standards.



PS/3.3 INDOOR POOL SAFETY

Applicable to *Active Design Guidelines*
Objectives: 3.7, 3.9.

☆ **Use pool alarms, retractable pool covers, and place rescue equipment such as reach poles poolside, where appropriate, to enable quick retrieval of a drowning victim. Telephones should be accessible poolside to summon emergency medical services quickly. Refer to the NYC Inclusive Design Guidelines for more information about pool safety for people with disabilities.**[21]

Evidence supports the placement of rescue equipment, such as reach poles and telephones poolside, to enable quick retrieval of a drowning victim and to call trained help.[22] In addition, to prevent drowning, especially among children, retractable pool covers and pool alarms are design strategies with some evidence of supporting pool safety.[23] Pool areas can be designed with areas to safely store chemicals for pool maintenance in order to reduce pool chemical-associated injuries. Guidelines on the design of pool chemical storage areas and pump rooms are available online: "Recommendations for Preventing Pool Chemical-Associated Injuries."[24, 25]

Locate rescue equipment such as reach poles poolside to enable quick retrieval of a drowning victim.



PS/3.4 BICYCLE AND BICYCLE HELMET STORAGE

Applicable to *Active Design Guidelines*
Objectives: 3.7, 3.9.

◇ **Create public facilities for bicycle helmet storage, which may increase the use of helmets. Bicycle helmets can prevent head and brain injuries, which represent the most serious type of bicycle-related injury. Create bicycle parking facilities in open areas with adequate lighting to maximize safety. Refer to the NYC Inclusive Design Guidelines for creating inclusive bicycle (as well as scooter and tricycle) storage and parking for people of all ages and abilities.** [26]

Infrastructure that promotes cycling and provides for bicycle helmet storage is needed.[27] Research supports having space for helmet storage in public places.[28]

A study that looked at determinants of helmet use among adolescents found that helmet users believed that access to helmet storage would increase the use of helmets.[29] Helmets, when worn properly, effectively reduce bicycle-related head and brain injuries for bicyclists of all ages and involved in all types of crashes, including those with motor vehicles.[30,31] In addition to reducing the risk of traumatic brain injuries, helmets also reduce the risk of serious facial injuries.[32,33,34] Bicycle helmet storage areas should be placed alongside bicycle storage units and racks. Although there is no evidence or literature for improving bike storage safety, previously described strategies for improving safety in parking facilities can be incorporated to ensure safety at bicycle storage locations as well.

ADDITIONAL INFORMATION:

When combined with public education, bicycle helmet legislation, which primarily addresses children, appears to effectively increase helmet use and decrease the head injury rate in the population.[1,35,36]

PS/3.5 WINDOW GUARDS AND BALCONY RAILINGS

Applicable to *Active Design Guidelines* Objectives: 3.4.

★ **Install approved window guards or other approved limiting devices on all windows, including balcony windows, but not on fire escape windows, in multiple dwellings where a child 10 years of age or younger resides. See, for example, the NYC Department of Health and Mental Hygiene's standards on window guards.[37,38] Install window locks on windows above ground level, and make balcony railings less than 4 inches apart to prevent falls by young children.**

Evidence shows that the installation of window guards, window locks, and balcony railings less than 4 inches apart are associated with reduced pediatric injury resulting from falls from windows and balconies.[7,39,40,41,42]

ADDITIONAL INFORMATION:

In 1972, the New York City Department of Health developed the "Children Can't Fly" program to prevent childhood injury and death from window falls.[43,44] The program had four major components: 1) reporting of falls by hospital emergency rooms and police, with follow-up by public health nurses; 2) a media campaign; 3) community education for prevention through door-to-door hazard identification, counseling by outreach workers and community organization efforts; and 4) provision of free, easily installed window guards to families with young children living in high-risk areas. The success of the program in drastically reducing child death and injury persuaded the New York City Board of Health to amend the Health Code in 1976 to require that landlords provide window guards in apartments where children 10 years old and younger reside. The law is the first and only one of its kind in the nation.



Evidence suggests that installing window guards can reduce pediatric injury resulting from falls from windows. Queens

PS/3.6 SIGNAGE

Applicable to *Active Design Guidelines*
Objectives: 3.5, 3.6.

