

# Determination of Service Levels for Pedestrians, with European Examples

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Qualitative evaluation of pedestrian precincts is important for providing adequate facilities for the elderly, the physically challenged, and children, who are most inclined to use this mode of travel. Evaluation has been attempted by using the qualitative criteria of safety, security, comfort and convenience, continuity, system coherence, and attractiveness. After the levels of activity and use in the pedestrian environments in Munich and Rome were studied, pedestrian environments have been classified into six service levels.

Walking is often thought to be a simple behavioristic exercise that requires very little effort or experience. This is far from true. Pedestrians process large amounts of sensory input for sophisticated signal exchanges to negotiate rights of way. These sensory inputs also help pedestrians to acquire, over time, valuable knowledge on different aspects of human perception such as peripheral vision, depth perception, judgment of speed and direction, and sound recognition.

Sensory stimulation is normal for adults, who process these inputs much faster than children; however, this process does diminish with age. Besides the slowing of their reflexes, the elderly often suffer from impaired hearing, inaccurate depth perception, decreased lateral vision, and faltering learning capacity. Children receive normal sensory inputs, but owing to their short exposure to such sensory stimulants they are unable to process the information as effectively as adults; this lack of experience causes perceptual difficulties resulting in uncertain reactions when exposed to direct confrontations with traffic. Physically challenged pedestrians require more than normal sensory inputs to compensate for their disabilities; complex processing slows down their reflexes. This is especially true when they are exposed to unsafe and incoherent environments. Braun and Roddin have referred to these groups as "captive pedestrians" (1).

In light of these physiological variations among the various groups of pedestrians, the flexibility of the pedestrian as a transportation unit varies considerably. Able-bodied young and middle-aged adults can negotiate through narrow passages, climb over barriers, and overcome hazardous conditions easily. They can "twist, duck, and turn sharply, and . . . can safely extricate themselves in the last few milliseconds before impending impact" (2). But "captive pedestrians" find similar situations overwhelming and often threatening, especially when they are exposed to vehicular conflicts. Given these facts, it is important to design pedestrian environments

that are coherent and nonthreatening while being stimulating and pleasing for all kinds of pedestrians.

## SERVICE LEVEL DESIGN CRITERIA

In the past few decades the pedestrian environment has been besieged by vehicles, and transportation planners and engineers have yielded to the growing demand of space for cars. As a result, the weakest member of the transportation system—the pedestrian—has been severely inconvenienced. On most walkways, designers have ignored the human requirement for space, not only for normal locomotion, but also for visual and psychological interaction (3). This unfortunate situation is the outcome of the preoccupation of the engineers and designers with the needs of the vehicular traffic for speed and safety.

Safety accompanied by speed requires wider, smoother, and straighter roads and can become a potent combination, leaving pedestrians and cyclists vulnerable and exposed to vehicular confrontation. This overemphasis on design standards for vehicular traffic stems from the fear of liability. In the United States, roadbuilding agencies accept certain responsibilities for vehicular safety, and design standards help to absolve them from legal battles with road users. These liability issues first surfaced in the late 1950s when motorists injured in accidents sued the roadbuilders, claiming inadequate design or improper construction. Unfortunately, similar issues have not been raised by pedestrians who have been severely inconvenienced by inadequate and hazardous conditions (4).

Historically, sidewalks have been the most unregulated part of street rights of way. They are narrow, unevenly surfaced, often in total disrepair, and encroached on by haphazardly placed miscellaneous activities such as convenience stands, gas pumps, cafes, and vending machines. In contrast, every effort has been made to protect the right of way for vehicular traffic and to enhance the comfort and convenience of drivers—allowing right turns on red, wide service and arterial roads, more than adequate turning radii at intersections, shorter red signal phase in the cycle time, and drive-in facilities, to mention a few.

## IDEAL PEDESTRIAN ENVIRONMENT

An "ideal" environment would be one where many activities could occur simultaneously without conflicts among users (cyclists, drivers, and pedestrians). There is perfect syno-

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morphism (fitness) between the designed environment and its proposed purpose without spatial interference between activities. In addition to absence of conflicts, the success and failure of the design also depends on the level and the type of use. Insufficient or improper use of the pedestrian facilities is as much of a dysfunction as designed environments with spatial interferences. From this discussion, the success of any pedestrian design can be said to depend on three criteria:

1. *User-friendly environments should offer amenities for various pedestrian groups.* Visual qualities convey powerful emotional messages as to what mode dominates the street scape, and every effort should be made to make it user-friendly for both vehicular and pedestrian traffic. In addition, designers should try to cater to the needs of a pedestrian as a vehicular unit, and to do so they should borrow the functional elements of strip commercial development and introduce them after modification in pedestrian environments. There should also be excellent intermodal connectivity where pedestrians can switch from one mode to the other without much discomfort or inconvenience.

