

Pedestrian Mobility Systems

INTRODUCTION

Revised 3-9-09

A. Pedestrian Mobility

Much can be learned from European cities about pedestrian mobility where conscious land use decisions are made to keep civic and municipal functions in the center, create highly attractive environments, and provide housing within and in close proximity to such areas. Additionally, Europeans have been pedestrianizing parts of their city centers, contributing to the attractiveness of the areas, making them places where people want to visit, shop, and live. They have achieved this by gradually taking space away from cars and parking and returning it to the pedestrian. Notable American cities such as Boulder (Colorado), Portland (Oregon), and Minneapolis (Minnesota) have also successfully pedestrianized urban spaces.

American cities are predominantly automobile-oriented with limited opportunity for safe and convenient walking. In 2000 16.6% of all deaths were due to poor diet and physical inactivity. This category may soon overtake tobacco as the leading cause of death.¹ The average annual traffic death rate is 50% higher in the top ten most sprawling metro areas than in the ten least sprawling metro areas.²

In system planning and in developing implementation codes it is critical to carefully consider the unique vulnerability of pedestrians, walking distances, walking environments, and public safety. A reverse design sequence, which begins with the desired patterns of the slow modes of transport, is an efficient and cost-effective approach to take into account the interests of pedestrians, particularly the most vulnerable – the elderly and children. Additionally, attractive axes, squares, and frontages extend the length people are willing to walk³.

Street networks also influence trip route and mode choice through the way destinations are connected; high connectivity networks contain a large number of blocks and intersections per some unit of area, whereas low connectivity networks have fewer blocks and intersections over the same area. More intersections increase the ability to travel a more direct and shorter route between origin and destination, which is critical for traveling on foot as long trips are rarely taken by such mode. Moreover, increased street connectivity has been correlated with reduced vehicle miles traveled and increases in pedestrian trips⁴.

Key elements of pedestrian environment design reflected within this chapter include: 1) sidewalk design, 2) access to desired uses, 3) access for persons with disabilities, 4) ease of street crossing, 5) manageable walking distances, 6) scale, 7) security, 8) visual interest, 9) climate, 10) noise and air quality and 11) efficient and unobtrusive parking.

¹ Mokdad, Ali H., Marks Causes of Death in the United States, 2000. *JAMA*, March 10, 2004; 291: 1238-1245., James S., Donna F., and Julie L. Gerberding.

² Ewing, R., Pendall, R. Chen, D. *Measuring sprawl and its impact. Smart Growth America, 2002. Available online.* Retrieved 12-16-08.

³ Bach, B. 2006, *Urban Design and Traffic: a selection from Bach's toolbox*, CROW, Ede.

⁴ Frank L., Engelke, P. & Schmid, T. 2003, *Health and Community Design: The Impact of The Built Environment on Physical Activity*, Island Press, Washington, D.C.



IMPLICATIONS OF NOT ADDRESSING THE ISSUE

1. Continued lack of satisfying pedestrian realms and networks that promote physical activity and convenient mobility
2. Decreased accessibility to community destinations, particularly by vulnerable populations
3. Increased automobile traffic congestion
4. Increased air pollution and related health impacts caused by automobile traffic
5. Increased levels of obesity and related illnesses
6. Higher costs for transportation as a percentage of household budgets
7. High traffic noise nuisance
8. Lower quality of life
9. Lower levels of mobility for all social, economic and age groups
10. Increased congestion and trip travel time
11. Higher municipal costs related to road and parking facilities for automobiles
12. Continued high traffic mortality and injury rates, particularly for pedestrians

GOALS

Eliminate obstacles, create incentives and enact standards to achieve the following:

1. Increase mobility choices, thereby enhancing social equity
2. Enhance public safety, particularly for pedestrians
3. Increase municipal cost savings for infrastructure construction and maintenance
4. Increase household cost savings for transportation expenses
5. Reduce per capita vehicle miles traveled (VMT)
6. Make cycling more advantageous than traveling by automobile in terms of convenience, comfort and time spent traveling
7. Improve public health through increased physical activity
8. Enhance cycling education in a comprehensive, sustained, age appropriate manner
9. Promote the supportive goal of high density, multiple destination centers

