Pedestrian Mobility Systems

INTRODUCTION
Much can be learned from European cities about pedestrian mobility. In Europe, conscious land use decisions are made to keep civic and municipal functions in the city center, create highly attractive environments, and provide housing around these areas. Additionally, Europeans have been pedestrianizing parts of their city centers and contributing to the attractiveness of the areas, thereby 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.\(^1\)

Furthermore, the average annual traffic death rate is fifty percent higher in the top ten most sprawling metro areas than in the ten least sprawling metro areas.\(^2\)

In system planning and developing implementation codes, it is critical to carefully consider the vulnerability of pedestrians, walking distances and 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 that takes into account the interests of pedestrians, particularly the most vulnerable, the elderly and children. Additionally, attractive crossings, squares, and frontages extend the distance and time that pedestrians are willing to walk.\(^3\)

Street networks also influence trip route and mode selection depending on the way destinations are connected. High connectivity networks contain a large number of blocks and intersections per unit of area, whereas low connectivity networks have fewer blocks and intersections over the same area. Frequent intersections increase the ability to travel a shorter and more direct route between origin and destination. This is critical to foot travel because it increases the number of trips taken on foot. Moreover, increased street connectivity has been positively correlated with reductions in miles travelled by vehicle and increased pedestrian trips.\(^4\)

Key elements of pedestrian environment design reflected within this chapter include sidewalk design, access to desired uses, access for persons with disabilities, ease of street crossing, managing walking distances, scale, security, visual interest, climate, noise, air quality and efficient and unobtrusive parking.


IMPLICATIONS OF NOT ADDRESSING THE ISSUE
- Continued lack of satisfying pedestrian realms and networks that promote physical activity and convenient mobility
- Increased air pollution and related health impacts caused by automobile traffic
- Increased levels of obesity and related illnesses
- Higher costs for transportation as a percentage of household budgets
- High traffic noise nuisance
- Lower quality of life
- Lower levels of mobility for all social, economic and age groups
- Increased congestion and trip travel time
- Higher municipal costs related to road and parking facilities for automobiles
- Continued high traffic mortality and injury rates, particularly for pedestrians

GOALS
Eliminate obstacles, create incentives and enact standards to achieve the following:
- Increase mobility choices, thereby enhancing social equity
- Enhance public safety, particularly for pedestrians
- Increase municipal cost savings for infrastructure construction and maintenance
- Increase household cost savings for transportation expenses
- Reduce per capita vehicle miles traveled (VMT)
- Make cycling more advantageous than traveling by automobile in terms of convenience, comfort and time spent traveling
- Improve public health through increased physical activity
- Enhance cycling education in a comprehensive, sustained, age appropriate manner
- Promote the supportive goal of high density, multiple destination centers

POTENTIAL SUSTAINABILITY MEASURES
- Increased modal share for pedestrian travel
- 80% of all facilities contained in pedestrian networks function at Level of Service C or better
- Reduction in mortality and injury rates for cyclists and pedestrians
- Decreased per capita spending over time for mobility
- Reduction in per capita vehicle miles traveled
- Decrease in obesity levels
- Decreased congestion
- Decreased air pollution—including carbon emissions
### PEDESTRIAN MOBILITY

#### KEY STATISTICS:
- More than ninety percent of trips in the USA take place by automobile
- Walking is used for less than ten percent of all trips in the United States; the bicycle for less than one percent\(^6\)
- Motor vehicle traffic accidents are the number one leading cause of unintentional injury deaths for all age groups between 1 and 64\(^7\)
- Two-thirds of adults are either overweight or obese\(^7\)
- Childhood obesity rates have tripled since 1980 (6.5% to 16.3%)\(^8\)
- More than a quarter of trips are "walkable" (twenty-seven percent of trips take place within one mile and fourteen take place within a half mile of home)\(^8\)

