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FHWA Course on Bicycle and Pedestrian Transportation

Instructor's Guide

Research and Development
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FOREWORD

Legislation such as the 1991 Intermodal Surface Transportation Efficiency Act (ISTEA) and the 1998 Transportation Equity Act for the 21st Century (TEA-21) demonstrate that the U.S. Federal Government is committed to the future of bicycling and walking transportation in the United States. Bicycle and pedestrian projects are eligible under almost all the major Federal-aid transportation funding programs. However, planning and designing for bicycle and pedestrian travel has been a neglected field of study. Many of our transportation and planning professionals have not had instruction regarding the safe accommodation of bicyclists and pedestrians though many of the planning and engineering techniques have been available for some time.

The Federal Highway Administration (FHWA) University Course on Bicycle and Pedestrian Transportation can be used to train future professionals. The FHWA course is intended for use on the university level as part of transportation planning and design curricula, providing information on pedestrian and bicycle planning techniques, as well as practical lessons on how to increase bicycling and walking through land-use practices and engineering design. The topics covered in the course are presented in modular format. Instructors have the option of teaching the entire course or extracting desired topics and incorporating these into his/her own course.

This course has three major components: a Student's Guide, an Instructor's Guide, and scripted slide shows. The Student's Guide comprises 24 modules covering basic introductory, planning, and design topics. The Instructor's Guide parallels the Student's Guide, suggesting goals, objectives, activities, and homework problems for the students. The slide shows illustrate various pedestrian and bicycle planning and design concepts.

Michael F. Trentacoste
Director, Office of Safety
Research and Development

NOTICE

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16. Abstract

Planning for bicycle and pedestrian travel is a somewhat new field of study, and yet it also involves planning and engineering techniques that have been around for many years. This coursebook provides the reader with current information on pedestrian and bicycle planning and design techniques, as well as practical lessons on how to increase bicycling and walking through land use practices, engineering measures, and a variety of other urban and rural design procedures.

This manual can be used to train future professionals, including planners, engineers, landscape architects, and other designers, in a variety of disciplines. Emphasis is placed on the importance of developing an interdisciplinary team approach to planning and implementing bicycle and pedestrian programs, and of the role played by each profession represented in this course.

This coursebook was developed by the USDOT Federal Highway Administration for use in graduate-level courses in non-motorized transportation planning and design. Several of the lessons address both bicycle and pedestrian issues, while others address one particular aspect of pedestrian or bicycle design.

17. Key Words	18. Distribution Statement
Bicycle, pedestrian, roadway design, traffic calming, crashes, planning, liability, intersections	No restrictions. This document is available to the public through the National Technical Information Service, Springfield, Virginia 22161.

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Unclassified	Unclassified	554 (Student Workbook + Instructor's Guide)	

SI* (MODERN METRIC) CONVERSION FACTORS

APPROXIMATE CONVERSIONS TO SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
		AREA		
in^2	square inches	645.2	square millimeters	mm^2
ft^2	square feet	0.093	square meters	m^2
yd^2	square yards	0.836	square meters	m^2
ac	acres	0.405	hectares	ha
mi^2	square miles	2.59	square kilometers	km^2
		VOLUME		
fl oz	fluid ounces	29.57	millimeters	mL
gal	gallons	3.785	liters	L
ft^3	cubic feet	0.028	cubic meters	m^3
yd^3	cubic yards	0.765	cubic meters	m^3
NOTE: Volumes greater than 1000 l shall be shown in m^3.				
		MASS		
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams (or "metric ton")	Mg (or "t")
		TEMPERATURE (exact)		
EF	Fahrenheit temperature	5(F-32)/9 or (F-32)/1.8	Celsius temperature	EC
		ILLUMINATION		
fc	foot-candles	10.76	lux	lx
fl	foot-Lamberts	3.426	candela/m^2	cd/m^2
		FORCE and PRESSURE or STRESS		
lbf	poundforce	4.45	newtons	N
lbf/in^2	poundforce per square inch	6.89	kilopascals	kPa

APPROXIMATE CONVERSIONS FROM SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
		AREA		
mm^2	square millimeters	0.0016	square inches	in^2
m^2	square meters	10.764	square feet	ft^2
m^2	square meters	1.195	square yards	yd^2
ha	hectares	2.47	acres	ac
km^2	square kilometers	0.386	square miles	mi^2
		VOLUME		
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m^3	cubic meters	35.71	cubic feet	ft^3
m^3	cubic meters	1.307	cubic yards	yd^3
		MASS		
g	grams	0.035	ounces	oz
kg	kilograms	2.202	pounds	lb
Mg	megagrams (or "metric ton")	1.103	short tons (2000 lb)	T
		TEMPERATURE (exact)		
EC	Celsius temperature	1.8C + 32	Fahrenheit temperature	EF
		ILLUMINATION		
lx	lux	0.0929	foot-candles	fc
fl	candela/m^2	0.2919	foot-Lamberts	fl
		FORCE and PRESSURE or STRESS		
N	newtons	0.225	poundforce	lbf
kPa	kilopascals	0.145	poundforce per square inch	lbf/in^2

* SI is the symbol for the International System of Units. Appropriate rounding should be made to comply with Section 4 of ASTM E380.

Table of Contents

LESSON 1: THE NEED FOR BICYCLE AND PEDESTRIAN MOBILITY (INSTRUCTOR'S NOTES)

Objectives:

Upon completion of this lesson, students will be able to:

1. Describe historical precedents in planning and development as they relate to non-motorized transportation.

2. Describe the health and societal benefits of non-motorized transportation.

3. Recognize the various levels of government and community support for non-motorized transportation.

4. Recognize both good and bad examples of bicycle and pedestrian planning and facilities.

Pre-Instruction:

Components	Activities
Motivation	Show examples (e.g., slides, videotape) of both good and bad bicycle and pedestrian facilities. Explain why the "good" places are good and the "bad" places are bad.
Objectives	Present and explain the four lesson goals listed above (V-1-1).

Information Presentation:

Components	Activities
Information Sequence	Outline the presentation of the lecture (V-1-2).
Information	Summarize the historical growth of cities and how this has led to the current form of urban/suburban travel (V-1-3). Summarize the personal and societal benefits of bicycling and walking (V-1-4). Point out that there are levels of community and governmental support of bicycling and walking (V-1-5).

	Review the examples of how modern planning practices consider and encourage the use of non-motorized transport (V-1-6).
Example(s)	Make liberal use of examples (e.g., slides, videotape) to illustrate the growth of cities and the effects of modern planning as they relate to non-motorized transportation.

Student Participation:

Components	**Activities**
Practice	Engage the class in an exercise wherein you have them assist you in compiling a list of good and bad bicycle and pedestrian facilities/features specific to your area/location. Have the students consider whether these features (both the good and the bad) were part of an actual plan or just an artifact of a lack of planning. Engage the class in a discussion of their results. Probe individuals as to why they believe that some of their trip-making could not have been done by walking or biking.
Feedback	Provide comment and feedback to the class as appropriate.

Follow-Up:

Components	**Activities**
Enrichment	Assign reading for Lesson 2. Ask the students to write a brief essay about their own most recent experience as a walker or a biker. Encourage them to write about the positive and negative aspects of this experience.
Review	Provide a summary of Lesson 1 (V-1-7).

Exercise	Ask the students to complete the exercise at the end of Lesson 1 in their workbooks. This exercise is reprinted below for your convenience. **1.8 Exercise: A Pictorial Essay** **Part 1** Take photographs of both good and bad locations to bicycle and walk in your community. Photographs can document conditions in several locations or within one particular development (commercial or residential). Your photo log should capture the overall environment (such as streetscape), specific barriers and/or good features, and general land use relationships to the transportation facility. Prepare a short write-up for each photograph explaining the problems or positive features you inventoried. **Part 2** Using the specific locations you documented in Part 1, conduct an evaluation of engineering issues related to the following facility design aspects: 1. Need for bicycle/pedestrian facilities–How would you establish the need for facilities (either existing or proposed improvements)? What data would you collect? What type of analysis procedures or comparisons would be useful in assessing need? If you documented existing facilities in your photographs, how would you evaluate effectiveness to those detractors that would suggest that money spent on facilities for pedestrian and bicycles is a waste of resources. Please develop some proposed guidelines, within the context of effective and reasonable public policy, for use by a local agency in addressing issues related to bicycle and pedestrian facilities. 2. Incorporation of needed facilities in new design –Describe how any deficiencies you noted in your photo logging exercise could have been addressed if pedestrian and/or bicycle facilities were included in the original design and construction. Tabulate and evaluate the associated impacts. If you documented existing designs, describe and quantify impacts associated with accommodating pedestrians and/or bicycles in the facility(ies) you photographed. 3. Incorporation of needed facilities in retrofit design–Assuming that you documented deficient locations for pedestrian and bicycle travel, list and describe possible ways to rectify and retrofit existing facilities so that these locations can more readily accommodate pedestrian and/or bicycle travel modes.

Solution Commentary	**Part 1** In conducting this portion of the exercise, students could focus on a variety of aspects. Problems or impediments to bicycle and pedestrian travel could include: narrow travel lanes/sidewalks, narrow bridges, untimely termination of facilities, discontinuity between adjacent development projects, substandard facility design, driveway/parking lot conflicts, etc. Good conditions could include intersection pedestrian features, separate multi-use paths, access management in commercial areas, mid-block crossings, bicycle parking, pedestrian grade-separated structures, etc. The object of this exercise is to help students focus on aspects of representative conditions encountered by pedestrians and bicyclists as they use the existing transportation network for functional trip purposes. **Part 2** Student evaluations conducted for this portion of the exercise could focus on the following engineering issues and related facility design aspects: 1. **Need for Bicycle/Pedestrian Facilities** – Some of the methods for establishing facility need could include development of exposure measures such as number of daily pedestrian trips per capita, average trip length, aggregate bicycle-miles traveled per year, and crash/accident rate. Maximizing the use of available data from agency sources such as local government, U.S. census data, regional planning statistics, etc. is an important aspect of developing a useful database to evaluate pedestrian and bicycle mobility issues. Sample-based surveys, as well as spot location data collection efforts such as counts, are also useful approaches. However, data collection is a time-consuming and expensive activity that makes the identification and use of existing data sources a crucial aspect in the establishment of databases for evaluating bicycle and pedestrian transportation issues. A good approach for promoting facility need within the context of the public dialogue is to quantify the benefits of pedestrian/ bicycling modes, such as reduced air emissions, energy savings, reduction of motor vehicle-miles traveled, mobility equity issues, and personal health advantages. 2. **Incorporation of Needed Facilities Into New Designs** – Generally, it is much easier to accommodate pedestrians and bicyclists if these modes of travel are given consideration in the initial design and construction of a transportation facility. Implementation of consistent design standards for pedestrian and bicycle facilities may result in impacts ranging from a small increase in construction costs to utility relocation and the problematic purchase of additional right-of-way.

	Measurement of impacts related to facility construction could be tabulated as additional cost per construction item, operational effect on traffic flow, anticipated effect on crash rate, additional right-of-way costs, likely utility relocation costs, construction impacts, etc. 3. **Incorporation of Needed Facilities Into Retrofitted Designs –** Retrofitting roadways to accommodate pedestrian and/or bicycle travel modes is generally much more difficult and either involves more compromise or greater cost than when considering similar improvements for new facilities. Common treatments may include removal of on-street parking, reallocation of travel-lane width, spot removal of problematic obstacles, special signing/pavement marking treatments, etc.

Lesson Objectives:

- Describe historical precedents in planning and development as they relate to non-motorized transportation
- Describe the health and societal benefits of non-motorized transportation
- Recognize the various levels of government and community support of walking and biking
- Recognize good and bad examples of bicycle and pedestrian planning and facilities

Lesson Outline:

- Growth of cities
- Current urban/suburban travel trends
- Benefits of bicycling and walking
- Government and community support
- Planning practices that encourage walking and biking
- Lesson summary

Urban/Suburban Development and Travel:

- Bicycling and walking have become novelty experiences
- Development follows the lead of the predominant personal transportation mode
- Planning and zoning regulations have favored low-density, automobile-oriented development
- Planners and designers “just don’t think about” pedestrians and bicyclists

Benefits of Bicycling and Walking:

- Health
- Energy
- Environment
- Transportation system

Government and Community Support:

- ISTEA
- TEA-21
- State coordinators/programs
- Travel demand management (TDM) strategies
- Stated user preference for walking and biking

Planning Practices That Encourage Walking and Biking:

(Instructor should provide a series of slides here that directly illustrate or complement by way of different examples the practices that are highlighted in the text of Section 1.7.)