◇ **Use signage with signal words such as "Danger" or "Caution" as one component of a safety system to alert those within a building to potential risks, where appropriate. Signs should be conspicuous, with simple messages, symbols, or pictographs that capture attention, can be read quickly, and can be understood by the intended audience. The NYC Inclusive Design Guidelines provides detailed recommendations when creating emergency and other informational signage in visual, auditory, and tactile formats for those with disabilities.**[21]

When the risk is not obvious, warning signs should be used. Studies on the effectiveness of signs in alerting the public to potential risks have established the following elements as critical: audience attention must be captured; signs must be conspicuous; visual clutter around the warning signs should be minimized; signal words like "Danger" or "Caution" should be used; symbols and pictographs can be included when helpful; simple messages must be used because they must be read quickly; and tailored or personalized messages should be used whenever possible.[45] Pretesting messages with the intended audience is necessary, especially when the audience will include those with low literacy or for whom English is not their first language. Signage is most effective when included as a component of a comprehensive safety system.[45]

Incorporate signage as a component of a comprehensive safety system. Research supports that signs with simple messages, symbols or pictographs are most effective.



PS/3.7 SPRINKLERS

Applicable to *Active Design Guidelines*
Objectives: 3.2, 3.7.

★ **Include automatic sprinkler systems in the design of all commercial buildings and new one-family and two-family homes, consistent with the International Code Council.**[46] **In some jurisdictions, automatic sprinkler systems are required for almost all commercial buildings.**

Sprinklers are a passive technology designed to extinguish or control the triggering fire event. As a technology, sprinklers have been field tested for decades, and evidence demonstrates that they provide a consistent, effective response.[47,48] In recent estimates, sprinklers are effective 97% of the time when activated.[48] Automatic sprinklers are highly effective elements of total system designs for fire protection in buildings. They save lives and property, producing large reductions in the number of deaths per thousand fires, the average direct property damage per fire, and the likelihood of a fire with large loss of life or large property loss. They reduce risk to firefighters as well as residents, and they reduce the impact of fires and firefighting on the environment.

Sprinklers provide a consistent, effective response and are an important part of fire safety.



PS/3.8 CRIME PREVENTION THROUGH ENVIRONMENTAL DESIGN (CPTED)

Applicable to *Active Design Guidelines* Objectives: 3.7.

★ **Consider implementing CPTED, a multifaceted approach to crime prevention through environmental design that incorporates indoor and outdoor lighting, access control, and surveillance.[49] CPTED is potentially beneficial in delivering safer environments, which can support active living and walkable communities, and should be incorporated into design.[50] There are three overlapping strategies in CPTED: natural access control (to decrease crime opportunity), natural surveillance (to keep potential intruders under observation), and territorial reinforcement (the concept that physical design can contribute to a sense of territoriality whereby users develop a sense of proprietorship and potential offenders perceive that territorial influence). Access control (such as locks and guards) and surveillance (for example, through lighting and windows) contribute to a sense of territoriality, making CPTED effective for crime prevention.[49]**

CPTED includes an array of strategies, which together provide a comprehensive approach to improving safety. Evidence shows that CPTED is effective in reducing crime,[51] specifically robbery[52] and violent crime among high-risk businesses.[53] Several states in the U.S. have reported a significant reduction in crime and drive-through drug trafficking as a result of implementing CPTED principles and plans.[54] Built environment features that increase watchful observation, such as windows with clear views of the street, and uniform and appropriate outside lighting, are effective at decreasing crime. Access control consists of environmental features that limit access to and escape routes from potential crime targets.[40,55] Entrances that require electronic identification, locks, fencing, and alarm systems are examples of effective types of access control.[40] Local building codes should be consulted for the limitations and conditions that they may impose on the use of access controls at entrances. For external security, bushes should be kept below 3 feet in height and lower tree limbs should be cleared to a height of 6 feet to maintain natural surveillance.[56] For internal workplace security, consider utilizing workplace designs that include secured and monitored entrances and alarmed exits[1] and installing internal video surveillance.[57] Open stairway designs, where permitted by local building code, avoid entrapment[40] and should also be included as an effective and safe building design strategy.

** Refer to Strategy PS/3.9. Lighting on page 56 for more information on how lighting promotes safety.*

PS/3.9 LIGHTING

Applicable to *Active Design Guidelines*
Objectives: 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.8, 3.9.