#### PEDESTRIAN MOBILITY SYSTEMS

<table>
<thead>
<tr>
<th>ACHIEVEMENT LEVELS (NOTE: HIGHER LEVELS GENERALLY INCORPORATE ACTIONS OF LOWER LEVELS)</th>
<th>Bronze (Good)</th>
<th>Silver (Better)</th>
<th>Gold (Best)</th>
<th>References/Commentary</th>
<th>Code Examples/Citations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remove Obstacles</td>
<td>Allow visual contact through coherent way-finding, unhindered views, interesting views, adequate lighting</td>
<td>Expand lawful business opening hours to allow for a variety of functions throughout the day, evening, and night</td>
<td>For streets in the urban core, shift priority from cars to cyclists and pedestrians</td>
<td>San Diego Regional Planning Agency (SANDAG), Planning and Designing for Pedestrians, Model Guidelines for the San Diego Region. (Includes an excellent overview of ADA requirements), Available online, Retrieved January 11, 2011.</td>
<td>All achievement levels</td>
</tr>
<tr>
<td></td>
<td>Allow for physical activity such as skateboarding and in-line skating in appropriate locations</td>
<td>Allow for outdoor public and café seating</td>
<td>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</td>
<td>Jacobs, Jane. (1961). The Death and Life of Great American Cities (1961). New York: Random House</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Allow for temporary or seasonal activities such as markets, skateboarding, festivals, and exhibitions</td>
<td>Eliminate single or limited use zones in neighborhood, community and town centers</td>
<td>Restrict parking in the immediate vicinity of major transit stations</td>
<td>Project for Public Spaces, Available online, Retrieved January 11, 2011.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Adjust anti-loitering laws to allow for activities such as resting, meeting, and general “hanging out”</td>
<td>Eliminate or reduce the number of one-way streets that serve primarily as thoroughfares</td>
<td>Restrict parking along the street frontage of a development (see Parking Framework Section)</td>
<td>Rosales, Jennifer. Parsons Brinckerhoff, Road Diet Handbook: Setting Trends for Livable Streets Summary, Available online, Retrieved January 11, 2011.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Limit auto-oriented uses such as service stations and light industrial within identified pedestrian precincts</td>
<td>Restrict the size of building footprints</td>
<td>Traffic calming measures (see Complete Streets Framework Section)</td>
<td>bronze</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Take traffic-calming measures (see Complete Streets Framework Section): On street parking</td>
<td>Restrict parking along the street frontage of a development (see Parking Framework Section)</td>
<td>Reduce speed limits for motorized traffic</td>
<td>bronze</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Bulb-outs</td>
<td>- Pedestrian medians</td>
<td>Use “road diet” techniques to reduce the number and width of road lanes devoted to the automobile</td>
<td>bronze</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Pedestrian medians</td>
<td>- Traffic diverters</td>
<td>- Speed tables and raised intersections</td>
<td>bronze</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Traffic calming circles</td>
<td>- Roundabouts</td>
<td>- Traffic calming circles</td>
<td>bronze</td>
<td></td>
</tr>
</tbody>
</table>

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\(^7\) National Vital Statistics System, National Center for Health Statistics, Centers for Disease Control.

\(^6\) Behavioral Risk Factor Surveillance System (BRFSS), Centers for Disease Control.

\(^8\) Ibid.
## PEDESTRIAN MOBILITY SYSTEMS

<table>
<thead>
<tr>
<th>Remove Obstacles (cont')</th>
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</table>

Bronze (Good) | Silver (Better) | Gold (Best) | References/Commentary | Code Examples/Citations |
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</tr>
</tbody>
</table>

- **Bronze (Good)**
  - Remove Obstacles
  - Pedestrian refuge island
  - One of many pedestrian streets in Munich, Germany

- **Silver (Better)**
  - Beatley, Timothy (2000) Green Urbanism: Learning From European Cities. 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.

- **Gold (Best)**
  - City of Santa Fe, NM, Land Development Code, Section 14.5.1 A Historic Districts. Process to approve “Walk Areas” on streets or portions of streets and restrict automobile traffic. [Available online, Retrieved January 11, 2011.](#)
  - City of Seattle, WA, Municipal Code Neighborhood Commercial Zones 23.34.060 Pedestrian designation. Limits street level uses to pedestrian oriented uses such as retail, entertainment, restaurants and personal services. Drive-in or drive-thru businesses are prohibited. [Available online, Retrieved January 11, 2011.](#)
  - SmartCode Central, SmartCode Version 9.2,Section 6, Table 4A—Public Frontages—general and Table 4A—specific, Table 7 Private Frontages, Table 13 Civic Space. [Available online, Retrieved January 11, 2011.](#)
  - City of Denver, CO, Municipal Code, Chapter 59, Article IV, Division 15, Sec. 59-316. Off-street parking requirements. Reduction in off street parking requirements within mixed use districts of up to 50% for developments within a quarter mile of rail transit station or within a 10 minute regional or urban bus corridor. [Available online, Retrieved January 11, 2011.](#)
### DRAFT Sustainable Community Development Code Framework