SUSTAINABILITY MEASURES

1. Increased modal share for pedestrian travel
2. 80% of all facilities contained in pedestrian networks function at Level of Service C or better.
3. Reduction in mortality and injury rates for cyclists and pedestrians
4. Decreased per capita spending over time for mobility
5. Reduction in per capita vehicle miles traveled
6. Decrease in obesity levels
7. Decreased congestion
8. Decreased air pollution—including carbon emissions




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KEY STATISTICS:

1. More than 90% of trips in the USA take place by automobile
2. Walking is used for less than 10% of all trips in the United States; the bicycle for less than 1%⁵
3. Motor vehicle traffic accidents are the number one leading cause of unintentional injury deaths for all age groups between 1 and 64⁶
4. Two-thirds of adults are either overweight or obese⁷
5. Childhood obesity rates have tripled since 1980 (6.5% to 16.3%)⁸
6. More than a quarter of trips are “walkable” (27% of trips take place within one mile and 14% take place within a half mile of home)



		ACHIEVEMENT LEVELS			References/Commentary	Code Examples/Citations
		Bronze (Good)	Silver (Better)	Gold (Best)		
 <p>Car free city center, Delft, NL. 13th Century “Oude Kerk” in the background.</p>	Remove Obstacles	<ul style="list-style-type: none"> ▪ Allow visual contact through coherent way-finding, unhindered views, interesting views, adequate lighting ▪ Allow for physical activity such as skateboarding and in-line skating in appropriate locations ▪ Allow for temporary or seasonal activities such as markets, skating, festivals, and exhibitions ▪ Adjust anti-loitering laws to allow for activities such as resting, meeting, and general “hanging out” ▪ Limit auto-oriented uses such as service stations and light industrial within identified pedestrian precincts ▪ Traffic calming measures (see Complete Streets chapter): <ul style="list-style-type: none"> ○ On street parking 	<ul style="list-style-type: none"> ▪ Expand lawful business opening hours to allow for a variety of functions throughout the day, evening, and night ▪ Allow for outdoor public and café seating ▪ Eliminate single or limited use zones in neighborhood, community and town centers ▪ Eliminate or reduce the number of one way streets that serve primarily as thoroughfares ▪ Restrict the size of building footprints ▪ Restrict parking along the street frontage of a development ▪ Traffic calming measures (see Complete Streets chapter) <ul style="list-style-type: none"> ○ Bulb-outs ○ Pedestrian medians ○ Traffic diverters ○ Chicanes 	<ul style="list-style-type: none"> ▪ For streets in the urban core shift priority from cars to cyclists and pedestrians ▪ Eliminate or amend regulations that fail to dimension buildings and spaces in recognition of the important human dimensions related to sense, movements, size and behavior ▪ Restrict parking in the immediate vicinity of major transit stations ▪ Traffic calming measures (see Complete Streets chapter) <ul style="list-style-type: none"> ○ Reduce speed limits for motorized traffic ○ Use “road diet” techniques to reduce the number and width of road lanes devoted to the automobile ○ Speed tables and raised intersections ○ Traffic calming circles ○ Roundabouts 	<ul style="list-style-type: none"> ▪ San Diego Regional Planning Agency (SANDAG). <i>Planning and Designing for Pedestrians, Model Guidelines for the San Diego Region</i>. online. Includes an excellent overview of ADA requirements. ▪ Jacobs, Jane. (1961). <i>The Death and Life of Great American Cities</i> (1961). New York: Random House ▪ Project for Public Spaces. online. Retrieved 2-10-09. ▪ Rosales, Jennifer. <i>Parsons Brinckerhoff. Road Diet Handbook: Setting Trends for Livable Streets Summary</i>. online. Retrieved 2-10-09. 	<p>All achievement levels</p> <ul style="list-style-type: none"> • City of Rotterdam: “Linked City: Vision for Public Space in Downtown Rotterdam” (2007). <i>Note subsection “Inner Core of the Plan,” and its emphasis on life between the buildings, park-n-walk garages, and strategies to encourage staying downtown.</i> online. Retrieved December 16, 2008. <i>Note: this approved bill has the force of law in a manner similar to by-laws in Canada and ordinances in the United States</i> <p>Bronze</p> <ul style="list-style-type: none"> ▪ Town of Breckenridge, CO. Amendment to the Model Traffic Code of Colorado to permit skateboards on most town streets. Council Bill 36. online. Retrieved 2-9-10.