☆ **Maintain good lighting indoors, including in hallways and stairwells, in outdoor areas surrounding workplaces, and in parking facilities, to reduce incidents and increase safety. More extensive information about lighting principles, lighting design, and industry standards and practices are available online.**[58,59] **Additional information and guidelines specific to blue light emergency call systems and other communication and alert systems for those with visual and/or auditory disabilities is also available in the NYC Inclusive Design Guidelines.** [60]

Adequate lighting is an important factor in preventing falls, particularly among the elderly.[7] Workplaces with bright exteriors and bright lighting are less likely to experience homicides.[57] Preventive strategies for minimizing the risk of workplace violence include good lighting.[61] Lighting is considered the most important security feature in a parking facility and is effective in reducing parking facility crime.[58] Consistent with CPTED principles, lighting should be part of a comprehensive approach to improving the built environment and increasing safety.

** Refer to Strategy PS/3.8 Crime Prevention through Environmental Design (CPTED) on page 55 for more information on use of lighting and other design interventions to promote safety.*



Lighting and visibility are key principles of the CPTED approach to crime prevention.

ACTIVE DESIGN OBJECTIVES LINKED TO SAFETY PROMOTING STRATEGIES: BUILDING REALM

Active Design Objectives	STAIR FEATURES	SURFACES IN INDOOR PLAY AREAS	INDOOR POOL SAFETY	BICYCLE AND BICYCLE HELMET STORAGE	WINDOW GUARDS AND BALCONY RAILINGS	SIGNAGE	SPRINKLERS	CRIME PREVENTION THROUGH ENVIRONMENT DESIGN (CPTED)	LIGHTING
	Safety Promoting Strategies								
3.1 DESIGNATING STAIRS FOR EVERYDAY USE Increase daily stair climbing by dedicating at least one stair in the building for everyday use.	X								X
3.2 STAIR LOCATION AND VISIBILITY Increase stair use by locating a highly visible and appealing stair within the building's orientation areas and points of decision.	X						X		X
3.3 STAIR DIMENSIONS Provide stairs that can accommodate the needs of different users, including large or small groups who may be ascending and descending.	X								X
3.4 APPEALING STAIR ENVIRONMENT Encourage stair use through appealing environments and experiences.	X				X				X
3.5 STAIR PROMPTS Encourage use of stairs by providing informational or motivational signage at points where users must decide between taking stairs or elevators and escalators.						X			X
3.6 ELEVATORS AND ESCALATORS Reduce the emphasis on a building's elevators and escalators to promote everyday use of stairs among people who can use the stairs, while supporting accessibility for all building occupants.						X			X
3.7 BUILDING PROGRAMMING Locate the building's commonly used functions strategically to promote walking, standing, and wheelchair travel during the course of the day.			X	X			X	X	
3.8 APPEALING AND SUPPORTIVE WALKING ROUTES Increase the frequency and duration of recreational and task-oriented walking by providing an appealing environment and experience along paths of travel.									X
3.9 BUILDING FACILITIES THAT SUPPORT EXERCISE Provide building facilities that support recreational and transportation-related exercise.		X	X	X					X