#### PEDESTRIAN MOBILITY SYSTEMS

<table>
<thead>
<tr>
<th>Bronze (Good)</th>
<th>Silver (Better)</th>
<th>Gold (Best)</th>
<th>References/Commentary</th>
<th>Code Examples/Citations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Create Incentives</td>
<td>- Implement density bonuses for well-designed, pedestrian-focused amenities</td>
<td>- Create flexible park land and open space dedication requirements that recognize amenities suitable to urban environments:</td>
<td>- Implement flexible park land and open space dedication requirements that recognize amenities suitable to urban environments:</td>
<td>- Duerksen, Christopher J. and Van Hemert, James (2003). True West. APA Press. This book contains many examples of contextually appropriate approaches to creating comfortable urban environments for pedestrians, notably with respect to regional climate.</td>
</tr>
<tr>
<td>Outdoor dining, 16th Street Mall, Denver, Colorado</td>
<td>- Min. 11' for residential (6' furnishing, 5' throughway)</td>
<td>- Min. 14' for low intensity mixed use (3' furnishing, 4' throughway, 3' for edge and frontage)</td>
<td>- Require safe landscaping without hidden areas and security cameras</td>
<td>Bronze: - Toronto, Ontario. Under the provison 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 Section 37 Benefits in the example by-law. <a href="#">Available online</a>. Retrieved January 11, 2011.</td>
</tr>
<tr>
<td>Enact Standards</td>
<td>- Establish sidewalk zones that include edge, furnishings, throughfare and frontage zones</td>
<td>- Require direct accessibility to all primary entrances and activity areas</td>
<td>- Require quality textured surfaces such as cobble, brick, pavers</td>
<td>Silver</td>
</tr>
<tr>
<td>Pedestrian Sidewalk Zones. San Diego Regional Planning Agency</td>
<td>- Require minimum adequate sidewalk sections for different contexts:</td>
<td>- Require fine-grained detail in architectural and urban form</td>
<td>- Require public art for large projects</td>
<td>Gold</td>
</tr>
<tr>
<td>Dutch “Woonerf”</td>
<td>- Min. 11' for residential (6' furnishing, 5' throughway)</td>
<td>- Require a variety of alternative pedestrian routes</td>
<td>- To protect pedestrians against moving vehicular traffic require on street parking, limit driveway access points, and require sensitive siting of parking facilities</td>
<td>All achievement levels</td>
</tr>
<tr>
<td>- Require adequate lighting—SANDAG recommends minimum 2.0 ftc for most pedestrian environments, 6 ftc for transit platforms</td>
<td>- Require quality textured surfaces such as cobble, brick, pavers</td>
<td>- Require mid-block pedestrian crossings in high traffic, destination rich areas (See Complete Streets Framework Section)</td>
<td>- Gehl, Jan and Gemzoe, Lars (2004). Public Spaces Public Life Copenhagen, Danish Architectural Press. Book discusses protection of pedestrians against crime &amp; 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.</td>
<td>- 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.</td>
</tr>
<tr>
<td>- Require defined spots for staying. Provide objects such as planters, monuments, and public art to lean against or stand next to</td>
<td>- Require pedestrian linkage with other public spaces in the vicinity in order to develop an attractive network</td>
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<td>- Gehl, Jan and Gemzoe, Lars (2004). Public Spaces Public Life Copenhagen, Danish Architectural Press. Book discusses protection of pedestrians against crime &amp; 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.</td>
<td>- San Diego Regional Planning Agency (SANDAG), Planning and Designing for Pedestrians, Model Guidelines for the San Diego Region, <a href="#">Available online</a>. Retrieved January 11, 2011.</td>
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2. Gehl, Jan and Gemzoe, Lars (2004). Public Spaces Public Life Copenhagen, 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.

*Silver:* Flexible park land standards. Note: search for examples still underway.