Lesson Summary:

- Post-WW II development plans have hampered the ability to accommodate bicycle and pedestrian travel
- There are many reasons to encourage the use of non-motorized transportation
- Currently there is strong government and community support for walking and biking
- There are many simple strategies that promote non-motorized transportation

LESSON 2: PEDESTRIAN AND BICYCLE ACTIVITY TODAY (INSTRUCTOR'S NOTES)

Objectives:

Upon completion of this lesson, students will be able to:

1. Estimate current levels of walking and biking activity in their community.

2. Explain how and why people decide to walk or bike.

3. Plan strategies to increase walking and biking activity.

4. Recognize various "at-risk" highway user populations (i.e., the young and the elderly) and how the risks to these groups can be managed through the promotion of walking and biking strategies.

Pre-Instruction:

Components	Activities
Motivation	Find someone in your community who regularly uses his or her bicycle for commuting, shopping, or other non-recreational trips. Ask this person to talk to your class about their experience as a person who is able to get along without being overly dependent on an automobile.
Objectives	Present and explain the four lesson goals listed above (V-2-1).

Information Presentation:

Components	Activities
Information Sequence	Outline the presentation of the lecture (V-2-2).
Information	Illustrate how much biking and walking people actually do. Summarize the factors that influence an individual's decision to walk or bike (V-2-3). Point out that there are many different strategies that can be used to encourage more bicycling and walking (V-2-4). Discuss how people who are transportation disadvantaged (i.e., children, older adults, and the disabled) can benefit from improvements to the biking and walking systems.
Example(s)	Use the graphics from the text to highlight how much biking and walking people already do.

Student Participation:

Components	Activities
Practice	During the class period, ask students to write down their travel activities for the day by mode. Ask them to consider which trips might have been replaced by a bicycle or pedestrian trip. Engage the class in a discussion of their results. Probe individuals as to why they believe that some of their trip-making could not have been done by walking or biking.
Feedback	Provide comment and feedback to the class as appropriate.

Follow-Up:

Components	Activities
Enrichment	Assign reading for Lesson 3. Ask the students to look for pedestrian and bicycle accident statistics from some national database (e.g., U.S. Department of Transportation, Bureau of Transportation Statistics (http://www.bts.gov)). Have them bring to class the most amazing or surprising statistics that they find.
Review	Provide a summary of Lesson 2 (V-2-5).

Lesson Objectives:

- Estimate current levels of walking and biking activity in their community
- Explain how and why people decide to walk or bike
- Plan strategies to increase walking and biking activity
- Recognize the risks of certain special user groups and how these risks can be managed through the promotion of walking and biking strategies

Lesson Outline:

- How much biking and walking do people actually do?
- Factors that influence walking or biking decisions
- Strategies that can be used to encourage bicycling and walking
- Benefits for the transportation disadvantaged from improvements to the biking and walking systems

Factors Influencing Walking/Biking Decisions:

- Distance
- Time
- Attitude
- Situation
- Safety
- Destination

Strategies to Encourage Bicycling and Walking:

- Build on existing support
- Press the transit connection
- Expand the current role of non-motorized transportation activities
- Monitor changes in bicycle design

Lesson Summary:

- People are already biking and walking
- There are a variety of reasons why people choose to bike or walk or not bike or walk
- There are many ways to encourage bicycling and walking in the community
- Bicycling and walking help to maintain independence and mobility for the transportation disadvantaged

LESSON 3: BICYCLE AND PEDESTRIAN PLANNING OVERVIEW (INSTRUCTOR'S NOTES)

Objectives:

Upon completion of this lesson, students will be able to:

1. Explain the impact of the current Federal surface transportation funding on bicycle and pedestrian planning.

2. State what elements are part of a local bicycle or pedestrian plan.

3. Use different types of analytical tools in bicycle and pedestrian planning processes.

4. Recognize the different types of mapping techniques used for bicycle and pedestrian planning.

Pre-Instruction:

Components	**Activities**
Motivation	Secure a copy of a state or local pedestrian or bicycle plan. Discuss the different elements of the plan with the class. Consider how each of the elements was developed.
Objectives	Present and explain the four lesson goals listed above (V-3-1).

Information Presentation:

Components	Activities
Information Sequence	Outline the presentation of the lecture (V-3-2).
Information	Provide a general explanation of the most recent Federal surface transportation law. Detail how this law affects planning, design, operation, and maintenance of pedestrian and bicycle facilities. Present and explain the importance of the different elements and sub-elements of a local pedestrian plan and a local bicycle plan (V-3-3 and V-3-4). Present the latent demand score (LDS) model as an example of an analytical technique that can be used for non-motorized transportation planning (V-3-5). Show the class different examples of how maps are used in the bicycle and pedestrian planning processes (V-3-6).
Example(s)	Much of the information transmission should be done by way of example. The viewgraphs reflect this.

Student Participation:

Components	Activities
Practice	After the information presentation has taken place, have the students critique the bicycle/pedestrian plans that they generated as a pre-class activity.
Feedback	Provide comment and feedback to the class as appropriate.

Follow-Up:

Components	Activities
Enrichment	Assign reading for Lesson 4. As with the prior lesson, provide each student with a map of your local area. Ask them to plan an "idealized" or "optimal" bicycle or pedestrian network for the area.
Review	Provide a summary of Lesson 3 (V-3-7).

Lesson Objectives:

- Explain the impact of the current Federal surface transportation funding
- Explain the elements of a local bicycle or pedestrian plan
- Use the different analytical tools for bicycle and pedestrian planning
- Recognize the different types of mapping techniques used in bicycle and pedestrian planning

Lesson Outline:

- Federal surface transportation law and pedestrian and bicycle facilities
- Elements of local pedestrian and bicycle plans
- Latent Demand Score (LDS) model and Bicycle Compatibility Index (BCI)
- Bicycle and pedestrian maps

Elements of a Local Pedestrian Plan:

- Strategy
- Project priorities
- Engineering
- Education
- Encouragement
- Enforcement

Elements of a Local Bicycle Network Plan:

- Establish performance criteria
- Inventory the existing system
- Identify travel corridors
- Evaluate/Select routes
- Select design treatments
- Evaluate the finished plan

Application of the LDS Model:

- Assess the current BLOS
- Estimate latent demand
- Compute analytical-based priority
- Measure public priority
- Compute final needs ranking
- Designate short- and long-term route plans

Types of Maps:

- Urban bicycle map
- Bicycling guide
- Bicycling touring guide
- City and county bicycle and pedestrian plan maps

Lesson Summary:

- Current Federal transportation laws support pedestrian and bicycle planning
- There are many specific steps in developing a pedestrian or bicycle plan
- There are some analytical techniques that can be used in pedestrian and bicycle planning processes
- There are several types of maps that aid in pedestrian and bicycle planning processes

LESSON 4: PEDESTRIAN AND BICYCLE CRASH TYPES (INSTRUCTOR'S NOTES)

Objectives:

Upon completion of the assignment, the students will be able to:

1. Explain the difference between a crash and an accident.

2. Explain the dynamics of the crash-avoidance process.

3. Recognize the magnitude of the annual number of pedestrian and bicycle crashes.

4. Explain several types of pedestrian and bicycle crash types and crash characteristics.

Pre-Instruction:

Components	**Activities**
Motivation	Secure a sanitized copy of a police accident report regarding a serious pedestrian crash and a serious bicycle crash. Discuss each crash with the class, considering each as a case study.
Objectives	Present and explain the four lesson goals listed above (V-4-1).

Information Presentation:

Components	Activities
Information Sequence	Outline the presentation of the lecture (V-4-2).
Information	Explain the difference between the terms *crash* and *accident*. Emphasize that although *accidents* are not preventable, *crashes* are. Explain the crash-avoidance process (V-4-3). State the number of pedestrian and bicycle crashes (V-4-4). Describe the different types of pedestrian and bicycle crashes. Characterize each of the different crash types in terms of age of victim, time of day of the crash, location of the crash, etc. (V-4-5 through V-4-9).
Example(s)	Much of the information transmission should be done by way of example. The viewgraphs reflect this.

Student Participation:

Components	Activities
Practice	Use the activity provided in the student notes.
Feedback	Provide comment and feedback to the class as appropriate.

Follow-Up:

Components	Activities
Enrichment	Assign reading for Lesson 4. Provide each student with a map of your local area. Ask them to delineate the area's designated bicycle routes or ask them to devise a safe route to a local elementary school.
Review	Provide a summary of Lesson 4 (V-4-10).
Exercise	Ask the students to complete the exercise at the end of Lesson 4 in their workbooks. This exercise is reprinted below for your convenience. **4.7 Exercise: Design a Countermeasures Program** **Part 1** Design a program that specifically provides countermeasures aimed at reducing one (or more) common bicycle and/or pedestrian crash types. Countermeasures can include physical changes to the bicycle/pedestrian environment (engineered and constructed solutions), or education programs aimed at a particular audience that may be susceptible to certain crash types. Be specific about what the program would include, and how it would be implemented throughout a community. Include an explanation of how you would propose to evaluate the effectiveness of your program **Part 2** Using the data provided for the case study location, Piedmont Park in Atlanta, Georgia, developed some conclusions regarding the crash data obtained through the State department of transportation (DOT) for 1995, 1996, and 1997 (see Figures 4.3 to 4.8). Cross-tabulations of crashes by time of day, location, and causation factors are helpful in gaining insight into safety problems and possible countermeasures. Data available for these type evaluations are often limited due to the low percentage of reported pedestrian accidents and bicycle crashes. However, important information can be obtained by a thorough analysis of available data For the purpose of providing some general background on the case study location, the following descriptive information is provided • Piedmont Park is a large public park located approximately 3 miles north of the central business district in the midtown area of Atlanta.

	• The park is surrounded on all sides by densely populated residential neighborhoods. • Very little parking is available within the park and most park users arrive by foot, roller blades, skateboard, or bicycle. • The park has extensive walking, running, and bicycling trails, and these are the primary uses of the park. In addition, there are numerous festivals and special events. • Access to the park from surrounding neighborhoods is via surface streets, most of which have narrow (4-foot- to 5-foot-wide) sidewalks. • The park is bound on all sides by heavily traveled arterial roadways that commonly experience significant peak-hour congestion. • Two transit stations are located within walking distance near the park and frequent pedestrian access to and from the park is linked with the stations. Typical sidewalk and crosswalk treatments are used along surface streets (10th St. and 14th St.) to connect with the transit stations. Bicycles are allowed on transit fixed-rail vehicles during all operational periods. Data provided for conducting a case study evaluation of pedestrian and bicycle conditions at Piedmont Park include the following information • Bicycle Crash Locations (Figure 4.3). • Pedestrian Accident Locations (Figure 4.4). • Site Location Map (Figure 4.5). • Tabulation of Pedestrian Accident Data (Figure 4.6). • Tabulation of Bicycle Crash Data (Figure 4.7). • Usage Data Collected at Major Park Entrances (Figure 4.8). • Summary of Major Roadways (Figure 4.9). **Part 3** Obtain pedestrian accident and bicycle crash data from your State DOT for a particular roadway or area of interest. You should obtain a minimum of 3 years of data in order to conduct your analysis of factors similar to those discussed in the Piedmont Park case study location. Although local city agencies sometimes maintain crash data, the State DOT is the most reliable source of available data. Most States maintain their crash data in a computerized database system

	and sorts of the data can be conducted on various field entries to list crashes associated with either pedestrians or bicycles. These types of crashes will only constitute a very small amount of the total crashes occurring along a roadway and it may be useful to receive a full listing of all the crashes associated with your location of interest. DOT's may only maintain data along the more significant roadways and often do not include subdivision/residential streets. Most DOT personnel are very helpful and willing to work to get you the data you need. You should clearly explain your intentions, location of interest, and type of data that you would like to obtain. Submitting a request in writing is typically required so that your data request can be efficiently processed through their system. In addition to the crash data, you may need other information that will allow you to decode the crash data and to physically link the crash to a location on the roadway network. An accident/crash investigation manual is usually available that lists all of the coded entries used in creating aggregated crash tabulations. Also, a roadway features log is typically available to link milepost listings to physical map features such as intersections, bridges, and street names. In the initial phases of conducting an analysis of crashes, it is seldom necessary to access the actual crash reports. It is much more useful to utilize aggregated crash records that are available through the crash data system. Allow ample time for DOT personnel to accommodate your request within their day-to-day workload. Generally, data can be received in 2 to 3 weeks after submitting a request.