1. Dannenberg A, Frumkin H, Jackson R. *Making Healthy Places: Designing and Building for Health, Well-being, and Sustainability*. Washington, DC: Island Press; 2011: p. 188–202.
2. Manning WA, ed. U.S. Fire Administration/ Technical Report Series. *The World Trade Center Bombing: Report and Analysis*. New York, NY: Department of Homeland Security; 1997.
3. Roys MS. Serious stair injuries can be prevented by improved stair design. *Applied Ergonomics*. 2001;32(2): p. 135–139.
4. Schnitzer PG. Prevention of unintentional childhood injuries. *American Family Physician*. 2006;74(11): p. 1864–1869.
5. Piccolo R, ed. *Inclusive Design Guidelines, New York City*. New York, NY: Mayor's Office for People with Disabilities; 2010: p 34–38; p. 72–79.
6. Public Health Law and Policy. Opening Up Stairways for Physical Activity: An Executive Summary. 2011. http:// www.phlpnet.org/sites/phlpnet.org/files/Stairways_Executive_Summary_2011.12.05.pdf.
7. Mack KA, Liller KD. Home injuries: Potential for prevention. *American Journal of Lifestyle Medicine*. 2010;4(1): p. 75–81.
8. Carr CS. Going up: a look at elevator safety. *Provider*. 2011;37(2):39-41.
9. Steele GK, O'Neil J, Huisingh C, Smith GA. Elevator-related injuries to older adults in the United States, 1990 to 2006. *The Journal of Trauma: Injury, Infection and Critical Care*. 2010;68(1): p. 188–192.
10. O'Neil J, Steele GK, Huisingh C, Smith GA. Escalator-related injuries among older adults in the United States, 1991–2005. *Accident Analysis and Prevention*. 2008;40(2): p. 527–533.
11. O'Neil J, Steele GK, Huisingh C, Smith GA. Elevator-related injuries to children In the United States, 1990 through 2004. *Clinical Pediatrics*. 2007;46(7): p. 619–625.
12. McGeehan J, Shields BJ, Wilkins III JR, Ferketich AK, Smith GA. Escalator-related injuries among children in the United States, 1990-2002. *Pediatrics*. 2006;188(2): p. e279–e285.
13. U.S. Consumer Product Safety Commission. *Public playground safety handbook*. Washington, DC: US Consumer Product Safety Comission; 2010. http:// www.cpsc.gov/cpscpub/pubs/325.pdf.
14. *American Society for Testing and Materials. Standard Consumer Safety Performance Specification for Playground Equipment for Public Use*. West Conshohocken, PA: American Society for Testing and Materials; 2011. http://www.astm.org/ Standards/F1487.htm.
15. US Access Board. *Accessible Play Areas: A Summary of Accessibility Guidelines for Play Areas*. Washington, DC; 2005. http:// www.access-board.gov/play/guide/guide.pdf.
16. American Society for Testing and Materials.F355-10a Standard Test Method for Impact Attenuation of Playing Surface Systems and Materials; 2010. http://www.astm.org/Standards/F355.htm.
17. Mack M, Sacks J, Hudson S, Thompson D. The impact attenuation performance of materials used under indoor playground equipment at child care centers. *Injury Control and Safety Promotion*. 2001;8(1): p. 45–47.
18. Huang TJ, Chang LT. Design and evaluation of shock-absorbing rubber tile for playground safety. *Materials and Design*. 2009;30(9): p. 3819–3823.
19. Norton C, Nixon J, Sibert JR. Playground injuries to children. *Archives of Disease in Childhood*. 2004;89(2): p. 103–108.Kotch J, Hussey J, Carter A. Evaluation of North Carolina child care safety regulations. *Injury Prevention* 2003;9(3): p. 220–225.
20. Piccolo R, ed. *Inclusive Design Guidelines, New York City*. New York, NY: Mayor's Office for People with Disabilities; 2010: p.113-124; 139-140; 205.
21. Quan L, Bennett EE, Branche CM. Interventions to Prevent Drowning. In: Doll L, Bonzo SE, Mercy JA, Sleet DA eds. *Handbook of Injury and Violence Prevention*. New York: Springer; 2006: p. 81–96.
22. Weiss J. Technical Report: Prevention of Drowning. 2010. From the American Academy of Pediatrics: Committee on Injury, Violence, and Poison Prevention. *Pediatrics*. 2010;126: p. e253–e262.
23. U.S. Environmental Protection Agency. *Chemical Safety Alert: Safe Storage and Handling of Swimming Pool Chemicals*. Washington, DC: Office of Solid Waste and Emergency Response; 2001. http://www.epa.gov/oem/docs/chem/spalert.pdf.
24. Centers for Disease Control and Prevention. Recommendations for Preventing Pool Chemical-Associated Injuries. 2012. http://www.cdc.gov/healthywater/swimming/pools/preventing-pool-chemical-injuries.html.
25. Piccolo R, ed. *Inclusive Design Guidelines, New York City*. New York, NY: Mayor's Office for People with Disabilities; 2010: p. 68–69.
26. The Royal Society for the Prevention of Accidents. *The Effectiveness of Cycle Helmets: A Synopsis of Selected Research Papers and Medical Articles*. Birmingham, UK: The Royal Society for the Prevention of Accidents; 2003.
27. Thompson NJ, Sleet D, Sacks JJ. Increasing the use of bicycle helmets: lessons from behavioral science. *Patient Education and Counseling*. 2002;46(3): p. 191–197.
28. O'Callaghan FV, Nausbaum S. Predicting bicycle helmet wearing intentions and behavior among adolescents. *Journal of Safety Research*. 2006;37(5): p. 425–431.
29. Rivara FP, Thompson DC, Patterson MQ, Thompson RS. Prevention of bicycle-related injuries: helmets, education, and legislation. *Annual Review of Public Health*. 1998;19: p. 293–318.
30. Lee RS, Hagel BE, Karkhaneh M, Rowe BH. A systematic review of correct bicycle helmet use: how varying definitions and study quality influence the results. *Injury Prevention*. 2009;15(2): p. 125–31.
31. Thompson Jr RC, Morris Jr JN, Jane JA. Current concepts in management of cervical spine fractures and dislocations. *Journal of Sports Medicine*. 1975;3(4): p. 159–167.
32. Thompson DC, Nunn ME, Thompson RS, Rivara FP. Effectiveness of bicycle safety helmets in preventing serious facial injury. *JAMA*. 1996;276(24): p. 1974–1975.
33. Rivara FP, Astley SJ, Clarren SK, Thompson DC, Thompson RS. Fit of bicycle safety helmets and risk of head injuries in children. *Injury Prevention*. 1999;5(3): p. 194–197.
34. Macpherson A, Spinks A. Bicycle helmet legislation for the uptake of helmet use and prevention of head injuries. *Cochrane Database of Systematic Reviews*. 2008;(3): CD005401.