2. *Pedestrian environments should be unique and must blend with the architectural vocabulary of the area.* Standard designs are successful on macro scale when designing for vehicular traffic, but they could be recipes for failure if used in pedestrian environments. Monotonous functional designs of the sidewalk do not help in creating distinct images. Lynch has written about the importance of the “visual quality” or “legibility” of the cityscape—easily identifiable districts and landmarks organized in a coherent pattern in a city (5). The same concept applies equally in pedestrian environments. The “legibility” of the surroundings enhances the quality of the pedestrian environments, and the users are offered a plethora of visual stimulation that helps them to create distinct images.

3. *Visually stimulating and exciting environments should capture the spirit of the people and the city.* Pedestrian precincts should be able to provide vignettes of the city, offering users and observers a glimpse of the urban environment. Stimulating environments add character and richness to the streetscape, providing the right ambience for a diversity of activities. The success of the design depends on the perception of the environment, and designers should focus on ways of incorporating excitement and fun in their design while placing the functional elements on the walkways.

To fulfill these three criteria, designers must ensure safety, security, convenience and comfort, continuity, system coherence, and the visual and psychological attractiveness of the environs (3). These six qualitative indexes were mentioned by Fruin in *Pedestrian—Planning and Design* and have been used in this paper to develop six service levels.

Vuchic used the term “service quality” as one of the factors that determines the level of service. He defined level of service as the basic element that attracts potential users to the system, and service quality as qualitative elements of service for transit usage (6). The same concept is used to define the six service levels for pedestrian usage.

To demonstrate these levels through illustrations, this paper has drawn on examples from different types of walkways that are operational in Munich, Germany, and Rome, Italy. The pedestrians precincts in both cities are used extensively

by commuters, tourists, and local residents and provide good examples of pleasant and unpleasant pedestrian environments.

## SERVICE LEVEL DESCRIPTIONS FOR WALKWAYS

### Service Level A

In Service Level A, the right of way is exclusively for the pedestrians; bicycles may be allowed only when pedestrian areas also encompass roads more than 20 ft wide (Figure 1). There is complete space separation between motorized and nonmotorized transport, eliminating pedestrian-vehicular conflict. The pedestrian network is well-connected, coherent, and comfortable for both able-bodied and captive users.

The built environment is designed and regulated to support diverse human activities and aesthetic experiences. The best way of identifying such environments is by studying the diversity in user activities and the diversity in users.

### Safety

There is complete space separation between vehicles and pedestrians in Level A. Bicycles are allowed only when the pedestrian zones also enclose roads more than 20 ft wide, but cyclists are forewarned through prominent signs that pedestrians have first preference. There is no pedestrian-vehicular conflict in such an environment, making it especially safe for physically challenged users.

### Security

The security of the pedestrian environment is ensured by the presence of people and police cars. The threat of being caught with very few avenues of escape discourages petty crimes.



**FIGURE 1** Service Level A: Marienplatz, Munich—U-bahn and S-bahn stations in pedestrian mall are easily accessed by elevators, enhancing the mall’s attractiveness among captive pedestrians.

### *Convenience and Comfort*

The modification in traffic circulation in Service Level A facilitates free pedestrian movement. Large stretches of effective walkway are free from obstacles for easy movement. Ramped curb cuts are provided wherever they are necessary for those who need such assistance.

Underground transit is easily accessible by elevators and escalators. Ticket vending machines and transit information are conveniently located to facilitate the use of transit. Other features that enhance the quality of the environment are the presence of telephone booths, drinking fountains, chairs and benches, and easily accessible public restrooms.

These precincts offer sanctuary from street level noises and air pollution. Pollution-sensitive uses (sitting areas and outdoor cafes) and users (children, elderly, and people with health problems) are protected in such environments. Because the atmosphere is free of vehicular intrusion, the urban ambient sound level varies between 40 and 50 dba.

### *Continuity*

The pedestrian corridor and the major public open spaces appear as a single entity. There are continuous stretches of either space- or time-separated, well-landscaped pedestrian networks connecting historic districts and other places of interests with the shopping areas.