Solution Commentary	**Part 1** Students could focus on the provision of specific countermeasures aimed at reducing some of the following common bicycle and/or pedestrian crash types: • Nighttime crashes. • Mid-block crashes: - Overtaking. - Right angle. - Conflicts with on-street parking. - Mid-block pedestrian crossing. • Intersection crashes: - Right angle. - Left-turning/through conflicts - Problems in crosswalks with turning vehicles. • Identification of hazardous locations. • Crashes based on time of day. Countermeasures for each of theses crash types may take some of the following forms: **Nighttime Crashes** – One approach could be to institute a public education program that promotes the use of bicycle reflectors, reflector vests, and lights for the operation of bicycles during nighttime hours. This could be accomplished via a public awareness campaign, education program in local schools, reflector give-away program, bumper-stickers, or other similar means based on the target audience. Enforcement could be yet another initiative, although it may be difficult to convince local law enforcement to devote very much time to this effort given the demands of their profession. Physical improvements could involve the provision of improved street lighting in critical areas, such as on bike routes, sidewalks, and/or intersections. **Mid-Block Crashes** – Consider the installation of "Share the Road" warning signs and/or bike route guide signs. Re-striping the outside lane to provide additional width and provision of a designated bike

	lane could be useful countermeasures for preventing crashes. Mid-block crossing markings, speed-control measures for motor vehicles, flashing beacons, bollards, and other traffic-calming treatments can be helpful in improving the roadway environment for both pedestrians and bicyclists, thus reducing the potential for crashes. Implementing measures to reduce motor vehicle speed can be beneficial to pedestrian and bicycle safety at mid-block locations. **Intersection Crashes** – Enforcement aimed at improving adherence to traffic-control devices could be an option at problematic intersection locations. Physical improvements could include improved crossing zones, provision of pushbuttons for pedestrians and bicyclists, special pavement markings and lanes designating areas for turning and through bicycles to queue, special roadway features that help indicate the possible presence of bicyclists and pedestrians (e.g., raised intersection, islands, traffic bollards, signs, etc.), and improved lighting. Removal of obstructions to improve visibility may also benefit safety for all modes. Also, improved capacity, such as the addition of left-turn lanes can be useful in reducing erratic maneuvers on behalf of motor vehicle operators, thus improving safety for all within the intersection area. **Identification of Hazardous Locations** – Problematic spot locations at bridges, busy roadways, bottlenecks, poor alignments, steep hills, etc. could be evaluated on a case-by-case basis. Improvement of spot locations typically benefit the circulation of trips through the larger transportation network. **Crashes Based on Time of Day** – Countermeasures aimed at reducing time of day- related crashes may address conditions related to rush-hour motor vehicle traffic that only occur for a short period of time each day. Improvements aimed at addressing these types of conditions may involve prohibiting on-street parking during certain periods, institution of special circulation patterns, special warning signs, modification of traffic signals, etc. Measuring the effectiveness or performance of proposed countermeasures could include the following: **Analysis of Before and After Crash Data** – This type of data can be obtained from most state departments of transportation over various periods of time. One problem exists in that many pedestrian and bicyclist crashes go unreported and do not show up in any agency databases. The exception to this would be for severe crashes where someone is either critically or fatally injured. These types of

	occurrences are often not representative of the risks that average users face on a day-to-day basis in utilizing the transportation system. **Conduct User Surveys and Evaluate Data** – This is a time-consuming but useful method for obtaining meaningful data for evaluating perceived user risk and satisfaction with facility type. This type of data is best used at an aggregate level that allows stratification for a variety of factors, such as age, frequency of use, conditions of use, etc. The use of this subjective type of data can be effective in augmenting other objective data. **Observation at Spot Locations** – Controlled observations that are used to quantify the level of conformance and other important user behavior provide very useful data for evaluating the effectiveness and/or need for improvement. Whereas most agencies maintain extensive databases on motor vehicle counts, speeds, classification, etc., very little data is typically available on pedestrians and bicyclists. For this reason, it is typically necessary to collect this time data on an as-needed basis, based on the characteristics of the conditions being evaluated. **Tabulation and Observation of Near Misses** – This is also a useful method for quantifying the magnitude of operational problems at given locations. Data of this type is very useful in supplementing crash data available through official agency sources. Frequently, users of a problematic facility are compensating for a bad design through very cautious use and/or corrective actions made quickly on the spot that narrowly avoid the occurrence of a collision. **Spot Counts and Estimate of Exposure Measures** – In order to make comparisons between various locations and to provide an indication of severity, it is necessary to develop, collect, and apply exposure measures with respect to occurrence data such as crash frequency. Often this can be effectively addressed through short-duration spot counts aimed at tabulating the number of users of various modes present at any given location of interest. Specific users such as rollerbladers, joggers, walkers, strollers, skate boarders, etc. could all be of interest based on their differing operating characteristics. **<u>Part 2</u>** Using crash data from Piedmont Park, the following cross-tabulations

were developed:

It may also be useful to develop some motor vehicle exposure measures for bicycle/pedestrian crashes, such as bicycle/pedestrian

	Pedestrian (total =21)		Pedestrian (total =21)	
	Intersection	Mid-block	Day	Night
Frequency	18	3	11	10
Percentage	86%	14%	52%	48%

	Bicycle (total =14)		Bicycle (total =14)	
	Intersection	Mid-block	Day	Night
Frequency	13	1	10	4
Percentage	93%	7%	72%	28%

	Bicycle Crash Type (total = 14)				Severity (total =14)	
	Sideswipe	Angle	Rear-end	Head-on	Injury	PDO
Frequency	1	10	2	1	10	4
Percentage	7%	71%	14%	7%	72%	28%

Accidents and Crashes by Time of Day

Time Period	Pedestrian (21)	Bicycle (14)
4:00 p.m. – 8:00 p.m.	8 (38%)	9 (64%)
8:00 p.m. – 12:00 a.m.	7 (33%)	1 (7%)

Accidents and Crashes by Location

Location	Pedestrian (21)	Bicycle (14)
10th/Peachtree	4 (19%)	5 (36%)
10th/Juniper	2 (10%)	2 (14%)
10th/Piedmont	4 (19%)	2 (14%)
10th St. Total (East of Piedmont)	10/21 (48%)	9/14 (64%)
14th St. Total (East of Piedmont)	6/21 (28%)	2/14 (14%)
Total 14th & 10th (East of Piedmont)	16/21 (76%)	11/14 (78%)

crashes per million entering vehicles (mev) at various intersections or per million vehicle-miles (mvm) traveled for roadway segments along 10th Street and 14th Street. Additional exposure values could be developed from an extrapolation of the Human Powered Transportation sort counts taken at four of the park entrances. Use of the crash data with some exposure values should assist in creating meaningful comparisons between locations and help in identification of the most critical locations needing improvement.

From evaluation of the Piedmont Park data, the following insights were gained regarding the identification and understanding of safety problems and causation factors facing pedestrians and bicyclists in the area surrounding the park:

- Recorded pedestrian crashes and bicycle crashes in the area surrounding Piedmont Park primarily occurred at intersections. 86% of the pedestrian crashes and 93% of the bicycle crashes occurred at red intersections.

- Approximately half of the recorded pedestrian crashes (52%) occurred during daylight hours, while the remaining crashes (48%) occurred during nighttime hours.

- A predominate number of recorded bicycle crashes in the area surrounding the park occurred during daylight hours (72%).

- Most pedestrian and bicycle crashes occurred at three congested intersections located along 10th Street. These three intersections were: 10th/Peachtree, 10th/Juniper, and 10th/Piedmont. Occurrences at these intersections comprised 48% of all recorded pedestrian crashes and 64% of all recorded bicycle crashes in the areas surrounding the park.

- Another location of concentrated pedestrian and bicycle crashes is along 14th Street. This short section of roadway comprises 28% of recorded pedestrian crashes and 14% of recorded bicycle crashes in the area surrounding the park.

- 38% of pedestrian crashes and 64% of bicycle crashes occurred during periods of peak afternoon and early evening traffic, generally from 4:00 p.m. to 8:00 p.m.

- 33% of pedestrian accidents occur during late evening conditions, generally from 8:00 p.m. to 12:00 a.m.

Based on observations from evaluation of the crash data, the following improvements are suggested as possible countermeasures for improving pedestrian and bicycle safety:

1. Identify modifications needed to improve capacity, visibility, pedestrian/bicycle operations or other safety-related features at the three critical intersections of 10^{th}/Peachtree, 10^{th}/Juniper, and 10^{th}/Piedmont. Possible improvements could include improved roadway alignment, lane additions, removal of on-street parking, sidewalk/crosswalk modifications, traffic signal changes, and/or enhanced signing/pavement markings. More detailed engineering studies would be necessary to analyze and design the most feasible and effective intersection improvements for each location.

2. Evaluate the need for pedestrian improvements at the 14^{th}/Peachtree intersection and along 14^{th} Street. Likely improvements could include modification of the crosswalk configuration, installation of pedestrian signals/pushbuttons,

	removal of obstructions, sidewalk widening, increased visibility of pedestrian activities via construction of traffic-calming treatments, travel lane modifications, and/or adjustments to traffic signal phasing. 3. Installation of traffic signs along roadways adjacent to the park that alert motorists of the presence of pedestrians and bicyclists, e.g., "share the road" and "pedestrian crossing ahead." 4. Creation of signed bike routes or bike lanes to either route bicyclists away from problematic locations in the roadway network or to allocate space for bicyclists to operate in bottleneck areas, such as congested intersections and typical narrow roadway sections. 5. Improved facilities for non-motorized transportation modes at major points of ingress and egress to Piedmont Park. This would also serve to make these more visible to the motoring public and possibly provide an added level of acceptance within the roadway right-of-way for non-motorized travel modes. 6. Improved sidewalk continuity and driveway restrictions along primary routes of pedestrian access leading to and from Piedmont Park. 7. Improved use of available right-of-way width along critical routes providing access to the park. This could involve widening sidewalks, removal of on-street parking, and/ or modification of travel lanes. 8. Provision of traffic-calming measures to reduce motor vehicle speed along roadways adjacent to the park or critical routes providing access to the park. 9. Education campaigns for bicyclists and motorists aimed at addressing problems related to mixed-mode operation along city streets during rush hour conditions. **<u>Part 3</u>** Collect data and conduct analyses similar to the evaluation conducted in Part 2 for Piedmont Park. The evaluation should be conducted in as much detail as possible. Students would benefit greatly by

	conducting site reviews that serve to inventory conditions present at the various locations of interest.