35. Dannenberg AL, Gielen AC, Beilenson PL, Wilson MH, Joffe A. Bicycle helmet laws and educational campaigns: an evaluation of strategies to increase children's helmet use. *American Journal of Public Health*. 1993;83(5): p. 667–674.

36. New York City Department of Health and Mental Hygiene. *Are your Window Guards Installed Safely?* Informational Poster. New York, NY; 2012. http://www.nyc.gov/html/doh/downloads/pdf/win/win-wf042-poster-engsp.pdf.

37. New York City Department of Health and Mental Hygiene. *Window Falls Prevention*. New York, NY; 2012. http://www.nyc.gov/html/doh/html/win/wingi.shtml.

38. DiGuiseppi C, Jacobs DE, Phelan K, Mickalide A, Ormandy D. Housing interventions and control of injury-related structural deficiencies: A review of the evidence. *Journal of Public Health Management & Practice*. 2010;16(5): p. S34–S43.

39. Doll LS, Bonzo S, Mercy JA, Sleet DA, eds. *Handbook of Injury and Violence Prevention*. New York: Springer; 2007: p. 257–275.

40. American Academy of Pediatrics. Falls from heights: Windows, roofs, and balconies. *Pediatrics*. 2001;107(5): p. 1188–1191.

41. Pressley JC, Barlow B. Child and adolescent injury as a result of falls from buildings and structures. *Injury Prevention*. 2005;11(5): p. 267–273.

42. Spiegel CN, Lindaman FC. Children can't fly: a program to prevent childhood morbidity and mortality from window falls. *American Journal of Public Health*. 1977;67(12): p. 1143–1147.

43. Barlow B, Niemirska M, Gandhi RP, Leblanc W. Ten years of experience with falls from a height in children. *Journal of Pediatric Surgery*. 1983;18(4): p. 509–511.

44. Gielen AC, Sleet DA, DiClemente RJ, eds. *Injury and Violence Prevention: Behavioral Science Theories, Methods, and Applications*. San Francisco: Jossey-Bass; 2006: p. 83–104.

45. International Code Council website. Washington, DC; 2012. www.iccsafe.org.

46. Hall JR. U.S. Experience with Sprinklers and Other Automatic Fire Extinguishing Equipment. Rockville, MD: National Fire Protection Association; 2010.

47. Butry DT, Brown MH, Fuller SK. *Benefit-cost Analysis of Residential Fire Sprinkler Systems*. Gaithersburg, MD: National Institute of Standards and Technology; 2007.

48. Crowe T. *Crime Prevention through Environmental Design: Applications of Architectural Design and Space Management Concepts*. 2nd ed. Woburn, MA: Butterworth-Heinemann; 2000.

49. Cozens P. *Public health and the potential benefits of Crime Prevention Through Environmental Design*. New South Wales Public Health Bulletin. 2007;18(11-12):232-237.

50. Cozens PM, Saville G, Hillier D. Crime prevention through environmental design (CPTED): a review and modern bibliography. *Property Management*. 2005;23(5): p. 328–356.

