Chapter 1

Introduction to Pedestrian Facilities

1. Pedestrian Activity in New Jersey

All trips involve walking, irrespective of their primary mode. Many trips, especially those under 1.6 kilometers (1 mile) in length, are made solely on foot. Nationally, at least 8.5% of all trips are walking trips.

Between 2.5% and 6% of all *work* trips in the US are made via walking. In New Jersey, this share averages 4.1% and ranges from a high of 10.9% in Hudson County to a low of 0.2% in Passaic County (See Table 1).

Table 1:
Pedestrian Work Trips in New Jersey

County	Percent of Workers Walking to Work
Hudson	10.86
Atlantic	6.09
Mercer	5.86
Cape May	5.31
Essex	4.95
Burlington	3.97
Union	3.88
Warren	3.74
Bergen	3.46
Cumberland	3.41
Camden	3.19
Middlesex	3.16
Monmouth	3.01
Salem	2.78
Gloucester	2.58
Ocean	2.32
Hunterdon	2.29
Morris	2.22
Somerset	1.98
Sussex	1.78
Passaic	0.16

Source: 1990 Census

The 1990 Census shows that 156,500 New Jerseyans (4.1%) walk to work. After driving alone (71.6%), carpooling (12.4%) and using buses (5.4%), walking is the most frequent mode of commuting in New Jersey. Almost as many New Jerseyans walk to work as take the bus.

Despite the importance of the pedestrian travel mode, the expenditure spent on pedestrian facilities across the State is a very small fraction of that spent on other travel modes. Money that is spent for pedestrians tends to be utilitarian and minimal for the most part, aimed at merely accommodating pedestrian movement, rather than fostering it.

Walking to school accounts for at least one third of all pedestrian miles in the US. Providing adequate and safe facilities for such trips is therefore a very important component of planning for pedestrians.

Walking for shopping and business is a function of the land use pattern and can range from 3% for the typical suburban shopping center to as much as 90% for convenience stores in dense Suburban Activity Centers. Shopping averages 9% of all daily pedestrian trips.

Recreational walking and jogging is increasingly popular as public awareness of health and fitness expands. Social and recreational walking trips account for 12% of all pedestrian trips. Almost 90% of suburban area residents walk for exercise and recreation. Up to one-third do so at least five days per week and more than one-third also run or jog. The self-evident benefits of both recreational and functional walking in terms of health and energy savings are complemented by more subtle benefits that include increased neighborliness and a heightened awareness of the manmade and natural environment.

Data on pedestrian accidents shows that most accidents (around 60%) occur between 2:00 PM and 10:00 PM, peaking with the rush hour. Most susceptible to accidents are children, teenagers and the elderly. About one-third of the victims of both urban and rural accidents are children under 10 years of age; teenagers account for another 19% (urban) to 29% (rural); and the elderly (65 years plus) represent another 6% (rural) and 19% (urban) of accidents. The most common types of urban and rural pedestrian accidents - dart-outs, mid-block and intersection-dash - can all likely be reduced through proper design for pedestrians.

These Planning & Design Guidelines address the needs of pedestrians in all of the above settings and for all of these trip purposes. The Guidelines are concerned with defining appropriate facilities and design criteria to accommodate and foster pedestrian movement as well as to make it safer.

Since these guidelines are a companion document to NJDOT's Bicycle Compatible Roadways and Bikeways, it is appropriate to discuss the relationship between pedestrian and bicycle domains in general terms. While both functions need to be carefully planned for, the movement characteristics and needs of pedestrians and bicycles differ in obvious ways. The greater speed and size of the bicycle and rider means that, in general, bicycles are best accommodated as part of the roadway and not on sidewalks. Additional outside lane dimensions or widened shoulders perform this function most typically. For recreational pathways and other unique circumstances (e.g., certain bridges), pedestrian and bicycle movement is sometimes combined if adequate width can be provided and usage is not intense.