### *System Coherence*

There is excellent connectivity and system coherence brought about by full utilization of the urban space. Streets, transit facilities, shopping areas, and historic buildings are easily distinguishable by their clear visual statements, eliminating the need for constant visual or tactile orientation, and allowing pedestrians to enjoy the sights and sounds about them.

### *Attractiveness*

The pedestrian environment is aesthetically designed and visually pleasing. Street events such as an amateur art sale or acrobatics, and flower shows add vitality to the environment. There is a combination of scale, color, shape, street character, and view to convey the positive visual attributes of the environment.

### **Service Level B**

The right of way in Service Level B is shared by motorized and nonmotorized transportation through physical separation to avoid conflict. Walk widths are more than adequate and free of impediments. The sidewalks are complemented by well-designed components for visual and psychological enjoyment, and special attention is given to the needs of captive pedestrians.

The composition in the streetscape design affords a variety of options to the potential users. The landscaping and distance



**FIGURE 2 Service Level B: Schwabing area on Leopoldstrasse, Munich—effective walkway is wide and uncluttered; ancillary walkway is tastefully landscaped, protecting pedestrians from air and noise pollution while accentuating space separation between pedestrians and cyclists.**

from the vehicular traffic (10 to 15 ft) reduces the noise level to 55 to 65 dba (Figure 2), and the layered arrangement of plants along the broad sidewalks filters the particulate pollutants.

The best way of identifying such environments is by studying the diversity in user activities, and the level of usage by the captive groups.

### *Safety*

Either horizontal or vertical separation among the modes exists to avoid bimodal conflict. Horizontal separation between pedestrians and bicycles or between pedestrians and vehicles may be further pronounced through landscaping, making it even safer for captive users.

### *Security*

The street and sidewalk configurations allow vigilance by pedestrians and patrolling police cars. High lighting levels and unobstructed lines of sight offer very little concealment, thereby reducing the risk of criminal activities.

### *Convenience and Comfort*

The grade-separated pedestrian network with considerable effective walk width free of obstacles provides an ideal environment for walking. In addition, ramped curb cuts are provided wherever necessary for those who need special assistance.

There is excellent intermodal connectivity. Easy access is provided by surface and underground transit, which arrive at short headways. Information on transit schedules and the routes available are posted at each stop for the convenience of transit users; shelters with seating are provided for the comfort of transit users. Bike racks are conveniently placed for those who opt for that mode. Other amenities such as telephone booths, mailboxes, and stamp vending machines are equally accessible from the sidewalks (Figure 3).



**FIGURE 3** Service Level B: Isartor, Munich—user-friendly, comfortable pedestrian environment in which facilities such as bus shelters with seating, detailed transit information, and convenience stands nearby make walkway very attractive to users.

#### *Continuity*

There are continuous stretches of physically separated, well-landscaped pedestrian networks with more-than-adequate walk widths free of impediments and accessible to captive users.

#### *System Coherence*

Excellent system coherence is an important element at Service Level B. The designers afford clear visual statements on the transit facilities, streets, restaurants, and shops, which enable pedestrians (especially the physically challenged) to overcome any directional confusion that may arise and divert their attention to secondary visual inputs such as observing street activities.

#### *Attractiveness*

Aesthetic components are not as profuse as in the previous level, as it is very difficult to incorporate all the visually pleasing elements on the ancillary walkways. But within these constraints, much visual variety can be introduced, such as tastefully designed street furniture, interesting patterns on the pavement, and small art pieces.

The positive compatibility components are numerous (1). Street furniture is designed to blend with the surrounding architectural vocabulary, and it is arranged to create places where one can step out of the flow of street life for a few moments of rest. Benches and trees, which are classified as passive street furniture, are not placed near the active objects such as mailboxes or telephone booths to afford privacy.

#### **Service Level C**

Service Level C right of way is shared by pedestrians and vehicles through physical separation, but the design preference shifts toward vehicular traffic. The walkways have in-

sufficient width to service bidirectional peak traffic flow, and pedestrians must make adjustments to avoid conflicts while walking. The pedestrian environment begins to get uncomfortable and strenuous for the physically challenged, who must make major adaptations to negotiate through the traffic.

The planned changes on the streetscape design have increased service quality for the vehicular road users. The wide roads and turning radii have resulted in higher speeds and greater traffic volumes. But this has harmed the pedestrian environments, introducing higher noise levels (65 to 90 dba) and greater concentration of particulate matter and toxic emissions in the air.