Lesson Objectives:

- Explain the difference between a *crash* and an *accident*
- Explain the dynamics of the crash-avoidance process
- Recognize the magnitude of the annual number of pedestrian and bicycle crashes
- Explain several types of pedestrian and bicycle crash types and crash characteristics

Lesson Outline:

- How is a crash different from an accident?
- Crash-avoidance process
- Pedestrian and bicycle crashes
  - Number
  - Characteristics
  - Types

Crash Avoidance Process:

- Search
- Detect
- Evaluate
- Decide
- Take action

Magnitude of the Problem:

- 6,500 pedestrians killed
- 900 bicyclists killed
- 14% of all highway fatalities
- 90,000 urban pedestrian injuries
- 60,000 urban bicyclist injuries

Pedestrian Crash Characteristics:

- Young people are over-represented
- 33% of all crashes result in serious injury or death
- Alcohol or drugs are involved in ~15% of all crashes
- Crashes most often occur during late afternoon or early evening hours

Pedestrian Crash Characteristics (continued):

- ~Two-thirds of all crashes occur in urban areas
- 60% of road-related crashes occur on two-lane roads
- Pedestrians were solely at fault in 43% of the crashes
- Drivers were solely at fault in 35% of the crashes

Bicycle Crash Characteristics:

- ~Three-quarters of all crashes occur around intersecting roads
- Young people are over-represented
- 18 percent of the bicycle-motor vehicle crashes result in serious injuries or death
- The number of alcohol- or drug- impaired riders may be on the rise

Bicycle Crash Characteristics (continued):

- Crashes most often occur during late afternoon or early evening
- ~Two-thirds of all crashes occur in urban areas
- 60% of road-related crashes occur on two-lane roads
- Bicyclists were solely at fault in 50% of the crashes
- Drivers were solely at fault in 28% of the crashes

Pedestrian/Bicycle Crash Types:

(Instructors should provide a series of slides here that directly illustrate the different crash types that are highlighted in the text of Section 4.6.)

Lesson Summary:

- Bicycle and pedestrian crashes are preventable
- Bicycle and pedestrian crashes account for a large portion of the highway safety problem in the United States
- The types of crashes that occur and the characteristics of these crashes make prevention a more attainable goal

LESSON 5: ADAPTING SUBURBAN COMMUNITIES FOR BICYCLE AND PEDESTRIAN TRAVEL (INSTRUCTOR'S NOTES)

Objectives:

Upon completion of this lesson, students will be able to:

1. Recognize the types of suburban development patterns that have led to automobile-oriented travel.

2. Demonstrate different strategies for re-designing suburban areas to accommodate non-motorized transport.

Pre-Instruction:

Components	Activities
Motivation	Take the class for a walk along a commercial strip or other equally pedestrian-unfriendly location in your area. Point out the problems with the development type in terms of how it discourages pedestrian and/or bicycle travel.
Objectives	Present and explain the two lesson goals listed above (V-5-1).

Information Presentation:

Components	Activities
Information Sequence	Outline the presentation of the lecture (V-5-2 and V-5-3).
Information	Review the historical development of urban and suburban land use as covered in Lesson 1. Focus on the suburban practices of leap-frogging and in-filling. Explain the importance of understanding the needs of the various users of non-motorized transportation, developing strategies to promote bicycling and walking, and recognizing current suburban land use forms that discourage non-motorized transportation (V-5-4 through V-5-6). Explain the inherent dangers in certain types of suburban development and land use features that affect bicyclists and pedestrians (V-5-7). Contrast planning for the automobile with planning for non-motorized transportation (V-5-8 and V-5-9). Demonstrate how good pedestrian and bicycling connections to transit services can encourage a symbiosis between these various modes. Provide examples of commercial and office developments that encourage walking and biking (V-5-10 and V-5-11).
Example(s)	Much of the information transmission should be done by way of example. The viewgraphs reflect this.

Student Participation:

Components	Activities
Practice	Use the activity provided in the student notes.
Feedback	Provide comment and feedback to the class as appropriate.

Follow-Up:

Components	Activities
Enrichment	Assign reading for Lesson 6. Ask the students to find an example of neo-traditional development completed within the last 10 years. Have them be prepared to report their findings to the rest of the class.
Review	Provide a summary of Lesson 5 (V-5-12).
Exercise	Ask the students to complete the exercise at the end of Lesson 5 in their workbooks. This exercise is reprinted below for your convenience. **5.10 Exercise** Describe 10 to 15 ways in which you would propose to retrofit a nearby residential development (or one that you grew up in) to make bicycling and walking viable forms of transportation. Elaborate on each idea, explaining how it would work and why it would improve the livability of the community

Lesson Objectives:

- Recognize suburban development patterns that have led to automobile travel
- Demonstrate strategies for re-designing suburban areas to accommodate non-motorized transportation

Lesson Outline:

- Historical development of urban and suburban land use
- User needs
- Strategies that promote bicycling and walking
- Suburban land use forms that discourage non-motorized transportation
- Safety concerns

Lesson Outline (continued):

- Planning for the automobile
- Planning for non-motorized transportation
- Connections to transit services
- Commercial and office developments that encourage walking and biking

Suburban Development:

- Streetcar suburbs
- Leap-frogging
- Auto orientation
- In-filling
- Abandonment of the street

User Groups:

- Children
- Parents
- Elderly
- Commuters
- Recreationists

Promotional Strategies:

- Serve large groups
- Improve unsafe, frequently used locations
- Improve the busiest locations
- Attract new users

Present Land Use Forms:

- Individual tract subdivisions
- Linear arterial streets
- Bypassed vacant land

Planning for Non-Motorized Transportation:

- Conceptual planning
- Build around existing routes
- Arterials vs. collectors
- Identify major generators of non-motorized traffic

Planning for Non-Motorized Transportation (continued):

- Identify major attractors of non-motorized traffic
- Compare existing routes vs. demand
- Consider where improvements should be made
  - Existing
  - New
- Consider the impacts of new development

Development Features That Encourage Walking and Biking:

- Setbacks
- Orientation and facades
- On-site walkways
- Access between adjacent developments
- Lighting

Development Features That Encourage Walking and Biking (continued):

- Improvements between the building and the street
- Lot coverage
- Parking reduction
- Parking lot design

Lesson Summary:

- Suburban development patterns have made it difficult to use non-motorized transportation

- There are many ways to change this condition
  - Existing retrofits
  - New developments

LESSON 6: NEO-TRADITIONAL NEIGHBORHOOD DESIGN (INSTRUCTOR'S NOTES)

Objectives:

Upon completion of this lesson, students will be able to:

1. Recognize neo-traditional neighborhood design.

2. Explain the key elements of neo-traditional neighborhood design.

Pre-Instruction:

Components	Activities
Motivation	To contrast with the motivational activity of the last lesson, take the class for a walk through an older neighborhood or other equally pedestrian-friendly location in your area that typifies neo-traditional neighborhood design. Point out the positive aspects of the development type in terms of how it encourages pedestrian and/or bicycle travel.
Objectives	Present and explain the two lesson goals listed above (V-6-1).

Information Presentation:

Components	Activities
Information Sequence	Outline the presentation of the lecture (V-6-2).
Information	Explain what neo-traditional neighborhood design is and how it encourages bicycling and walking. Illustrate the different elements of neo-traditional neighborhood design (V-6-3 and V-6-4).
Example(s)	Make liberal use of examples (e.g., slides, videotape) to illustrate neo-traditional neighborhood design.

Student Participation:

Components	Activities
Practice	Have the students sketch out a completely new development using neo-traditional neighborhood design concepts.
Feedback	Provide comment and feedback to the class as appropriate.

Follow-Up:

Components	Activities
Enrichment	Assign reading for Lesson 7. Provide the students with a copy of the local planning or zoning ordinance. Have them look for the sections relevant to non-motorized transportation.
Review	Provide a summary of Lesson 6 (V-6-5).

Lesson Objectives:

- Recognize neo-traditional neighborhood design
- Explain the key elements of neo-traditional neighborhood design

Lesson Outline:

- What is neo-traditional neighborhood design?
- How does neo-traditional neighborhood design encourage bicycling and walking?
- What are the different elements of neo-traditional neighborhood design?

Elements of Neo-Traditional Neighborhood Design:

- Basic street layout
- Use of alleys
- Street design speed
- Street width
- Curb radii
- Intersection geometry

Elements of Neo-Traditional Neighborhood Design (continued):

- Street trees and landscaping
- Street lighting
- Sidewalk width and location
- Building setbacks
- Parking

Lesson Summary:

- Neo-traditional neighborhood design is a means of encouraging non-motorized transportation

- There are many design elements that constitute a neo-traditional neighborhood

LESSON 7: USING LAND USE REGULATIONS TO ENCOURAGE NON-MOTORIZED TRAVEL (INSTRUCTOR'S NOTES)

Objectives:

Upon completion of this lesson, students will be able to:

1. Describe how land use regulations can be used to support non-motorized transportation.

2. Cite examples of land use planning practices that encourage non-motorized travel. Students will understand and can explain the key elements of neo-traditional neighborhood design.

Pre-Instruction:

Components	**Activities**
Motivation	Engage the class in a discussion of their findings relative to the assignment for this lesson. Ask them to report any conclusions they reached regarding (including, but not limited to): • Sidewalk regulations • Bikeways • Clustering of buildings • Building setbacks • Parking (both automobile and bicycle) • Provisions for transit
Objectives	Present and explain the two lesson goals listed above (V-7-1).

Information Presentation:

Components	Activities
Information Sequence	Outline the presentation of the lecture (V-7-2).
Information	Describe what elements of general zoning and subdivision regulation are key in designing for non-motorized transportation (V-7-3 and V-7-4). Explain how site plan review performs an oversight function regarding the design. Go over the site plan checklist that is provided in the Student's Guide. Describe what elements of zoning and subdivision regulation are key in designing for non-motorized transportation in commercial areas (V-7-5 and V-7-6). Go over the different aspects of a pedestrian/bicycle-oriented neighborhood (V-7-7 and V-7-8).
Example(s)	Acquire and make use of examples from the reference materials cited at the end of the Student's Guide to illustrate the various planning and zoning concepts that you discuss.

Student Participation:

Components	Activities
Practice	Have the students formulate changes to the local planning or zoning ordinance so that walking and biking are encouraged.
Feedback	Provide comment and feedback to the class as appropriate.

Follow-Up:

Components	Activities
Enrichment	Assign reading for Lesson 8. Have the students check newspapers and magazines for stories about pedestrian or bicycling accidents. Ask them to bring copies of whatever they find to the next class.
Review	Provide a summary of Lesson 7 (V-7-9).

Lesson Objectives:

- Describe how land use regulations can be used to support non-motorized transportation
- Cite examples of land use planning practices that encourage non-motorized travel

Lesson Outline:

- General elements of zoning and subdivision regulation
- Site plan review as an oversight function
- Zoning and subdivision regulation for commercial areas
- Pedestrian- and bicycle-oriented neighborhoods

General Elements of Zoning and Subdivision Regulation:

- Subdivision layout
- Cul-de-sacs
- Future extension of streets
- Staged implementation
- Internal circulation

General Elements of Zoning and Subdivision Regulation (continued):

- Lot coverage
- Front-access parking
- Parking reduction
- Design standard compliance

Zoning and Subdivision Regulation for Commercial Developments:

- Setbacks
- Orientation and facades
- On-site circulation
- Access between developments

Zoning and Subdivision Regulation for Commercial Developments (continued):

- Lighting
- Building street interface
- Parking lots

Aspects of a Pedestrian and Bicycle-Oriented Neighborhood:

- Connectivity
- Alternative routes
- Pedestrian/Bike scale
- Narrow streets

Aspects of a Pedestrian and Bicycle-Oriented Neighborhood (continued):

- Parallel parking
- Mix of building sizes
- Mix of building types
- Public spaces

Lesson Summary:

- Zoning and planning regulations can be effective tools in encouraging pedestrian and bicycle travel
- Effective planning for pedestrians and bicyclists can be done in both residential and commercial areas
- Planners and designers must remember to think with a pedestrian and bicycle orientation

LESSON 8: TORT LIABILITY AND RISK MANAGEMENT (INSTRUCTOR'S NOTES)

Objectives:

Upon completion of this lesson, students will be able to:

1. Describe the significance of tort liability as it relates to non-motorized transportation.

2. Define basic terms related to tort liability.

3. Formulate a basic risk-reduction strategy.

Pre-Instruction:

Components	Activities
Motivation	Ask the class to present what they found in either newspapers or magazines relative to the assignment for this lesson. After an individual student describes a pedestrian or bicycle accident, have the class consider who or what contributed to the occurrence of the accident. Be sure to have them think about more than one of the parties involved (including the local transportation agency, if appropriate).
Objectives	Present and explain the three lesson goals listed above (V-8-1).