⁵ U.S. Department of Transportation, Bureau of Transportation Statistics, Federal Highway Administration, 2001 National Household Travel Survey, January 2004 dataset, available at <http://www.nhts.ornl.gov/2001/index.shtml>, as of June 2004.



⁶ National Vital Statistics System, National Center for Health Statistics, Centers for Disease Control.

⁷ Behavioral Risk Factor Surveillance System (BRFSS), Centers for Disease Control.

⁸ Ibid.


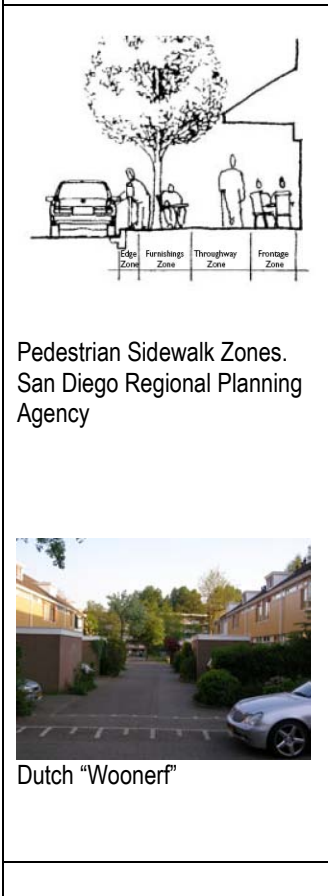
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		Bronze (Good)	Silver (Better)	Gold (Best)	References/Commentary	Code Examples/Citations
 <p>Pedestrian refuge island</p>	<p>Remove Obstacles (con't.)</p>				<ul style="list-style-type: none"> City of Rotterdam. <i>Spatial Development Strategy 2030: Rotterdam Urban Vision (2007)</i>. In particular, note sections on "Attractive residential city," and "International City on the river." Plan proposes increasing urban density by adding 56,000 dwelling units in inner city sites. online. Retrieved December 16, 2008. Beatley, Timothy (2000) <i>Green Urbanism: Learning From European Cities</i>. Island Press. This outstanding resource highlights the significant steps taken in many European cities to restrict automobiles and create attractive walking environments for citizens. For example, in most Dutch cities, major portions of the central shopping areas are pedestrian-only. What has been coined as the "permeability" of places can be seen in Dutch cities such as Delft, where there is a dense network of streets, providing a great variety of routes and a diversity of sights and sounds for pedestrians and bicyclists. 	<p>Silver</p> <ul style="list-style-type: none"> Town of Skaneateles, NY. <i>Town Development Code, Section 148-26(M). Shopping Centers</i>. Limits building footprint to 45,000 square feet. Available online. Retrieved 3-31-09.
		 <p>One of many pedestrian streets in Munich, Germany</p>				
		Bronze (Good)	Silver (Better)	Gold (Best)	References/Commentary	Code Examples/Citations