51. Casteel C, Peek-Asa C. Effectiveness of crime prevention through environmental design (CPTED) in reducing robberies. *American Journal of Preventive Medicine*. 2000;18(4 Suppl): p. 99–115.

52. Casteel C, Peek-Asa C, Howard J, Kraus JF. Effectiveness of crime prevention through environmental design in reducing criminal activity in liquor stores: a pilot study. *Journal of Environmental and Occupational Medicine*. 2004;46(5): p. 450–458.

53. Tipton H, Krause M, eds. *Information Security Management Handbook*. 6th ed., vol. 3. Boca Raton, FL: Auerbach Publications; 2009: p. 377–392.

54. Peek-Asa C, Zwerling C. Role of environmental interventions in injury control and prevention. *Epidemiological Review*. 2003; p. 25:77–89.

55. Paton D, Johnson D, eds. *Disaster Resilience: an integrated approach*. Springfield, IL: Charles C Thomas, Publisher Inc.; 2006: p. 66–86.

56. Occupational Safety and Health Administration. *OSHA Fact Sheet: Workplace Violence*. Washington, DC: U.S. Department of Labor Occupational Health and Safety Administration; 2002.

57. Smith M. National Institute of Justice. *Research in Brief: Crime Prevention Through Environmental Design in Parking Facilities*. Washington, DC: U.S. Department of Justice; 1996. https://www.ncjrs.gov/pdffiles/cptedpkg.pdf.

58. Illuminating Engineering Society of North America. New York, NY; 2012. http://www.ies.org/.

59. Piccolo R, ed. *Inclusive Design Guidelines, New York City. New York*, NY: Mayor's Office for People with Disabilities; 2010: p. 111–112; p. 129–138.

60. Rai S. Preventing workplace aggression and violence—a role for occupational therapy. *Work*. 2002;18(1): p. 15–22.

CHAPTER FOUR CONCLUSION



Water Street ,
Manhattan


STARBUCKS
COFFEE
ALERTON
ABM
Energy Management & Temperature Controls
www.abmsys.com
516-352-2626
54 CHERRY LANE

CONCLUSION

This supplement to the *Active Design Guidelines* was created to provide additional information for designers, architects, planners, and engineers on implementing active design strategies in urban and building design that promote active living and maximize safety. Several key findings emerged through reviewing the evidence for urban design and building design strategies. First, Active Design strategies are often wholly compatible with well-accepted injury prevention principles. Second, the safety of multiple Active Design strategies can often simultaneously be enhanced by a single injury prevention strategy. All road users may be better protected when Active Design strategies that reduce crash risk, such as traffic calming, are implemented, where appropriate. Finally, for some of the Active Design strategies included in this report, there is a need for further research because there is insufficient evidence on the links between these strategies and promoting safety. Each of these findings is addressed in more detail here.



Separating various road users, especially pedestrians and cyclists from cars, is an effective design strategy that maximizes safety. Union Square, Manhattan

Active Design Strategies Are Consistent With Injury Prevention Principles

Advances in the science of injury prevention have led to established principles that guide efforts to enhance safety. Several of these are particularly relevant to promoting Active Design in both urban environments and buildings.

First, separating people from hazards is an important goal when designing environments in which people work, live, and play. This principle is exemplified by properly built bike lanes that offer good street connectivity and are supported with appropriate, well-displayed signage and traffic controls.

Second, because injuries result when energy forces are applied to the human body in amounts that exceed the body's tolerance, the principle of reducing energy exposure is also important. Installing energy-absorbing surfaces where there is potential for falls from heights (such as on playgrounds) is one example of applying this principle in urban design.

Finally, designers must always consider the ways in which people, especially the most vulnerable, will use newly designed space, whether in buildings or in the urban environment. For instance, opportunities for rooftop gardens and play spaces should include structures that prevent the risk of falls, especially among children. When planning trails and paths for pedestrians and bicyclists, designers should consider how older adults, people with physical limitations, families with strollers, and bicyclists can all safely use the space. Signage and pavement markings can be useful to maximize safety in such circumstances. In addition, separating each of these various road users, especially pedestrians and cyclists from cars, but also pedestrians from bicyclists, can be an effective design strategy for maximizing safety.