2. Goals and Visions for Pedestrian Use

The Intermodal Surface Transportation Efficiency Act (ISTEA) set a new direction for surface transportation in America that is enunciated in its statement of policy:

> ***"to develop a National Intermodal Transportation System that is economically efficient, environmentally sound, provides the foundation for the Nation to compete in the global economy and will move people and goods in an energy efficient manner."***

Provisions for walking, with its potential for providing economically efficient transportation, became an important policy goal of ISTEA. The Secretary of Transportation was directed to conduct a national study that developed a plan for the increased use and enhanced safety of bicycling and walking. The National Bicycling and Walking Study - Transportation Choices for a Changing America presents a plan of action for activities at the Federal, State and local levels for meeting the following goals:

- To double the current percentage (from 7.9 percent to 15.8 percent) of total trips made by bicycling and walking; and
- To simultaneously reduce by 10 percent the number of bicyclists and pedestrians killed or injured in traffic crashes.

The potential for increasing the number of pedestrian trips is evident in the National Personal Transportation Survey, which shows that more than a quarter of all trips are 1.6 kilometers (one mile) or less, and 40 percent are 3.2 kilometers (two miles) or less. Almost half are 4.8 kilometers (three miles) or less and two-thirds are 8.0 kilometers (five miles) or less. Approximately 53 percent of all people live less than 3.2 kilometers (two miles) from the nearest public transportation route.

New Jersey residents have become aware of the energy, efficiency, health and economic benefits of walking for transportation and recreational purposes. In 1995, New Jersey Department of Transportation completed a statewide plan that established policies, goals and programmatic steps to promote safe and efficient walking for transportation and recreation in New Jersey. Through an extensive outreach effort, residents established a statewide vision for the future of bicycling and walking for all communities in New Jersey:

> ***"New Jersey is a place where people choose to bicycle and walk. Residents and visitors are able to conveniently walk and bicycle with confidence and a sense of security in every community. Both activities are a routine part of transportation and recreation systems."***

In order to achieve this vision for New Jersey, it is necessary to plan and provide appropriate facilities that will accommodate, encourage and promote walking. This document provides direction regarding how appropriate facilities for pedestrians should be provided.

3. Pedestrian Characteristics and Level of Service Standards

This section presents some basic definitions of concepts and characteristics of pedestrian movement, their relationship to various land use contexts and common pedestrian accident types. It is designed as a resource when planning for pedestrian movement.

Where pedestrian movement is very dense, such as on pedestrian bridges or tunnels, at intermodal connections, outside stadiums, or in the middle of downtown, then pedestrian capacity analysis may be needed. Research has developed a Level of Service concept for pedestrians that relates flow rate to spacing and walking speed. Table 2 presents some of these data. In most situations, however, this level of analysis is unnecessary and simpler standards can be applied.

Table 2

Pedestrian Flow Characteristics on Walkways and Stairs

	Level of Service					
	A	B	C	D	E	F
Flow rate (ped./min./ft.)						
Walkways	<2	2-6.25	5.26-10	10-15	15-25	Variable
Stairs up	<5	5-7	7-10	10-13	13-17	Variable
Stairs down	<6	6-8	8-11	11-14	14-19	Variable
Spacing (sq. ft./ped.)						
Walkways	>130	40-130	24-40	15-24	6-15	<6
Stairs	>20	15-20	10-15	7-10	4-7	<4
Walking speed (ft./min.)						
Walkways	>260	250-260	240-250	225-240	150-225	<150
Stairs up	100	100	100	90-100	70-90	<70
Stairs down	120	120	120	100-120	75-100	<75

Source: Highway Capacity Manual, 1994.

Note: See Metric Conversion Tables in Appendix.

An average walking speed of 1.2 meters per second (four feet per second) has been used for many years. There is a growing tendency to use 1.1 meters per second (3.5 feet per second) as a general value and 0.9 or 1.0 meters per second (3.0 or 3.25 feet per second) for specific applications such as facilities used by the elderly or handicapped. Table 3 presents walk/trip characteristics by trip purpose based on a national sample. In assessing the probability of pedestrian trip making, these averages can serve as a helpful rule of thumb. Similarly, Figure 1 shows pedestrian trip generation rates for different land uses. Where roads abut such uses, either existing or proposed, these numbers provide an indication of potential trip making activity. The Highway Capacity Manual provides procedures for the operational analysis of walkways, crosswalks and street corners.