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 <p>Outdoor dining. 16th Street Mall, Denver, Colorado</p>	<p>Create Incentives</p>	<ul style="list-style-type: none"> Density bonuses for well designed pedestrian focused amenities. 	<ul style="list-style-type: none"> Flexible park land and open space dedication requirements that recognize amenities suitable to urban environments: For example: <ul style="list-style-type: none"> Include high quality design aesthetics; views; and trees, plants, and water features in meeting standards for parks and public spaces. 	<ul style="list-style-type: none"> Flexible park land and open space dedication requirements that recognize amenities suitable to urban environments: For example: <ul style="list-style-type: none"> Include positive responses to climate considerations in the evaluation and/or standards for meeting parks and public space requirements. For example, the use of shade for sun, protection from wind, shelter from rain, natural ventilation for cooling 	<ul style="list-style-type: none"> Duerksen, Christopher J. and Van Hemert, James (2003). <i>True West</i>. APA Press. This book contains many examples of contextually appropriate approaches to creating comfortable urban environments for pedestrians, notably with respect to regional climate. 	<p>Bronze</p> <ul style="list-style-type: none"> Toronto, Ontario. Under the provision of Section 37 of Ontario's Planning Act the City of Toronto routinely exchanges increased density to fund bus shelters, nature trails, streetscape improvements public art, and park improvements. See <i>Section 37 Benefits</i> in the example by-law online. Retrieved 3-31-09. <p>Silver</p> <ul style="list-style-type: none"> Flexible park land standards. Note: search for examples still underway <p>Gold</p> <ul style="list-style-type: none"> Forthcoming
 <p>Pedestrian Sidewalk Zones. San Diego Regional Planning Agency</p> <p>Dutch "Woonerf"</p>	<p>Enact Standards</p>	<ul style="list-style-type: none"> Establish sidewalk zones that include edge, furnishings, throughfare and frontage zones. Require minimum adequate sidewalk sections for different contexts: <ul style="list-style-type: none"> Min. 11' for residential (6' furnishing, 5" throughway) Min. 14" for low intensity mixed use (3' furnishing, 4' throughway, 3' for edge and frontage) Require direct accessibility to all primary entrances and activity areas. Require fine-grained detail in architectural and urban form Require adequate lighting—SANDAG recommends minimum 2.0 f/c for most pedestrian environments, 5 f/c for transit platforms Require defined spots for staying. Provide objects such as planters, monuments, public art, etc., to lean against or stand next to 	<ul style="list-style-type: none"> Require quality textured surfaces such as cobble, brick, pavers Require public art for large projects To protect pedestrians against moving vehicular traffic require on street parking, limit driveway access points, and require sensitive siting of parking facilities Require safe landscaping without hidden areas and security cameras Require a variety of alternative pedestrian routes For larger projects require an area with low ambient noise levels and public seating arrangements conducive to hearing and talking Enact design standards that encourage maximizing advantages of public space such as pleasant views and opportunities for people watching 	<ul style="list-style-type: none"> Require pedestrian linkage with other public spaces in the vicinity in order to develop an attractive network Require mid-block pedestrian crossings in high traffic, destination rich areas (See Complete Streets chapter) Require broad sidewalks in designated areas Establish traffic calming standards for town and city centers Require or permit investment in a "Park and Walk" System (European concept of parking lots within ½ to 2.5 km from major destinations). In lieu of meeting individual off street parking requirements (See <i>Parking chapter</i>) 	<ul style="list-style-type: none"> Gehl, Jan and Gemzoe, Lars (2004). <i>Public Spaces Public Life Copenhagen</i>. Danish Architectural Press. Book discusses protection of pedestrians against crime & violence by incorporating well lit areas, allowing for passive surveillance, and overlapping functions in space in time as well as landscaping without hidden areas and having security cameras. Protection from traffic noise, fumes and noise impacts also discussed. City of Rotterdam's Park and Walk system is designed to discourage automobile traffic inside the city center and encourage pedestrian activity. Locations permit reaching main destinations within 10 minutes and are linked with transit. 	<p>All achievement levels</p> <ul style="list-style-type: none"> City of Rotterdam: "Linked City: Vision for Public Space in Downtown Rotterdam" (2007). <i>In particular note subsections "Headline of the Town Plan," "Traffic" and "Culture."</i> online. Retrieved December 18, 2008. City of Rotterdam: "Spatial Development Strategy 2030: Rotterdam Urban Vision" (2007). online. Retrieved December 16, 2008. <p>Bronze</p> <ul style="list-style-type: none"> San Diego Regional Planning Agency (SANDAG). <i>Planning and Designing for Pedestrians, Model Guidelines for the San Diego Region</i>. online. Retrieved 3-31-09.. See section on sidewalk zones and standards as well as section on l.
		<p>Bronze (Good)</p>	<p>Silver (Better)</p>	<p>Gold (Best)</p>	<p>References/Commentary</p>	<p>Code Examples/Citations</p>