When properly installed, window guards and railings can help prevent injury.
Manhattan

Injury Prevention Strategies Can Yield Benefits Across Multiple Active Design Objectives

When injury prevention strategies such as improved timing of traffic signals or multi-way stops at intersections are present, both pedestrians and bicyclists will benefit. CPTED (Crime Prevention Through Environmental Design) principles address many Active Design objectives, from increasing "eyes on the street" to utilization of parks and playgrounds to using transit for commuting to and from work. Improved lighting, one of the fundamental interventions in the CPTED approach, can increase safe physical activity of all kinds and contribute to preventing both unintentional injury and violence.

Where More Evidence is Needed

For some of the Active Design objectives included in this report, there is insufficient evidence regarding their relationship to injury outcomes. For instance, while red light cameras have demonstrated utility in reducing motor vehicle crashes, there are no data specific to injuries to pedestrians and bicyclists. More refined data collection is needed. Similarly, no studies have compared the relative safety of stairs versus elevators and escalators. Precautions for maximizing stair safety, however, are known and have been incorporated into this report. Finally, in many cases, the evidence-based injury prevention strategies are multifaceted, and consequently the data are not refined enough to identify the specific effective "ingredients" of the strategy. For instance, studies evaluating the CPTED strategy have demonstrated



Playgrounds with safety surfacing under equipment can help prevent injuries to children and can significantly reduce major fractures. Playground equipment at Florida Avenue Park in Washington DC

reductions in both violent crime and drug trafficking, but it remains unclear which of the specific CPTED components were necessary and sufficient.

These limitations represent opportunities for the future. As Active Design features become more widely used in buildings and urban areas, surveillance of injuries should be one of the outcomes evaluated over time. To maximize safety in the application of Active Design strategies, injury prevention evidence and/or experts should be incorporated throughout the Active Design planning, implementation, and evaluation process.

Considering Injury Prevention When Deciding On Active Design Strategies: Some Final Thoughts

Designers, architects, planners, and engineers must balance many factors when making decisions about which Active Design strategies will work in any given situation and space. Resources, use of the space by many audiences including those who are especially vulnerable, and potential unintended consequences of the strategy are a few of the important considerations. Some strategies will work better in certain settings than in others. For example, there is evidence supporting the ability of pedestrian bridges to protect pedestrians from traffic where safe on-road crossings cannot be incorporated. However, when pedestrian bridges are used, additional considerations, such as the lighting beneath them, become important in preventing unintended crime. Monitoring injury outcomes as a potential impact of Active Design strategies is an important part of Active Design evaluation.

Several conclusions can be drawn. First, efficient use of resources demands that highest priority be given to well-studied and cost-effective strategies to mitigate injury risk while promoting active environments. Thus, a comprehensive approach to Active Design initiatives should include support for research and evaluation. Second, there should be opportunities for input from interdisciplinary experts in injury prevention, as well as from the community being served, particularly where the research evidence for safety is lacking. Finally, as communities throughout the world implement creative designs to promote active environments and healthy lifestyles, there should be widespread opportunities for both professionals and the public to share experiences and lessons learned.

ACKNOWLEDGMENTS

PRIMARY AUTHORS:

Johns Hopkins Center for Injury Research and Policy, Johns Hopkins Bloomberg School of Public Health
Keshia M. Pollack, PhD, MPH
Associate Professor

Maryanne M. Bailey, MPH, CPH
Research Program Manager

Andrea C. Gielen, ScD, ScM
Professor and Director

CONTRIBUTING EDITORS:

New York City Department of Health and Mental Hygiene
Karen K. Lee, MD, MHSc, FRCPC
Director, Built Environment and Healthy Housing

Sarah Wolf, MPH, RD
Community Engagement Coordinator, Built Environment and Healthy Housing

Society for Public Health Education
M. Elaine Auld, MPH, MCHES
Chief Executive Officer

THANKS TO THE FOLLOWING FOR THEIR CONTRIBUTIONS:

Copy Editors
Irene Cheng, MArch, MPhil
Cheng+Snyder

Zoë Slutzky

Layout, Design and Images
Elizabeth Ellis, MFA
Office of Creative Services, New York City Department of Design and Construction

Belinda Kanpetch, MAUD

Eleanor Crockett, MPH
Intern, Image Coordinator, New York City Department of Health and Mental Hygiene