Specific accident classification types have been developed for pedestrian collisions. Accidents often occur because of deficient roadway designs or traffic control measures and/or due to improper behavior on the part of motorists and pedestrians. Examples of some of the more common types of pedestrian accidents and their likelihood of occurrence are shown in Figures 2 and 3.

Table 3

Walk Trip Characteristics by Purpose

	Daily pedestrian miles traveled in millions No. (%)	Average walk trip length (in miles)	Average trip time (in minutes)
To or From Work	0.18 (5.0%)	0.3	8.6
Work Related	0.23 (6.4%)	0.6	15.0
Shopping	0.33 (9.2%)	0.2	10.1
Other Family or Personal Business	0.19 (5.3%)	0.2	7.7
School/Church	1.15 (32%)	0.4	10.6
Doctor/Dentist	0.20 (5.6%)	0.6	19.4
Vacation	0.02 (0.5%)	0.7	19.8
Visit Friends or Relatives	0.12 (3.4%)	0.1	7.2
Other Social or Recreational	0.61 (17%)	0.5	11.8
Other	0.54 (15%)	0.5	12.5
TOTAL	3.57 (100%)		

Source: National Personal Transportation Survey, 1992.

Note: See Metric Conversion Tables in Appendix.

LAND USE TYPE	TRIP GENERATION RATES/PEDESTRIANS PER 1,000 SQ. FT. 5 10 15 20 25 30 35 40 45
RETAILING	
SPECIALTY RETAILING	
NEIGHBORHOOD SHP. CTR.	
COMMUNITY SHP. CTR.	
NORMAL RETAILING	
REGIONAL SHOPPING CENTER	
FAST FOOD CARRY OUT	
FAST FOOD WITH SERVICE	
FULL SERVICE	
OFFICES	
LOCAL USE BUILDINGS	
HEADQUARTERS BUILDINGS	
MIXED USE BUILDINGS	
ALL OFFICE USES	
RESIDENTIAL	
SINGLE FAMILY DWELLING	
APARTMENT DWELLINGS	
HOTELS AND MOTELS	
PARKING	
METERED CURB	
UNMETERED CURB	
PARKING LOT	
PARKING GARAGE	

TRIP GENERATION IS A FUNCTION OF TYPE AND SIZE OF LAND USE

Figure 1

Pedestrian Trip Generation Rates by Land Use Type

Source: A Pedestrian Planning Procedures Manual, FHWA, 1979.