The diversity in user activities (window shopping, sitting, and watching) is considerably limited, and the level of use by captive groups begins to decline in Level C.

#### *Safety*

Physical separation still ensures safety from vehicular conflict. But the impediments on the effective walkways accompanied by continual streams of bidirectional flows may intimidate captive users, who must negotiate a far greater number of obstacles to reach their destinations.

#### *Security*

The street and sidewalk configuration provides clear lines of sight for patrolling police cars. The pedestrian density is considerable, providing safety in numbers, and the nonconventional users (homeless, panhandlers) do not affect usage; also, the adjacent buildings face the streets, affording a sense of security.

#### *Convenience and Comfort*

The walkways are unable to cope with bidirectional peak traffic flow; as a result, minor adjustments must be made by even able-bodied pedestrians. The effective walk width is indistinguishable from the ancillary walk width, and impediments obstruct free flow. A case in point is Figure 4, where



**FIGURE 4** Service Level C: Via Navicella, Rome—walkway is incapable of coping with complex pedestrian traffic configuration because of bus stop; at this level, designers' focus has shifted in favor of vehicular traffic; captive pedestrians find such environments arduous and uncomfortable.

the walkway has not been widened to accommodate the changes in traffic configuration resulting from a transit stop. The inter-modal connectivity is not as coherent as at the previous level, and pedestrians opting for other modes (transit or bicycles) may be inconvenienced.

Minimum effort is made to upgrade the pedestrian environment. Facilities such as bus shelters, convenience stands, and telephone booths are not available. The comfort levels start to drop because of high noise decibels, air pollution from the vehicular traffic, and poorly surfaced walkways (Figure 4).

Captive users find these walkways uncomfortable and inconvenient. They must make major adjustments to weave through bidirectional flows on uneven pavements, with curb ramps that are few and far between.

### *Continuity*

Continuous stretches of sidewalks exist, but they often have variable widths and poor design standards completely unsuitable for physically challenged users.

### *System Coherence*

The perception of urban space becomes less coherent in Level C, and pedestrians, particularly those with disabilities, feel uncomfortable with the visual statements that guide them. They are primarily concerned with orientation and direction, with limited receptivity to sensory gradients such as color, light, ground slope, smells, sounds, and textures (3). This is especially true for physically challenged users and the elderly, who have to weave through bidirectional traffic.

### *Attractiveness*

Mediocre design standards prevail, according very little importance to aesthetic components of walkways. There may be a piecemeal approach to incorporate artistic elements into the street space, but no concerted effort is made to infuse vitality into the pedestrian environment as the primary focus of the designers is to create service quality for the vehicular traffic.

### **Service Level D**

Physical separation still exists for pedestrians and vehicles in Service Level D, but not between pedestrians and bicycles, so there is a greater risk of conflicts between these two modes. The risk factor increases further because of the reduction in effective walk width and the obstructions from street furniture and other impediments. The pedestrian walkways become increasingly inhospitable toward the elderly and the physically challenged users, to the point that many avoid using them. Such situations are illustrated in Figures 5 and 6.

The planned changes on the streetscape design continue to increase service quality for the vehicle road users; the sidewalks are created on leftover spaces and the users must share the narrow right of way with impediments such as gas stations



**FIGURE 5** Service Level D: intersection of Leopoldstrasse and Schellingstrasse, Munich—effective walk width reduced by improper placement of street furniture and illegal bicycle parking; environment is hazardous for physically challenged pedestrians.

(common in Italy), parking meters, trash cans, and cyclists. The negative compatibility characteristics—such as higher noise decibels (65 to 90 dba), greater concentration of toxic emissions, and poor pedestrian path continuity—become increasingly prevalent.

The diversity in user activities is limited to walking out of necessity, and the level of use by captive groups declines sharply.

### *Safety*

Physical separation between motorized transportation and pedestrians reduces the risk of pedestrian-vehicular conflict, but the streetscape design encourages cyclists to use sidewalks, increasing the odds of pedestrian-bicycle conflicts. Captive pedestrians are particularly at risk owing to their slower reflex actions to imminent conflicts.



**FIGURE 6** Service Level D: Schellingstrasse, Munich—pedestrian environment is visually boring, walled up on one side and parked cars on the other; cyclists and pedestrians are using same right of way, making it especially unsafe for captive groups.