Information Presentation:

Components	Activities
Information Sequence	Outline the presentation of the lecture (V-8-2).
Information	Present examples of pedestrian and bicyclist injuries that led to lawsuits. Explain the basic definitions of terms related to tort liability (V-8-3). Discuss the process of formulating a risk management strategy. Cite common design errors that can lead to tort liability problems (V-8-4 and V-8-5).
Example(s)	Discuss the many examples given in the Student's Guide to demonstrate how serious tort problems can be.

Student Participation:

Components	Activities
Practice	Have the students design a risk management plan related to pedestrian and bicycling issues. Focus on some of the issues discussed in other lessons (e.g., planning, programming, and maintenance) to illustrate that risk management is integrated with these other activities.
Feedback	Provide comment and feedback to the class as appropriate.

Follow-Up:

Components	Activities
Enrichment	Assign reading for Lesson 9. Have the students contact the local transit agency to check on whether your local transit agency accommodates pedestrian or bicycling activities. For example, are bikes allowed on buses, light-rail cars, heavy-rail cars, or commuter rail cars? Are there bicycle parking facilities (e.g., racks, lockers) located at or near rail transit stations or bus stops? Does the transit agency offer service to pedestrian- or bicycle-oriented recreation/amenities (e.g., downtown shopping, parks, trailheads, amusement parks)?
Review	Provide a summary of Lesson 8 (V-8-6).

Lesson Objectives:

- Describe the significance of tort liability
- Define basic terms
- Formulate a risk-reduction strategy

Lesson Outline:

- Examples of pedestrian and bicyclist injuries that have led to lawsuits
- Basic definitions of terms related to tort liability
- Formulation of a risk management strategy
- Errors that can lead to tort problems

Basic Definitions:

- Tort
- Negligence
- Ordinary care
- Sovereign immunity

Errors That Can Lead to Tort Problems:

- Drainage grates
- Path discontinuity
- Inadequate curve radii
- Surface problems

Errors That Can Lead to Tort Problems (continued):

- Poor sight distance
- Not thinking about pedestrian and bikes
- Bridges and underpasses
- Maintenance

Lesson Summary:

- Tort liability is a serious problem
- The risk associated with providing pedestrian and bicycle facilities can be managed
- A plan of prudent design, operations, and maintenance will help to manage the risk

LESSON 9: BICYCLE AND PEDESTRIAN CONNECTIONS TO TRANSIT (INSTRUCTOR'S NOTES)

Objectives:

Upon completion of this lesson, students will be able to:

1. Describe the problems related to the lack of pedestrian and bicycle connections to transit.

2. Cite examples of how pedestrians are being accommodated by transit services.

3. Cite examples of how bicyclists are being accommodated by transit services.

4. Describe the elements of programs wherein pedestrian and bicycle travel has been successfully integrated with transit.

Pre-Instruction:

Components	**Activities**
Motivation	Ask the class to present the results of their inquiries regarding how well your local transit agency accommodates pedestrians and bicyclists.
Objectives	Present and explain the four lesson goals listed above (V-9-1).

Information Presentation:

Components	Activities
Information Sequence	Outline the presentation of the lecture (V-9-2 and V-9-3).
Information	Describe the problems and opportunities related to providing good bicycle and pedestrian connections to transit. Discuss examples of how some cities are providing good connections to transit services for pedestrians. Explain why and how bicycles should be integrated with transit (V-9-4 and V-9-5). Cover the various concerns of both the transit agency and bicyclists (V-9-6 and V-9-7). Describe the "bikes on buses" and "bikes on rails" programs. Describe different types of bicycle parking facilities. Cite the elements of successful bike-transit programs (V-9-8).
Example(s)	Show multiple examples (e.g., slides, videotape) of some of the methods cited in the Student's Guide regarding how transit agencies accommodate pedestrians and bicyclists.

Student Participation:

Components	Activities
Practice	Use either of the exercises presented at the end of the Student's Guide section.
Feedback	Provide comment and feedback to the class as appropriate.

Follow-Up:

Components	Activities
Enrichment	Assign reading for Lesson 10. Have the students locate information on biking and walking trails in the area. Ask them to consider both functional (i.e., home-based work, home-based shopping, non-home-based shopping) travel and recreational (both home-based and non-home-based) travel needs.
Review	Provide a summary of Lesson 9 (V-9-9).
Exercise	Ask the students to complete the exercise at the end of Lesson 9 in their workbooks. This exercise is reprinted below for your convenience. **9.12 Exercise** Choose a local transit station (or individual transit stop) and determine the potential catchment area. Design a program for increasing bicycle and pedestrian access to the transit station, including both design improvements and education/promotion efforts. For physical improvements, include both the immediate vicinity, as well as connections to origins that lie in the catchment area. **Alternate Exercise** Choose a nearby transit stop or park-n-ride station and ride a bike or walk to it. Document the problems along the way, as well as those you experience when you arrive at the station/stop. Given your knowledge of the community, what would it take to get people to bicycle and walk to this site?

Lesson Objectives:

- Describe the problems related to pedestrian/bicycle connections to transit
- Cite examples of how pedestrians are being served
- Cite examples of how bicyclists are being served
- Describe the elements of successful programs

Lesson Outline:

- Problems and opportunities related to providing bicycle and pedestrian connections to transit
- Examples of good connections to transit services for pedestrians
- How and why bicycles should be integrated with transit

Lesson Outline (continued):

- Transit agency and bicyclist concerns
- “Bikes on buses” programs
- “Bikes on rails” programs
- Bicycle parking facilities
- Elements of successful bike-transit programs

Why Bicycles Should Be Integrated With Transit:

- Significant amounts of the population live near transit stations in urban areas
- Improvements for bicycle access lead to increased ridership
- Vehicle modifications and station access improvements can be made at modest cost

How Bicycles Should Be Integrated With Transit:

- Bike racks on buses
- Transporting bikes on light and heavy rail, commuter rail, and intercity rail vehicles
- Bike parking
- Station design improvements
- Links to transit stops
- Bicycle-ferry programs

Transit Agency Concerns:

- Schedule adherence
- Safety and protection of transit property
- Equipment procurement

Bicyclist Concerns:

- Fares
- Permits
- Fees
- Restricted hours
- Parking
- Access

Elements of Successful Bike-Transit Programs:

- Demonstration project
- Advisory committees
- Marketing and promotion

Lesson Summary:

- Providing good links to transit for pedestrians and bicyclists is essential
- Providing good facilities for pedestrians and bicyclists at transit stations is essential
- Linking pedestrians and bicyclists with transit can increase transit ridership

LESSON 10: OFF-ROAD TRAILS (INSTRUCTOR'S NOTES)

Objectives:

Upon completion of this lesson, students will be able to:

1. Describe the importance of off-road trails for walking and bicycling.

2. Cite the different types of trails.

3. Outline different issues related to trail design.

Pre-Instruction:

Components	Activities
Motivation	Ask the class to present the results of their inquiries regarding biking and walking trails in the area. Have them report on where the trails begin and end, how wide the trails are, and how frequently they are used.
Objectives	Present and explain the three lesson goals listed above (V-10-1).

Information Presentation:

Components	Activities
Information Sequence	Outline the presentation of the lecture (V-10-2).
Information	Discuss the importance of off-road trails as they relate to the overall transportation network. List and describe the different types of trails (V-10-3 and V-10-4). Discuss the different issues related to trail design (V-10-5 and V-10-6).
Example(s)	Show multiple examples (e.g., slides, videotape) of the types of trails and trail design elements.

Student Participation:

Components	Activities
Practice	Using a local U.S. Geological Survey map, have the students design a new trail that would enhance recreation and travel in you area. Have the students discuss the reasons behind the selection of their route.
Feedback	Provide comment and feedback to the class as appropriate.

Follow-Up:

Components	Activities
Enrichment	Assign reading for Lesson 11. Have the students locate a local example of traffic calming. Have them visit the location, take measurements, and sketch the traffic-calming device. Have them critique the effectiveness of the device.
Review	Provide a summary of Lesson 10 (V-10-7).

Lesson Objectives:

- Describe the importance of off -road trails for walking and bicycling
- Cite the different types of trails
- Outline different issues related to trail design

Lesson Outline:

- Importance of off-road trails as they relate to the transportation network
- Different types of trails
- Trail design issues

Different Types of Trails:

- Urban trails and pathways
- Rail-trails
- Trails in greenways
- Interpretive trails

Different Types of Trails (continued):

- Historic trails
- Rural trails
- Primitive trails

Trail Design Issues:

- Location and use
- Trail width
- Traffic control
- Paths adjacent to roadways

Trail Design Issues (continued):

- Intersection design
- Restricting motor vehicles
- Pavement design

Lesson Summary:

- Trails can provide additional links in the pedestrian and bicycle network
- Trails can be of many types
- There are many different issues related to trail design

LESSON 11: TRAFFIC CALMING (INSTRUCTOR'S NOTES)

Objectives:

Upon completion of this lesson, students will be able to:

1. Cite the goals and objectives of traffic calming.

2. Describe the issues related to traffic calming.

3. List several types of traffic-calming devices, along with some of the advantages and disadvantages associated with each.

Pre-Instruction:

Components	Activities
Motivation	Ask the class to present the results of their search to locate a local example of traffic calming. Ask them to report on the details they collected about the device (e.g., a dimensioned sketch) and give their critique of the device's effectiveness.
Objectives	Present and explain the three lesson goals listed above (V-11-1).

Information Presentation:

Components	Activities
Information Sequence	Outline the presentation of the lecture (V-11-2).
Information	Discuss the need for traffic calming. List and describe the goals and objectives of traffic calming (V-11-3 and V-11-4). Discuss the issues related to traffic calming (V-11-5). Discuss the different types of traffic-calming devices and the advantages and disadvantages of each (V-11-5 through V-11-8).
Example(s)	Show examples (e.g., slides, videotape) of the different types of traffic-calming devices.

Student Participation:

Components	Activities
Practice	Use one of the activities provided in the Student's Guide.
Feedback	Provide comment and feedback to the class as appropriate.

Follow-Up:

Components	Activities
Enrichment	Assign reading for Lesson 12. Have the students review and critique the latest version of the *Manual on Uniform Traffic Control Devices* (MUTCD) as it relates to accommodating pedestrians and bicyclists in work areas.
Review	Provide a summary of Lesson 11 (V-11-9).
Exercise	Ask the students to complete the exercise at the end of Lesson 9 in their workbooks. This exercise is reprinted below for your convenience. **11.5 Exercise** Do one of the following exercises 1. Choose a site-specific location (such as two to three blocks of a local street) where fast traffic or short cuts are a problem. Conduct a site analysis to determine problems. Prepare a detailed site solution that incorporates several traffic-calming devices. Illustrate with drawings and describe the anticipated changes in traffic speed. 2. Prepare a traffic-calming solution for an entire neighborhood or downtown area that illustrates an area-wide approach to slowing traffic. Conduct a site analysis to determine problem areas. Illustrate your solutions and describe the anticipated changes in traffic speed and flow.