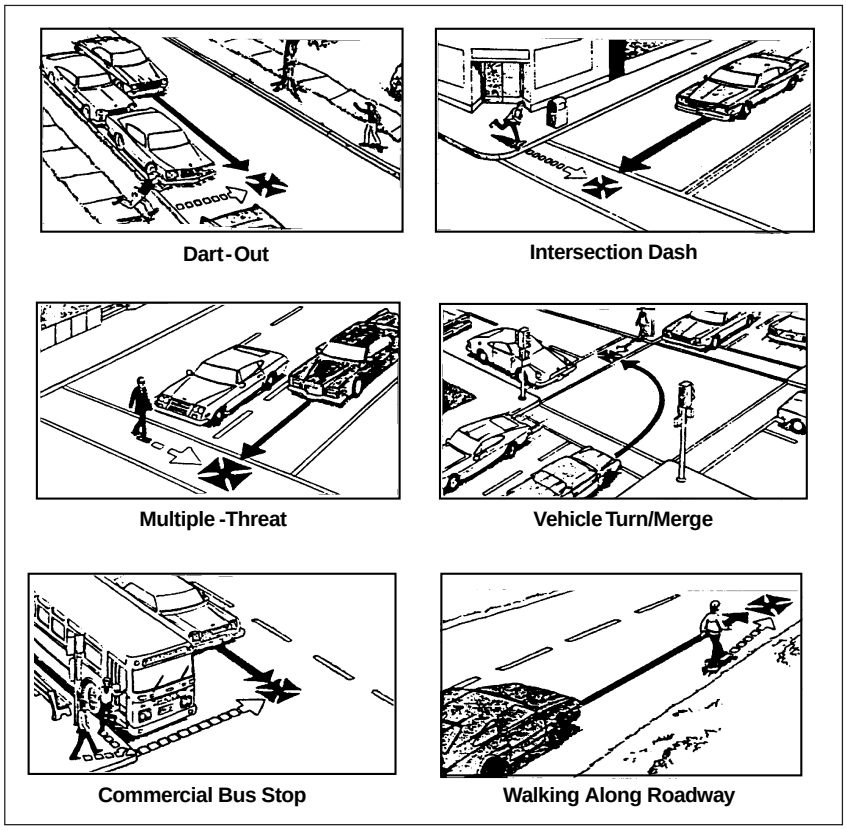

Figure 2

Common Types of Pedestrian Accidents

Source: Planning, Design and Maintenance of Pedestrian Facilities, FHWA, 1989

Figure 3

Pedestrian Accident Types (Urban Areas)

DART-OUT (FIRST HALF) (24%)
Midblock (not at intersection)
Pedestrian sudden appearance and short time exposure (driver does not have time to react)
Pedestrian crossed less than halfway

DART-OUT (SECOND HALF) (10%)
Same as above except pedestrian gets at least halfway across before being struck

MIDBLOCK DASH (8%)
Midblock (not at intersection)
Pedestrian running but *not* sudden appearance or short time exposure as above

INTERSECTION DASH (13%)
Intersection
Same as dart-out (short time exposure or running) except it occurs at an intersection

VEHICLE TURN-MERGE WITH ATTENTION CONFLICT (4%)
Vehicle turning or merging into traffic
Driver is attending to traffic in one direction and hits pedestrian from a different direction

TURNING VEHICLE (5%)
Vehicle turning or merging into traffic
Driver attention *not* documented
Pedestrian *not* running

MULTIPLE THREAT (3%)
Pedestrian is hit as he steps into the next traffic lane by a vehicle moving in the same direction as vehicle(s) that stopped for the pedestrian
Collision vehicle driver's vision of pedestrian obstructed by the stopped vehicle

BUS STOP RELATED (2%)
Pedestrian steps out from in front of bus at a bus stop and is struck by vehicle moving in same direction as bus while passing bus

VENDOR-ICE CREAM TRUCK (2%)
Pedestrian struck while going to or from a vendor in a vehicle on the street

DISABLED VEHICLE RELATED (1%)
Pedestrian struck while working on or next to a disabled vehicle

RESULT OF VEHICLE-VEHICLE CRASH (3%)
Pedestrian hit by vehicle(s) as a result of a vehicle-vehicle collision

TRAPPED (1%)
Pedestrian hit when traffic light turned red (for pedestrian) and vehicles started moving

WALKING ALONG ROADWAY (1%)
Pedestrian struck while walking along the edge of the highway or on the shoulder

OTHER (23%)
Unusual circumstances, not countermeasure corrective

Source: Florida Pedestrian Safety Plan, FDOT, 1992

4. Integrating Pedestrian Facilities into the Highway Planning Process

Guidelines on the design of a range of specific pedestrian facilities, including sidewalks, shoulders, medians, crosswalks, curb ramps, etc., are provided in Chapter Two. This section provides a policy context or criteria for the selection of appropriate facilities.

The selection of appropriate pedestrian facilities for different situations may be based on two factors:

- pedestrian facility problems or conditions that typically occur, and potential solutions related, for example, to cross section design, signalization, institutional or legal issues
- pedestrian safety factors and the potential enforcement/regulatory, engineering and physical countermeasures for these situations

Both site specific facility conditions and safety factors should be used and evaluated to select roadway improvements for pedestrians.

Table 4 presents a summary of pedestrian facility problems and potential solutions. Many of the concepts and design treatments presented in Chapter Two are addressed.

Figures 4 and 5 illustrate in matrix format the relationship between pedestrian accident types and their potential engineering and educational countermeasures.