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 <p>Denver's beloved public art "blue bear" at the Colorado Convention Center</p>  <p>Cobbled sidewalk, Prague, Czech Republic</p>	<p>Enact Standards (con't.)</p>	<ul style="list-style-type: none"> ▪ Provide standards for attractive entrances to public spaces ▪ Require street furniture ▪ Require extra protection from unpleasant climatic conditions relating to <i>heat, rain and sunshine</i>—awnings and colonnades, for example ▪ Require safe and visible pedestrian street crossings (<i>See Complete Streets chapter</i>) <ul style="list-style-type: none"> • Pedestrian activated warning lights • Refuge islands ▪ Require continuity in the design of the street profile (<i>See Complete Streets chapter</i>) ▪ Meet all ADA standards for accessibility ▪ Reduced street curve radii ▪ Establish preferred pedestrian access through parking lots ▪ Parking lot landscape screening ▪ Straight line connection between primary entrance and street ▪ Require identifiable distinctions where system crosses parking, loading and driveways: elevation, speed bumps, distinct paving material 	<ul style="list-style-type: none"> ▪ Require extra protection from unpleasant climatic conditions relating to <i>wind and glare</i>. Methods for wind include homogenous building heights to prevent the wind from reaching the streets and squares, careful siting of entries and streets, street trees and canopy walkways. Reducing glare through careful analysis during site design. ▪ Establish standards and zones for outdoor seating areas, including material selections for benches and chairs. Include resting opportunities such as benches in the evaluation and/or standards for required parks and public space ▪ Require sufficient density of employees, residents and recreational users to support non-vehicular modes of travel (<i>see Urban Form chapter</i>) ▪ Require direct or 45 degree main entrance for nonresidential buildings on transit streets ▪ Street facing facades with minimum percentage doors and windows ▪ Maximum garage wall facing street standards 	<ul style="list-style-type: none"> ▪ Increase the proportion of "green time" for pedestrians relative to motorized traffic at signalized crossings ▪ Require a continuing tree structure, a spatial design that incorporates city streets passing through a row of trees 		<ul style="list-style-type: none"> ▪ City of Portland, OR. <i>Portland Zoning Code. Sec.33.130.240</i>. Primary entrance connection to street. And identifiable distinctions for system crossings. online. Retrieved 4-1-09. <p>Silver</p> <ul style="list-style-type: none"> • City of Denver, CO. Public art requirements—Denver Revised Municipal Code [DRMC] 20-85, et seq. ▪ City of Seattle, WA. <i>Seattle Rights of Way Improvement Manual, Chapter 4 Design Criteria</i>. online. Retrieved 3-31-09. Includes street furniture and special objects standards. ▪ City of Santa Fe, NM. <i>Land Development Code, Section 14.5.1 A Historic Districts</i>. online. Retrieved 3-31-09. Climate adaptation through the use of a portal, characteristic of old Santa Fe style commercial buildings covering the entire sidewalk, the columns being set at the curb line. • City of Portland, OR. <i>Portland Zoning Code Sec Code Sec. 33-130-242</i>. Nonresidential building entrances on transit streets. online. Retrieved 4-1-09. • City of Portland, OR. <i>Portland Zoning Code Sec. 33-130-250</i>. Street facing facades and garage wall standards. . online. Retrieved 4-1-09.
		<p>Bronze (Good)</p>	<p>Silver (Better)</p>	<p>Gold (Best)</p>	<p>References/Commentary</p>	<p>Code Examples/Citations</p> <ul style="list-style-type: none"> • City of Denver, CO. <i>Municipal Code</i>.
	<p>Enact</p>					

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	Standards (con't.)					<p><i>Chapter 59, Article IV. Restrictions On Structures Within Areas Necessary To Preserve Mountain Views. online. Retrieved 3-31-09.</i></p> <ul style="list-style-type: none"> • City of San Francisco, CA. <i>Planning Code, sec. 263.11. Special Height Exceptions: South Of Market RSD 40-X/85-B Height District.</i> Establishes wind comfort criteria: 7 mph equivalent for public sitting areas and 11 mph for pedestrian activity. online. Retrieved 3-31-09. <p>Gold</p> <ul style="list-style-type: none"> • Research on pedestrian linkage requirements underway
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Strategic Success Factors (supportive policy and programs)

Successful outcomes require that regulatory tools be grounded in solid comprehensive policy planning and accompanied by competent administration and supportive programs.

PLANNING POLICY

Develop a pedestrian plan or element in a transportation or mobility plan

PROGRAMS & ADMINISTRATION

- Create opportunities for people to interact in the public realm. For example, create 24 hour precincts where activities overlap through the day, week, and year, inviting many different user groups to enjoy the area.
- Develop a "Traffic-Winding Off" system to cut-off through traffic in city center. Such a system cuts off through movement of motorized traffic in the city and provides connections only for slow traffic and public transport on city streets in order to dedicate more and better space to pedestrians at the expense of the automobile.