Kristina Capron, MA
Special Assistant, New York City Department of Health and Mental Hygiene

Background Research
Julia Cen Chen, MPP
Intern, Society for Public Health Education

Rachel L. Howard, AA
Administrative Coordinator, Johns Hopkins Center for Injury Research and Policy

Karen Strother, BA
Administrative Coordinator, Johns Hopkins Center for Injury Research and Policy

THANKS TO THE FOLLOWING FOR THEIR REVIEW AND INPUT:

New York City Department of Design and Construction
David Burney, FAIA
Commissioner

Joanna Frank, BArch, LEED AP
Director, Active Design

Victoria Milne, MID
Director, Office of Creative Services

New York City Mayor's Office of People with Disabilities
Robert Piccolo, AIA
Deputy Commissioner

New York City Department of Transportation
Kimberly Wiley Schwartz
Assistant Commissioner for Education and Outreach

Anne Marie Doherty
Chief, Research, Implementation & Safety

Matthew Roe
Planning & Research Manager, Office of Research, Implementation, and Safety

New York City Department of Buildings
Keith Wen, RA, NCARB
Executive Director of Technical Policy, Technical Affairs Division

New York City Department of Parks and Recreation
Celia M. Petersen, RLA
Director, Specifications and Estimating

New York City Department of Health and Mental Hygiene
Laura DiGrande, DrPH
Co-Director, Injury Surveillance and Prevention Program

Lawrence Fung, MPH
City Research Scientist, Injury Surveillance and Prevention Program

James K. Middleton III
Executive Director, Office of Community Sanitation, Bureau of Food Safety and Community Sanitation

Judith Garcia Rubin
Director, Office of Special Populations, Summer Camps & Window Fall Prevention Programs, Bureau of Food Safety and Community Sanitation

Carolie Feracho
Assistant Director, Window Fall Prevention Program

Betty Adams
Outreach Coordinator, Window Fall Prevention Program

SPECIAL THANKS TO:

David Sleet, PhD
Associate Director for Science, U.S. Centers for Disease Control and Prevention, Division of Unintentional Injury Prevention

This document was supported by a cooperative agreement to the Society for Public Health Education from the U.S. Centers for Disease Control and Prevention (CDC) 1U58DP0001335. The information and views presented herein are those of the authors and do not imply endorsement of the CDC.

SUGGESTED CITATION:

Johns Hopkins Center for Injury Research and Policy, NYC Department of Health and Mental Hygiene, Society for Public Health Education. *Active Design Supplement: Promoting Safety*, Version 2, 2013.

PHOTO CREDITS

Front cover NYC Department of Transportation; Inside front cover Eleanor Crockett; 8-9 NYC Department of Transportation; 11 NYC Department of Transportation; 13 Katherine H; 15 District Department of Transportation, District of Columbia; 17 Eleanor Crockett; 18-19 NYC Department of Transportation; 20 NYC Department of Health and Mental Hygiene; 21 Gregory Garnich; 22 NYC Department of Transportation; 23 Rose Gelrod / Dream Charter School; 24 NYC Department of Transportation; 25 Eleanor Crockett; 26 NYC Department of Health and Mental Hygiene; 27 Donna Cook / LightGuard Systems; 28 Eleanor Crockett; 29 NYC Department of Health and Mental Hygiene; 30 Suzanne Nathan/www.pedbikeimages.org: 31 Province of British Columbia; 32 Laura Sandt; 33 Ben Gabbe; 35 © Albert Vecerka /ESTO, courtesy of Davis Brody Bond Aedas; 36 Eleanor Crockett; 37 Skye Duncan / NYC Department of City Planning; 44-45 Skye Duncan / NYC Department of City Planning; 46 NYC Department of Health and Mental Hygiene; 47 Eleanor Crockett; 49 Xiangyang Zhang; 50 Kuzmik Andrei; 52 NYC Department of Health and Mental Hygiene; 53 G. Yener; 54 Baris Simsek; 56 Mike Panic; 60-61 NYC Department of Transportation; 62 NYC Department of Transportation; 63 Kristina Capron, NYC Department of Health and Mental Hygiene; 64 Eleanor Crockett; Inside Back Cover, Jeremy Edwards









JOHNS HOPKINS
BLOOMBERG
SCHOOL of PUBLIC HEALTH

Johns Hopkins Center for Injury Research & Policy