Lesson Objectives:

- Cite the goals and objectives of traffic calming
- Describe issues related to traffic calming
- List types of traffic-calming devices and their advantages and disadvantages

Lesson Outline:

- Need for traffic calming
- Goals and objectives of traffic calming
- Traffic-calming issues
- Types of traffic-calming devices

Goals and Objectives of Traffic Calming:

- Improved street “feel”
- Enhanced aesthetics
- Reduced crime
- Balance among modes

Goals and Objectives of Traffic Calming (continued):

- Increased safety
- Improved air quality and noise reduction
- Decreased fuel consumption
- Accommodation of motor vehicles

Traffic-Calming Issues:

- Safety
- Impact of traffic operations
- Lack of proven design standards
- Liability
- Emergency/Service vehicle access
- Impacts on bicycling

Types of Traffic Calming Devices:

- Raised pavement areas
- Reduced street area
- Street closures
- Traffic diversion
- Texture and visual devices
- Parking

Combination Devices:

- Woonerf
- Entry treatments
- Shared surfaces
- Bicycle boulevards

Combination Devices (continued):

- Slow streets
- Channelization
- Traffic calming on major roads
- Modified intersection design

Lesson Summary:

- Traffic calming is a viable alternative for having different types of transport share the street
- There are many types of traffic-calming devices and strategies from which to choose

LESSON 12: PEDESTRIAN AND BICYCLE FACILITIES IN WORK ZONES (INSTRUCTOR'S NOTES)

Objectives:

Upon completion of this lesson, students will be able to:

1. Cite problems and associated solutions for helping pedestrians and bicyclists navigate work zones.

Pre-Instruction:

Components	Activities
Motivation	Ask the class to present the results of their review and critique of the latest version of the *Manual on Uniform Traffic Control Devices* (MUTCD) as it relates to what accommodations are made for pedestrians and bicyclists.
Objectives	Present and explain the lesson goal listed above (V-12-1).

Information Presentation:

Components	Activities
Information Sequence	Outline the presentation of the lecture (V-12-2).
Information	Discuss the problems pedestrians and bicyclists experience in work areas. List and describe the elements of work-zone traffic control planning that might alleviate some of the problems of pedestrians and bicyclists (V-12-3 and V-12-4).
Example(s)	Show examples (e.g., slides, videotape) of the different ways that pedestrians and bicyclists are accommodated in work areas.

Student Participation:

Components	Activities
Practice	Discuss how the MUTCD or your State signing manual could be improved to better accommodate pedestrians and bicyclists.
Feedback	Provide comment and feedback to the class as appropriate.

Follow-Up:

Components	Activities
Enrichment	Assign reading for Lesson 13. Have the students identify some place in your community that they would classify as a "pedestrian space." Have them consider why pedestrians congregate in this area and, more specifically, what elements of the place make the location a "pedestrian space."
Review	Provide a summary of Lesson 12 (V-12-5).

Lesson Objectives:

- Cite problems with and solutions for helping pedestrians and bicyclists navigate work zones

Lesson Outline:

- Problems of pedestrians and bicyclists in work areas
- Work-zone elements that might alleviate the problems

Planning and Design Elements:

- Advance warning and guidance
- Illumination and reflectorization
- Separating pedestrians and bicyclists from vehicular traffic
- Accommodating people with ambulatory impairments

Planning and Design Elements (continued):

- Accommodating the visually impaired
- Surface irregularities
- Temporary walkways or bikeways

Lesson Summary:

- Work areas can be very unfriendly places for pedestrians and bicyclists
- There are ways to accommodate all types of traffic in a work area

LESSON 13: WALKWAYS, SIDEWALKS AND PUBLIC SPACES (INSTRUCTOR'S NOTES)

Objectives:

Upon completion of this lesson, students will be able to:

1. Describe the basic requirements for sidewalks.

2. List locations where sidewalks are needed.

3. Describe the elements that make up an inviting pedestrian space.

Pre-Instruction:

Components	**Activities**
Motivation	Ask the class to report on the place they identified as a "pedestrian space." Have them explain what are the design elements that make that location a pleasant space for pedestrians.
Objectives	Present and explain the three lesson goals listed above (V-13-1).

Information Presentation:

Components	Activities
Information Sequence	Outline the presentation of the lecture (V-13-2).
Information	Discuss the requirements for basic sidewalks (V-13-3 and V-13-4). Explain where sidewalks should be provided (V-13-5). Describe the design elements that make up a pleasant pedestrian space (V-13-6 and V-13-7).
Example(s)	Show examples (e.g., slides, videotape) of the different, well-done pedestrian areas.

Student Participation:

Components	Activities
Practice	Use one of the activities provided in the Student's Guide.
Feedback	Provide comment and feedback to the class as appropriate.

Follow-Up:

Components	Activities
Enrichment	Assign reading for Lesson 14. Ask the students to find examples of poorly signed and marked pedestrian areas. Have them draw a sketch that highlights some of the problems at the location.
Review	Provide a summary of Lesson 13 (V-13-8).
Exercise	Ask the students to complete the exercise at the end of Lesson 13 in their workbooks. This exercise is reprinted below for your convenience. **13.7 Exercise: Design a Pedestrian Space** **Part 1** Choose an existing public space that currently does not encourage walking and redesign it to better accommodate pedestrians. Your plan should be developed at a conceptual level. You should prepare a plan view drawing with enough information to identify major existing features, proposed improvements, and impacts. Profile and cross-section view drawings are also helpful in presenting particular details required to construct your proposed improvements. Aerial photographs and U.S. Geological Survey topographic maps often provide a good background for overlaying proposed improvements **Part 2** Conduct a pedestrian capacity analysis for the Piedmont Park case study location (as described in Exercise 3.8 of Lesson 3) using procedures described in the *Highway Capacity Manual*. The four major park entrances, as indicated on the Site Location Map, should be evaluated to determine the pedestrian level of service (LOS). In order to conduct this evaluation, the following assumptions should be utilized • Expand 15-minute pedestrian counts included in the park usage data to represent hourly volumes. • All of the pedestrian volume at each of the four entrances accesses the park on existing 5-foot-wide feet wide sidewalks. Utilize and document other assumptions as necessary in order to

	conduct the LOS analysis. Be sure to evaluate the sensitivity of values related to your assumptions Determine the existing level of service for pedestrians at the four major park entrances. Do the sidewalks need to be widened? In addition, evaluate pedestrian level of service under the following scenarios: • Average weekday pedestrian traffic is anticipated to double in 5 years, will 5-foot-wide sidewalks be adequate? • Special events will generate pedestrian volumes five times those measured for an average weekday.
Solution Commentary	**<u>Part 1</u>** This plan could be developed using overlays on an existing map or aerial photograph in association with enlarged details of special areas of interest. Typical construction details and section views should be used to augment the plan view layout. Choosing case study locations where students can thoroughly review the site during field review visits will greatly enhance the value of this exercise. **<u>Part 2</u>** Data from the Piedmont Park case study and the procedures described in the *Highway Capacity Manual* should lead to relatively straightforward analysis under the various conditions. The level of service (LOS) should be determined using the existing counts, future average weekday volumes, and future special events volumes. Students should carefully document all analysis assumptions, discuss the sensitivity of the assumptions, and relate LOS findings to operational and improvement recommendations.

Lesson Objectives:

- Describe the requirements for sidewalks
- List locations where sidewalks are needed
- Describe elements that make up inviting pedestrian spaces

Lesson Outline:

- Requirements for basic sidewalks
- Where sidewalks should be provided
- Design elements that make up a pleasant pedestrian space

Requirements for Basic Sidewalks:

- Minimum width
- Desirable width
- Curbing
- Paving materials
- Borders and buffers
- Street furniture placement

Requirements for Basic Sidewalks (continued):

- Grade
- Stairs
- Landscaping
- Rural sidewalks
- Bridge sidewalks
- Corners

Where Sidewalks Should Be Provided:

- Schools
- Transit stops
- Parks/Sports areas
- Shopping districts
- Recreational corridors
- Medical complexes and hospital
- Public buildings

Design Elements That Make Up a Pleasant Pedestrian Space:

- Trees
- Pavers
- Awnings
- Outdoor cafes
- Alleys/Narrow streets

Design Elements That Make Up a Pleasant Pedestrian Space (continued):

- Kiosks
- Play areas
- Public art
- Pedestrian streets/malls
- Transit malls

Lesson Summary:

- Sidewalks should be designed to meet certain minimum requirements
- Sidewalks should be provided for certain types of land use
- Different elements of design are key to creating inviting pedestrian spaces

LESSON 14: PEDESTRIAN SIGNING AND PAVEMENT MARKINGS (INSTRUCTOR'S NOTES)

Objectives:

Upon completion of this lesson, students will be able to:

1. Describe the regulatory signs related to pedestrians.

2. Describe the warning signs related to pedestrians.

3. Describe the pavement markings related to pedestrians.

Pre-Instruction:

Components	Activities
Motivation	Ask the class to report on the examples they found of poorly signed and marked pedestrian areas. Have them describe what were the problems they noted at the location. Elicit their ideas on how the situation could be remedied through improved signing and marking.
Objectives	Present and explain the three lesson goals listed above (V-14-1).

Information Presentation:

Components	Activities
Information Sequence	Outline the presentation of the lecture (V-14-2).
Information	Discuss the planning and design considerations for implementing signing and markings to control and protect pedestrian movements. Describe the regulatory signs related to pedestrians (V-14-3). Describe the warning signs related to pedestrians (V-14-4). Describe the pavement markings related to pedestrians (V-14-5). Discuss how signs are also an important part of the pedestrian wayfinding system.
Example(s)	Show examples (e.g., slides, videotape) of the different signs and markings related to pedestrians. Show examples (e.g., slides, videotape) of well-done pedestrian guide signing.

Student Participation:

Components	Activities
Practice	Prepare a drawing of an unsigned, unmarked complex intersection or interchange. Ask the students to design a signing and marking plan that will accommodate both motorized and non-motorized traffic.
Feedback	Provide comment and feedback to the class as appropriate.

Follow-Up:

Components	Activities
Enrichment	Assign reading for Lesson 15. Assign the first portion of the assignment for the exercise given in Lesson 15, wherein the students are asked to photograph four urban intersections.
Review	Provide a summary of Lesson 14 (V-14-6).
Exercise	Ask the students to complete the exercise at the end of Lesson 14 in their workbooks. This exercise is reprinted below for your convenience. **14.8 Exercise** The need to develop and detail pedestrian signs and pavement markings in a manner in which these provisions can be constructed within the normal field of highway construction is an extremely important issue. Signs and pavement markings for a proposed roadway project are specified through a detailed system of standard drawings, specifications, and bid item numbers. An example plan view drawing demonstrating this method for highway-related signs and pavement markings using Caltrans (California Department of Transportation) specifications is provided for reference in Figure 14-1. Engineers use the standards to ensure uniform construction and contractors use the standards to develop construction cost estimates for their bids. The use of these procedures in developing designs is a critical link in the continuum of planning, designing, and constructing transportation facilities. Construction of pedestrian and bicycle facilities should make full use of this well-established system. Most State DOT's have a variety of specifications that pertain to pedestrian and bicycle facilities. Specific standard drawings pertaining to bicycle and pedestrian facility construction as taken from the Caltrans Standard Plans document are summarized below. Develop a plan to install pedestrian signs and pavement markings that uses nomenclature and reference standards from your State DOT. Estimate the quantity of each construction item needed and develop an engineer's construction cost estimate. You will need to utilize the following resources: • Standard Drawings (periodically published document).

	• Standard Specifications (periodically published document). • Bid Item Numbers (typically a published list). • Statewide Average Bid Summary (typically assembled several times a year).
Solution Commentary	Students should conduct this exercise in as much detail as possible. If this exercise is conducted on a conceptual level only, the effectiveness of this activity will be significantly reduced. The objective is to help the student understand to what degree needed improvements for bicycles can be addressed within the existing system of standards for roadway construction, signing, and pavement markings. It is also intended that students will gain an appreciation for the level of detail and exacting form that engineering plans take in the real world of public works construction projects.