*Gold:* (Forthcoming)
## PEDESTRIAN MOBILITY SYSTEMS

<table>
<thead>
<tr>
<th>Enact Standards (con’t.)</th>
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<th>Gold (Best)</th>
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<tbody>
<tr>
<td>▪ Provide standards for attractive entrances to public spaces</td>
<td>▪ Require street furniture</td>
<td>▪ Increase the proportion of &quot;green time&quot; for pedestrians relative to motorized traffic at signalized crossings</td>
<td></td>
<td></td>
<td>▪ City of Portland, OR, Portland Zoning Code Sec.33.130.240. Primary entrance connection to street. And identifiable distinctions for system crossings. Available online. Retrieved January 11, 2011.</td>
</tr>
<tr>
<td>▪ Require extra protection from unpleasant climatic conditions relating to wind and glare (See Visual Elements Framework Section) including homogenous building heights to prevent the wind from reaching the streets and squares, careful siting of entries and streets, street trees and canopy walkways</td>
<td>▪ Require extra protection from unpleasant climatic conditions relating to wind and glare (See Visual Elements Framework Section) including homogenous building heights to prevent the wind from reaching the streets and squares, careful siting of entries and streets, street trees and canopy walkways</td>
<td>▪ Require a continuing tree structure (a spatial design that incorporates city streets passing through a row of trees)</td>
<td></td>
<td></td>
<td>▪ City of Denver, CO, Public art requirements, Denver Revised Municipal Code [DRMC] 20-85, et seq. Program information and statutory comments. Available online. Retrieved January 11, 2011.</td>
</tr>
<tr>
<td>▪ Require safe and visible pedestrian street crossings (See Complete Streets Framework Section)</td>
<td>▪ Reduce glare through careful analysis during site design</td>
<td>▪ Reduce glare through careful analysis during site design</td>
<td></td>
<td></td>
<td>▪ City of Seattle, WA, Seattle Rights of Way Improvement Manual, Chapter 4 Design Criteria. (includes street furniture and special objects standards) Available online. Retrieved January 11, 2011.</td>
</tr>
<tr>
<td>▪ Establish preferred pedestrian access through parking lots (See Parking Framework Section)</td>
<td>▪ Establish standards and zones for outdoor seating areas, including material selections for benches and chairs</td>
<td>▪ Establish standards and zones for outdoor seating areas, including material selections for benches and chairs</td>
<td></td>
<td></td>
<td>▪ City of Santa Fe, NM, Land Development Code, Section 14.5.1 A Historic Districts. 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. Available online. Retrieved January 11, 2011.</td>
</tr>
<tr>
<td>▪ Meet all ADA standards for accessibility</td>
<td>▪ Include resting opportunities such as benches in the evaluation and/or standards for required parks and public space</td>
<td>▪ Include resting opportunities such as benches in the evaluation and/or standards for required parks and public space</td>
<td></td>
<td></td>
<td>▪ City of Portland, OR, Portland Zoning Code Sec Code Sec. 33-130-242. Nonresidential building entrances on transit streets. Available online. Retrieved January 11, 2011.</td>
</tr>
<tr>
<td>▪ Reduce street curve radii</td>
<td>▪ Require sufficient density of employees, residents and recreational users to support non-vehicular modes of travel (see Urban Form Framework Section)</td>
<td>▪ Require sufficient density of employees, residents and recreational users to support non-vehicular modes of travel (see Urban Form Framework Section)</td>
<td></td>
<td></td>
<td>▪ City of Portland, OR. Portland Zoning Code Sec. 33-130-250. Street facing facades and garage wall standards. Available online. Retrieved January 11, 2011.</td>
</tr>
<tr>
<td>▪ Establish preferred pedestrian access through parking lots (See Parking Framework Section)</td>
<td>▪ Require direct or forty-five degree main entrance for nonresidential buildings on transit streets</td>
<td>▪ Require direct or forty-five degree main entrance for nonresidential buildings on transit streets</td>
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</table>
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<tr>
<td>Silver (Better)</td>
</tr>
<tr>
<td>Gold (Best)</td>
</tr>
</tbody>
</table>

### References/Commentary


### Code Examples/Citations

- Gold
- 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 pedestrian element in a larger 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

<table>
<thead>
<tr>
<th>Residential</th>
<th>Residential/C</th>
<th>Residential/Collector</th>
<th>Main Street/CBD</th>
<th>Commercial/500 Feet</th>
<th>Minor Arterial</th>
<th>Arterial</th>
<th>Major Arterial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume (vehicles per day)</td>
<td>&lt; 1,200</td>
<td>1,200-2,400</td>
<td>2,500-5,000</td>
<td>&lt;18,000</td>
<td>18,000-25,000</td>
<td>25,000-35,000</td>
<td>35,000-50,000</td>
</tr>
<tr>
<td>Total speed limits</td>
<td>15-20</td>
<td>20-30</td>
<td>35-50</td>
<td>35-45</td>
<td>45-55</td>
<td>55-65</td>
<td></td>
</tr>
</tbody>
</table>

A. Pedestrian bulb-outs
B. Wheelchair access ramps
C. Pedestrian refuge islands
D. Curb radii no greater than 16'
E. Special paving in crosswalks
F. Benches and other amenities
G. Pedestrian-scale lighting
H. 10'/8' travel lanes
I. Building articulation
J. Street trees
K. Accessible transit stops

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