### Security

The sidewalk configuration and parked cars may inhibit vigilance from the streets at some stretches: however, this is offset somewhat by the presence of other pedestrians during the daytime. But in the evening, sharp turns or bends on the walkways create blind spots along some stretches where pedestrians may be vulnerable to assaults.

### Convenience and Comfort

Pedestrians (especially captive users) are inconvenienced because the environment is far from being user-friendly, because of

- Improper placing of street furniture (phone booths, trash cans, mailboxes);
- Obstructions resulting from illegal parking of bicycles and improper positioning of convenience stands, phone booths, and gas stations;
- Inadequate design standards for transit stops and access to the subway;
- Conflicts with bicycles using the same right of way; and
- Lack of ramped curb cuts or clearly marked handicap access areas for those who need assistance.

There is poor intermodal connectivity because switching from walking to any other mode (or vice versa) is not convenient and smooth. This marked drop in convenience and comfort puts stress even on able-bodied pedestrians, and the frequent stops and maneuvers to avoid conflicts increase travel time.

### Continuity

The pedestrian corridors are not well connected, and continued stretches of sidewalk are no longer guaranteed. The possibility of several breaches in the pedestrian network, leading to complete disorientation, is highly probable.

### System Coherence

The perception of the urban street becomes increasingly incoherent because of confusing directional signs and other visual statements. Confusion and complexity are further heightened by the fear of collision with bicycles. The pedestrian's attention is fully focused on primary visual inputs of orientation and avoidance of impending collision.

### Attractiveness

The designers have ignored pedestrians' need for visual and psychological interaction with the milieu. The pedestrian environment is poor in service quality, prohibiting diversity of uses. The mental image and the legibility of the environments are indistinct, and users associate such environments with negativity. Cognitive maps drawn by users indicate their complete disassociation with the milieu.

### Service Level E

The streetscape design in Service Level E favors vehicular traffic. The roads are widened at the expense of the sidewalks, reducing the effective walkway width to a bare minimum that does not even support off-peak bidirectional flow without conflict with vehicular traffic. This level exemplifies one of the poorest design standards, in which the needs of captive users have been completely disregarded.

The negative compatibility characteristics—such as higher noise decibels (65 to 90 dba), larger concentration of toxic emissions, poor pedestrian path continuity, increased vehicular traffic, and unpleasant contrast between facilities and the existing architectural styles—become glaringly prominent (Figure 7).

The level of use drops significantly and is limited to walking through these stretches out of necessity. This level also offers one of the poorest examples of intermodal connectivity, and people prefer to use vehicles over other modes.

### Safety

All groups of pedestrians feel threatened by the prospect of probable vehicular conflict because of poor service levels on the walkways. The horizontal grade separation is unable to eliminate conflicts with vehicular traffic because the effective walk widths are incapable of supporting bidirectional flow.

Often the continuity of grade separation is breached and pedestrians must negotiate through parked cars or turning vehicles, which are especially formidable obstacles for captive pedestrians (Figure 8).

### Security

The proximity to moving vehicles may increase the number of drive-by crimes (purse-snatching, assaults on women), and pedestrians may have very few avenues of escaping such confrontations. Also, infrequent use of the walkways makes these stretches even more susceptible to criminal activities.



**FIGURE 7** Service Level E: near Colosseum, Rome—streetscape favors vehicular traffic; bare minimum walkway provided, capable of supporting unidirectional flow in single file; bidirectional flow may result in conflict with vehicular traffic; unsuitable for physically challenged pedestrians.



**FIGURE 8** Service Level E: near Roman Forum, Rome—pedestrians must negotiate through parked cars to reach other end of sidewalk; especially hazardous environment for captive pedestrians.

#### *Comfort and Convenience*

Facilities that afford comfort and convenience are non-existent; designers have overlooked the needs of the users and have made no effort to improve the walking conditions. At this level, all pedestrians need to make major adjustments, such as accepting violation of personal space or stepping on to the road to enable bidirectional flows.

Walking is no longer pleasurable and comfortable, and those who do walk are thoroughly inconvenienced by the obstacles, noise, and emissions from the vehicular traffic, along with close confrontations with vehicular traffic.