- Establish car-free zones.
- Establish a neighborhood "woonerf" type program for streets
- Establish a "safe routes to school" program

APPENDIX:

Pedestrian Measure Guidelines Matrix (left) and Elements of a Pedestrian Friendly Intersection (right) ⁹

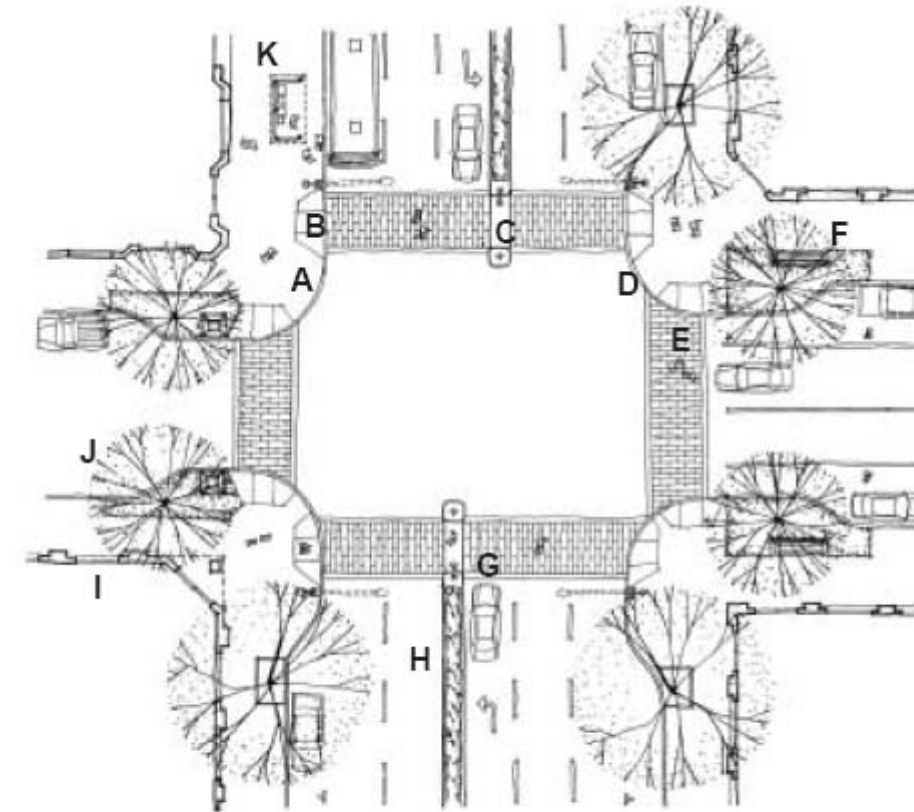
	Residential	Residential	Residential	Main	Commercial	Minor	Arterials	Major
	< 1,200	1,200-2,000	2-5,000	Street/CBD	>2 lanes	Arterials	Arterials	Arterials
Volume (vehicles per day)	< 1,200	1,200-2,000	2-5,000	<10,000	7-15,000	10-15,000	15-20,000	>20,000
Typical speeds (mph)	15-25	25	25-30	25-30	30-35	30-35	35-40	35-45
Special Xwalk Markings								
Overhead Signage								
Bulbouts								*
Colored/Textured Xwalks							*	
Midblock Crossings								
Refuge Islands								
Staggered Crosswalk								
Pedestrian Corral								
In-Pavement Lights								
Roundabouts								
Speed Tables								
Traffic Circles								
Diverters								
Chicanes								
Overpass/Underpass								

* Possibly appropriate where arterial serves as a community's "Main Street."

Table Key

Most appropriate	Moderately Appropriate	May be appropriate with mitigating circumstances

Table 4.1. Pedestrian Measure Guidelines Matrix



- A. Pedestrian bulb-outs
- B. Wheelchair access ramps
- C. Pedestrian refuge islands
- D. Curb radii no greater than 15'
- E. Special paving in crosswalks
- F. Benches and other amenities
- G. Pedestrian-scale lighting
- H. 10'6" travel lanes
- I. Building articulation
- J. Street trees
- K. Accessible transit stops

PLANNING AND DESIGNING FOR PEDESTRIANS

⁹ San Diego Regional Planning Agency (SANDAG). *Planning and Designing for Pedestrians, Model Guidelines for the San Diego Region*. Available online. Retrieved 3-31-09