Lesson Objectives:

- Describe the regulatory signs related to pedestrians
- Describe the warning signs related to pedestrians
- Describe the pavement markings related to pedestrians

Lesson Outline:

- Planning and design considerations
- Regulatory signs
- Warning signs
- Pavement markings
- Pedestrian wayfinding systems

Regulatory Signs:

- Stop
- Yield
- No right turn on red (RTOR)
- Pedestrian prohibitions
- Pedestrian crossings
- Signs related to pedestrian signals

Warning Signs:

- Pedestrian crossing
- Advance pedestrian crossing
- Playground
- School crossing
- Advance school crossing
- School bus stop ahead

Pavement Markings:

- Crosswalks
  - Standard
  - Ladder
  - Diagonal
  - Striped/Skipped

- Stop bars
  - Staggering at RTOR locations

- STOP/YIELD
- PED XING
- SCHOOL XING

Lesson Summary:

- Signing and marking are important for controlling and segregating motorized and non-motorized traffic

- Appropriate pedestrian signing and marking improve the pedestrian wayfinding system

LESSON 15: PEDESTRIAN ACCOMMODATIONS AT INTERSECTIONS (INSTRUCTOR'S NOTES)

Objectives:

Upon completion of this lesson, students will be able to:

1. Describe the major issues related to safely accommodating pedestrians at intersections.

2. Explain when, where, and how to use crosswalks.

3. Explain how to use curb bulbs to design safe intersections for pedestrians.

4. Explain how to use pedestrian signals.

5. Explain how to use pedestrian refuge islands.

Pre-Instruction:

Components	**Activities**
Motivation	Review the photographs that the students took of the four urban intersections. Ask the class to critique the design of the intersections in terms of their pedestrian-friendliness.
Objectives	Present and explain the five lesson goals listed above (V-15-1).

Information Presentation:

Components	Activities
Information Sequence	Outline the presentation of the lecture (V-15-2).
Information	Tell the class about general design principles that make for safer intersections for pedestrians (V-15-3). Discuss the effective use of crosswalks (V-15-4). Discuss the use of curb bulbs (V-15-5). Discuss the use of pedestrian signals at intersections (V-15-6 and V-15-7). Discuss the use of pedestrian refuge islands (V-15-8 through V-15-10).
Example(s)	Show examples (e.g., slides, videotape) of the different design practices cited in the text.

Student Participation:

Components	Activities
Practice	Use the activity provided in the Student's Guide.
Feedback	Provide comment and feedback to the class as appropriate.

Follow-Up:

Components	Activities
Enrichment	Assign reading for Lesson 16.
Review	Provide a summary of Lesson 15 (V-15-11).
Exercise	Ask the students to complete the exercise at the end of Lesson 15 in their workbooks. The exercise is reprinted below for your convenience. **15.7 Exercise: Urban Intersections** The need to develop and detail pedestrian intersection improvements in a manner that can be constructed within the normal field of highway construction is an extremely important issue. Pedestrian accommodations at intersections include both traffic signal and pavement marking improvements. An exercise covering pavement marking issues was previously addressed in Exercise 14.8. With regard to signalization at intersections, pedestrian improvements typically include pedestrian signals, pedestrian push buttons, conduit/wiring, mounting brackets, and pedestrian poles. Traffic signal improvements are specified through a detailed system of standard drawings, specifications, and bid item numbers. An example plan view drawing demonstrating this method for specifying traffic signal improvements using Georgia Department of Transportation standards is provided for reference in Figure 15-1. Develop a plan to install pedestrian signals and related improvements for an intersection in your community. The plan should be developed using nomenclature and reference standards from your State DOT. A list of standard drawings pertaining to pedestrian facility construction from Caltrans (California Department of Transportation) was previously provided in Exercise 14.8. If possible, you should obtain an intersection drawing from your local traffic engineering department. This drawing typically shows the location of existing roadway features, travel lanes, signal equipment, and utilities. In addition to preparing a plan of proposed improvements, develop an estimate of quantities needed for each construction item and prepare an engineer's construction cost estimate. You will need to utilize the following resources: • Plan view drawing of local intersection.

	• Standard drawings (periodically published document). • Standard specifications (periodically published document). • Bid item numbers (typically a published list). • Statewide average bid summary (typically assembled several times a year).
Solution Commentary	Students should conduct this exercise in as much detail as possible. If this exercise is conducted on a conceptual level only, the effectiveness of this activity will be significantly reduced. The objective is to help the student understand to what degree needed improvements for pedestrians can be addressed within the existing system of standards for roadway construction and traffic signal installation. It is also intended that students will gain an appreciation for the level of detail and exacting form that engineering plans take in the real world of public works construction projects.

Lesson Objectives:

- Describe issues related to accommodating pedestrians at intersections
- Explain how to use crosswalks
- Explain how to use curb bulbs
- Explain how to use pedestrian signals
- Explain how to use pedestrian refuge islands

Lesson Outline:

- General design principles that make safer intersections
- Use of crosswalks
- Use of curb bulbs
- Use of pedestrian signals
- Use of pedestrian refuge islands

Intersection Design Principles:

- Encourage crossing at corners
- Make pedestrians visible
- Make the vehicular traffic visible to pedestrians
- Make pedestrian actions predictable
- Ease movement to street level
- Minimize the time pedestrians are in the road
- Slow vehicular traffic

Use of Crosswalks:

- Location
- Control of pedestrian movements
- Promote a connected pedestrian network
- Visibility
- Marking types
- Lighting
- Maintenance

Use of Curb Bulbs:

- Shortens pedestrian crossing distance
- Shortens pedestrian signal phase
- Allows pedestrians to see the traffic
- Allows traffic to see the pedestrians

Use of Pedestrian Signals:

- Pedestrian walking speeds
- If delay > 30 seconds, pedestrians will cross on their own
- Make the pedestrian signal heads visible from the crosswalks
- Place pushbuttons near curb ramps

Use of pedestrian signals (continued):

- Use pushbuttons with indicator lights (like an elevator call button)
- Place button boxes in medians
- Place pedestrian signal heads on channelized islands
- Provide audible signals where necessary
- Walk/Don’t Walk phases

Use of Pedestrian Refuge Islands:

- Street width
- Vehicular volumes
- Pedestrian volumes
- Signal timing
- Roadway alignment
- Maintenance

Design of Pedestrian Refuge Islands:

- Cut-through ramps

- Dimensions (minimum)
  - 12 feet long
  - 6 feet wide
  - 50-square-foot area

- Highly visible approach nose

Design of Pedestrian Refuge Islands (continued):

- Pedestrian pushbuttons
- Proper signing
- Guidestrips for the blind
- Barriers for controlling pedestrian movements

Lesson Summary:

- Pedestrians can be accommodated even at wide, high-volume intersections
- There are a wide variety of design elements to effect good pedestrian design at intersections

LESSON 16: MID-BLOCK CROSSINGS (INSTRUCTOR'S NOTES)

Objectives:

Upon completion of this lesson, students will be able to:

1. Describe problems associated with using mid-block crossings.

2. Explain the advantages of using medians for mid-block crossings.

3. Explain the design considerations for using medians for mid-block crossings.

4. Describe where and under what circumstances mid-block crossings should be allowed.

Pre-Instruction:

Components	**Activities**
Motivation	Ask the students if they can tell you where there are mid-block crossings in your community. Ask the students if these crossing locations are appropriate. Have them think about other places, locally, where a mid-block crossing might be useful.
Objectives	Present and explain the four lesson goals listed above (V-16-1).

Information Presentation:

Components	Activities
Information Sequence	Outline the presentation of the lecture (V-16-2).
Information	Explain the pros and cons of having mid-block crossings. Discuss the advantages of using medians in conjunction with mid-block crossings (V-16-3). Discuss the design considerations of using medians in conjunction with mid-block crossings (V-16-4). Explain where and under what circumstances mid-block crossings should be allowed (V-16-5).
Example(s)	Show examples (e.g., slides, videotape) of the different design practices related to mid-block crossings that are cited in the text.

Student Participation:

Components	Activities
Practice	Use the activity provided in the Student's Guide.
Feedback	Provide comment and feedback to the class as appropriate.

Follow-Up:

Components	Activities
Enrichment	Assign reading for Lesson 17. Have the students visit the home page of the U.S. Architectural and Transportation Barriers Compliance Board (http://www.access-board.gov/). Ask them to bring to the next class information on issues related to accommodating disabled pedestrians.
Review	Provide a summary of Lesson 16 (V-16-6).
Exercise	Ask the students to complete the exercise at the end of Lesson 16 in their workbooks. This exercise is reprinted below for your convenience. **16.9 Exercise** Choose an urban site that would be a good candidate for a mid-block crossing with a pedestrian refuge island. Document the reasons that people often cross at this site (or would cross, given the opportunity). Photograph the site and prepare a sketch design solution.

Lesson Objectives:

- Describe problems associated with mid-block crossings
- Explain the advantages of using medians for mid-block crossings
- Explain design considerations for using medians for mid-block crossings
- Describe where mid-block crossings should be allowed

Lesson Outline:

- Pros and cons of mid-block crossings
- Advantages of using medians with mid-block crossings
- Design considerations for using medians with mid-block crossings
- Where mid-block crossings should be allowed

Advantages of Using Medians:

- Allow more frequent gaps
- Cheaper to build
- Cheaper to maintain

Design Considerations for Using Medians:

- Width
  - 8 feet desirable
  - 2-foot minimum

- Ramps may be needed

Use of Mid-block Crossings:

- Local roads
- Collector roads
- Arterials with four lanes
- Arterials with six or more lanes

Lesson Summary:

- Mid-block crossings can be an effective part of the overall pedestrian network
- Mid-block crossings can be created by using simple designs and logical guidelines

LESSON 17: PEDESTRIANS WITH DISABILITIES (INSTRUCTOR'S NOTES)

Objectives:

Upon completion of this lesson, students will be able to:

1. Describe the different types of disabilities that affect pedestrians.

2. Explain how the Americans With Disabilities Act (ADA) influences the design of pedestrian facilities.

Pre-Instruction:

Components	Activities
Motivation	Have the students describe what information they found on their visit to the home page of the U.S. Architectural and Transportation Barriers Compliance Board. Use the activity provided in the Student's Guide.
Objectives	Present and explain the two lesson goals listed above (V-17-1).

Information Presentation:

Components	Activities
Information Sequence	Outline the presentation of the lecture (V-17-2).
Information	Discuss the different ways that an individual can be disabled (V-17-3). Explain how the ADA influences the design of pedestrian facilities (V-17-4).
Example(s)	Show examples (e.g., slides, videotape) of the different design practices related to ADA compliance that are cited in the text.

Student Participation:

Components	Activities
Practice	Have the class share their experiences as disabled pedestrians (the pre-instruction motivational activity). Focus on what design changes they would make in the local area to better accommodate people with disabilities.
Feedback	Provide comment and feedback to the class as appropriate.

Follow-Up:

Components	Activities
Enrichment	Assign reading for Lesson 18. Have the students take a bicycle ride on a shared roadway and note what problems they encounter on their trips.
Review	Provide a summary of Lesson 17 (V-17-5).
Exercise	Ask the students to complete the exercise at the end of Lesson 17 in their workbooks. The exercise is reprinted below for your convenience. **17.4 Exercise** To help you realize how challenging visual and mobility impairments can be, you will get a chance to travel in a wheelchair, and then as a blindfolded pedestrian. For safety, the following rules apply to this *activity:* • Always have your protector (partner) with you. • Only travel in the area designated for this activity. • Always lean backwards when going down a ramp (wheelchair). • Always lean forward when going up a ramp (wheelchair). • The protector should be in front of the wheelchair when going downhill, and behind the wheelchair when going uphill. • Do not hold onto the blind person or push the wheelchair. • Talk to the blind person to let them know you are there, and only warn of dangers (do not direct).

Lesson Objectives:

- Describe disabilities that affect pedestrians
- Explain how ADA influences the design of pedestrian facilities

Lesson Outline:

- Ways that an individual can be disabled
- ADA design of pedestrian facilities

Types of Disabilities:

- Mobility impairments
- Sensory deficiencies
- Cognitive impairments

ADA Design Issues:

- Sidewalks
- Ramps
- Street furniture
- Pushbuttons
- Curb cuts/wheelchair ramps

Lesson Summary:

- Pedestrians can have many different types of disabilities
- Compliance with ADA standards will assist disabled pedestrians to safely navigate the system

LESSON 18: SHARED ROADWAYS (INSTRUCTOR'S NOTES)

Objectives:

Upon completion of this lesson, students will be able to:

1. Describe the different types of shared roadways.

2. Explain the elements used in designing roadways for the shared use of vehicular and bicycle traffic.

Pre-Instruction:

Components	**Activities**
Motivation	Have the students describe the problems they encountered when they took their bicycle trip on a shared roadway.
Objectives	Present and explain the two lesson goals listed above (V-18-1).