#### *Continuity*

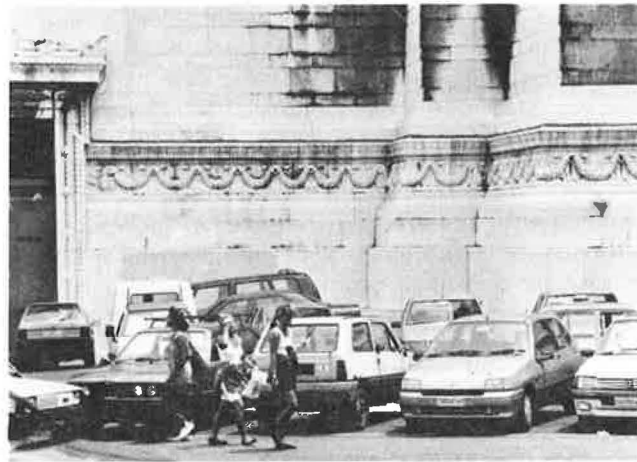
The prevailing design standards prepare pedestrians for the possibility of several breaks in the continuity. Figure 8 shows a distinct breach in the continuity of the sidewalk, where the pedestrians have to negotiate through parked cars to reach the other end of the sidewalk. Such discontinuity causes very poor visual and psychological interaction and may prove to be disastrous for captive pedestrians (especially for the blind).

#### *System Coherence*

Pedestrians' perceptions of urban space falter, and pedestrians may devote sensory awareness entirely to the task of restrained locomotion to avoid collision with pedestrians ahead. This occurs mainly because the pedestrians are not assured of their primary concern of orientation and direction, as was seen in Figure 7, where the stream of pedestrians show no interest toward the Colosseum in Rome and appear preoccupied with walking.

#### *Attractiveness*

The walkway ceases to be an aesthetic component of the streetscape, offering nothing in the form of diversity and va-



**FIGURE 9** Service Level F: near monument of Vittorio Emanuele, Rome—pedestrian needs have been totally disregarded, and pedestrians have been exposed to direct confrontation with vehicular traffic; hazardous for all pedestrian groups.

riety. This level exemplifies designers' complete disregard for integrating the pedestrian mode as a major component of the transportation network, thereby overlooking the need to provide the right ambience for walking.

#### **Service Level F**

Service Level F is the worst-case scenario, in which designers have not provided any distinctly separate right of way for the pedestrians, and preference is given only to vehicular traffic. The streetscape design facilitates vehicular movement, placing severe restrictions on pedestrian movement. The safety of pedestrians has been overlooked, and they are either exposed to fast-moving vehicular traffic or forced to negotiate through a maze of parked cars. Captive pedestrians find such environments particularly intimidating and life-threatening. The security for the pedestrians is undermined by the streetscape configuration; physical assaults and hit-and-run accidents are not uncommon.

In such situations the pedestrians feel totally disoriented, confused, and thoroughly inconvenienced. There is complete breakdown in the pedestrian traffic flow, as each pedestrian selects a different route to avoid direct vehicular conflict. They can best produce indistinct cognitive maps of their environs and can share only their experiences of discomfort and intimidation as collective memories (Figure 9).

#### **CONCLUSION**

City planners in ancient and medieval times were cognizant of the human need to communicate and interact and made every attempt to enable such social exchange. The architects and planners of those times were equally concerned with convenience and comfort of the pedestrians. The same principles of convenience, comfort, safety, security, and aesthetics are still applicable today.

The best pedestrian environment would accord exclusionary rights to pedestrians: prohibiting vehicular traffic and providing an environment rich in qualitative elements for diversified pedestrian activities. Unfortunately, such ideal conditions can be found only in certain sections of the city and can never be implemented on a large scale. So a more realistic solution would be to foster pedestrian areas with Service Level B, where the right of way is shared by different modes through horizontal and vertical grade separation and attention is given to make the pedestrian environment user-friendly, particularly for captive pedestrians.

Designers should upgrade all pedestrian walkways to Service Level B, and Service Level A where possible. Service Level C can be acceptable only where further improvements would cause major changes in the building configuration and the vehicular traffic flow, but designers should provide ramps on curb cuts and other facilities to ameliorate the conditions for physically challenged users.

Service Levels D and E need major structural and design changes after research and data collection. Service Level F exemplifies the total apathy of transportation planners and designers toward the needs of pedestrians. Such environments should be classified as hazardous areas needing immediate attention.

One of the major problems with streetscape design is that traffic planners and designers ignore the importance of intermodal connectivity and the facilities that enhance such transfers. The service levels proposed in this paper provide a valuable tool to evaluate and improve the most important link

for efficient modal transfers—walkways—to ensure an efficient transportation system.

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