Information Presentation:

Components	Activities
Information Sequence	Outline the presentation of the lecture (V-18-2).
Information	Discuss where and when to use shared lanes. Describe the use of wide curb lanes. Describe the use of shoulder bikeways (V-18-3). Describe the use of bike routes (V-18-4). Describe the use of bicycle boulevards (V-18-5). Review poor practices and other design considerations (V-18-6).
Example(s)	Show examples (e.g., slides, videotape) of the different types of shared roadways cited in the text.

Student Participation:

Components	Activities
Practice	Use the activity provided in the Student's Guide.
Feedback	Provide comment and feedback to the class as appropriate.

Follow-Up:

Components	Activities
Enrichment	Assign reading for Lesson 19. Have the students take a bicycle ride on a road with bicycle lanes and note what problems they encounter on their trips.
Review	Provide a summary of Lesson 18 (V-18-7).

Exercise	Ask the students to complete the exercise at the end of Lesson 18 in their workbooks. The exercise is reprinted below for your convenience. **18.9 Exercise** Choose a local street that would be a good candidate for a bicycle boulevard. The street segment should be several blocks in length, and should include at least one crossing of a major arterial. Prepare a conceptual design plan for the street segment, showing the location of signing, traffic signals, on-street parking, and traffic-calming features. Your design should be shown in plan view, and should be accompanied by a narrative explaining the purpose of special design features.

Lesson Objectives:

- Describe the types of shared roadways
- Explain the design elements used for shared roadways

Lesson Outline:

- Wide curb lanes
- Shoulder bikeways
- Bike routes
- Bicycle boulevards
- Poor practices and other considerations

Shoulder Bikeways:

- Width
- Pavement design
- Transverse joint design

Bike Routes:

- Continuity
- Demand
  - Bicycle
  - Vehicular
- Traffic Control Devices (TCDs)
- Parking
- Surface problems

Bicycle Boulevards:

- Direct, continuous route
- Have cross-traffic stop
- Divert vehicular traffic away
- Use traffic calming
- Ample signing
- Protect the bicyclists at crossings

Poor Practices/Other Design Considerations:

- Sidewalk bikeways
- Extruded curbs
- Raised pavement markers (RPMs)
- Drainage grates
- Railroad Crossings
- Sidewalk ramps on bridges
- Rumble strips

Lesson Summary:

- There are many ways to allow motor vehicles and bicycles to share the same roadway
- Use of specific design elements creates a shared roadway that is bicycle-friendly

LESSON 19: BICYCLE LANES (INSTRUCTOR'S NOTES)

Objectives:

Upon completion of this lesson, students will be able to:

1. Explain the elements used in designing roadways that include bicycle lanes.

Pre-Instruction:

Components	Activities
Motivation	Have the students describe the problems they encountered when they took their bicycle trip on a roadway with bicycle lanes.
Objectives	Present and explain the lesson goal listed above (V-19-1).

Information Presentation:

Components	Activities
Information Sequence	Outline the presentation of the lecture (V-19-2).
Information	Discuss where and when to use bicycle lanes. Review the general design principles related to bicycle lanes and intersections (V-19-2 through V-19-6).
Example(s)	Show examples (e.g., slides, videotape) of the different types of bicycle lanes cited in the text.

Student Participation:

Components	Activities
Practice	Use the activity provided in the Student's Guide.
Feedback	Provide comment and feedback to the class as appropriate.

Follow-Up:

Components	Activity
Enrichment	Assign reading for Lesson 20. Have the students compile a list of streets where it might not be appropriate to have bicycle traffic. This information will be used as a starting point for the discussion of restriping existing lanes.
Review	Provide a summary of Lesson 19 (V-19-7).
Exercise	Ask the students to complete the exercise at the end of Lesson 19 in their workbooks. The exercise is reprinted below for your convenience. **19.11 Exercise** Redesign a local intersection to include bike lanes. Choose an intersection with a moderate level of complexity, and assume that curb lines can be moved at will in order to achieve your design. Prepare a report and graphics that show existing conditions and recommended modifications. Signalization changes (if necessary) should also be explained, as well as any advance striping and signing needed on the intersection approaches.

Lesson Objective:

- Explain the design elements used for bicycle lanes

Lesson Outline:

- Where and when to use bicycle lanes
- Design principles related to bicycle lanes

Bicycle Lane Design Principles:

- Lane widths
- Unmarked lanes
- Location in the cross-section
- Two-way lanes
- Continuous right-turn lanes

Bicycle Lane Design Principles (continued):

- Contra-flow lanes
- Pavement markings
- Signing
- Diagonal parking
- Intersections

Intersection Design:

- Bus stops
- Right-turn lanes
- Offset intersections
- Signal actuation
- Expressway interchanges

Intersection Design (continued):

- At-grade crossings
- Grade-separated crossings
- Right-lane merge
- Exit ramps
- Dual right-turn lanes
- Tight right-turn lanes

Lesson Summary:

- There are many ways to allow for bicycle lanes on vehicular roadways
- Use of specific design elements create safe and efficient bicycle lanes

LESSON 20: RESTRIPING EXISTING ROADS WITH BIKE LANES (INSTRUCTOR'S NOTES)

Objectives:

Upon completion of this lesson, students will be able to:

1. Describe where and when it might be appropriate to restripe existing roadways to accommodate bicycles.

2. Explain what techniques for restriping are available to the designer.

Pre-Instruction:

Components	Activities
Motivation	Have the students present their lists of roadways where bicycle traffic might be inappropriate. Have the students describe why bicycle traffic would not be acceptable at these locations. Have the students consider what changes might be made in order to accommodate bicycles.
Objectives	Present and explain the two lesson goals listed above (V-20-1).

Information Presentation:

Components	Activities
Information Sequence	Outline the presentation of the lecture (V-20-2).
Information	Discuss where and when it might be appropriate to restripe existing roadways to accommodate bicycles. Review the general design principles related to the restriping of vehicular traffic lanes to accommodate bicycles (V-20-3).
Example(s)	Show examples (e.g., slides, videotape) of the different types of restriped traffic lanes cited in the text.

Student Participation:

Components	Activities
Practice	Use the activity provided in the Student's Guide.
Feedback	Provide comment and feedback to the class as appropriate.

Follow-Up:

Components	Activities
Enrichment	Assign reading for Lesson 21. Have the students compile a list of maintenance problems they have noticed on their earlier bicycle rides.
Review	Provide a summary of Lesson 20 (V-20-4).
Exercise	Ask the students to complete the exercise at the end of Lesson 20 in their workbooks. This exercise is reprinted below for your convenience. **20.10 Exercise** Choose a local urban street that would be a good candidate for a bike lane retrofit project. Redesign a two-block section of the roadway to include bike lanes (sketch drawings will be sufficient). Present at least two options for retrofitting the street, and include solutions that would require further traffic studies. Indicate proposed dimensions for travel lanes, parking lanes, and bike lanes. If removal of parking is one of your solutions, describe the public involvement process you would go through to achieve agreement from adjacent property owners and businesses.

Lesson Objective:

- Describe where and when it might be appropriate to restripe existing roadways
- Explain techniques for restriping existing roadways

Lesson Outline:

- Where and when to restripe existing roadways
- Design principles related to restriping

Lane Restriping Design Principles:

- Reduce lane widths
- Reduce number of vehicle travel lanes
- Reconsider the need for parking
- Reallocate lane space

Lesson Summary:

- There are many ways to restripe existing roadways to accommodate bicycles
- The specific design strategies to do this involve a redesign of the highway cross-section in terms of space allocation for specific user groups

LESSON 21: BICYCLE FACILITY MAINTENANCE (INSTRUCTOR'S NOTES)

Lesson Objectives:

Upon completion of this lesson students will be able to:

1. Understand and can explain the importance of bicycle facility maintenance.

2. Understand and can state in their own words the objectives of bicycle maintenance.

3. Plan an implementation strategy to effect bicycle facility maintenance.

4. List several types of typical maintenance problems, along with solutions to these problems.

Pre-Instruction:

Components	**Activities**
Motivation	Show a few examples (e.g., slides, videotape) of poorly maintained bicycle facilities. Explain the types of problems bicycle riders might encounter because of the illustrated problems.
Objectives	Present and explain the four lesson goals listed above (V-21-1).

Information Presentation:

Components	Activities
Information Sequence	Outline the presentation of the lecture (V-21-2).
Information	Summarize the objectives of bicycle facility maintenance (V-21-3). Outline how to develop a maintenance implementation plan (V-21-4). Review examples of typical maintenance problems and solutions (V-21-5).
Example(s)	Associate the development of the maintenance implementation plan with your own experiences in developing engineering implementation plans. Show multiple examples (e.g., slides, videotape) of typical maintenance problems.

Student Participation:

Components	Activities
Practice	Divide the students into small groups and have them compile a list of bicycle facility maintenance problems specific to your area/location. Have the students propose solutions to the identified problems.
Feedback	Initiate a group discussion of the identified problems and solutions. Encourage all of the working groups to provide feedback to their peers. Provide comment and feedback to the class as appropriate.

Follow-Up:

Components	Activities
Enrichment	Assign reading for Lesson 22. Ask the students to compile a list of types of local bicycle parking facilities.
Review	Provide a summary of Lesson 21 (V-21-6).

Lesson Objectives:

- Understand the importance of bicycle facility maintenance
- Understand the objectives of bicycle facility maintenance
- Plan an implementation strategy to effect bicycle facility maintenance
- Identify typical maintenance problems and solutions

Lesson Outline:

- Maintenance objectives

- Implementation planning
  - Resources
  - Schedule

Maintenance Objectives:

- Strive to keep facilities “hazard free”
- Encourage reporting of hazards
- Design and build facilities with maintenance in mind
- Program for maintenance

Implementation Planning:

- Identify implementors
- Review policies and practices
- Review results
- Recommend changes
- Create spot improvement program
- Evaluate the process

Typical Maintenance Problems:

- Surface
- Vegetation
- Signing and marking

Lesson Summary:

- Maintenance is an important function
- Formulate program objectives
- Develop implementation plan

LESSON 22: BICYCLE PARKING AND STORAGE (INSTRUCTOR'S NOTES)

Objectives:

Upon completion of this lesson, students will be able to:

1. Explain the objectives of providing bicycle parking.

2. Describe the means for implementing bicycle parking in a community.

3. Describe the different classes of bicycle parking.

Pre-Instruction:

Components	Activities
Motivation	Have the students present their lists of bicycle parking facilities. Have the students consider whether these facilities are adequate in terms of: • Capacity • Security (are the facilities in open, well-lit areas?) • Ease of use • Convenience
Objectives	Present and explain the three lesson goals listed above (V-22-1).

Information Presentation:

Components	Activities
Information Sequence	Outline the presentation of the lecture (V-22-2).
Information	Tell the students the objectives of providing bicycle parking (V-22-3). Go over the implementation strategy for providing bicycle parking (V-22-4 and V-22-5). Describe the different classes of bicycle parking (V-22-6).
Example(s)	Show examples (e.g., slides, videotape) of the different types of parking facilities cited in the text.

Student Participation:

Components	Activities
Practice	Have the students identify an area where bicycle parking is needed. Ask them to design bicycle parking for this location. Have them think about: • Number of spaces needed • Type of parking • Lighting
Feedback	Provide comment and feedback to the class as appropriate.

Follow-Up:

Components	Activities
Enrichment	Assign reading for Lesson 23.
Review	Provide a summary of Lesson 22 (V-22-7).

Lesson Objective:

- Explain the objectives of bicycle parking
- Describe the means for implementing bicycle parking
- Describe the different classes of bicycle parking

Lesson Outline:

- Bicycle parking objectives
- Implementation strategy
- Bicycle parking classes

Bicycle Parking Objectives:

- Provide well-located, secure bicycle parking at popular bicycling destinations

- Require new commercial, public, and high-density residential developments to include bicycle parking

Implementation Strategy:

- Install parking on public property
- Encourage businesses to provide parking
- Change zoning regulations to ensure that parking is provided in new developments

Implementation Elements:

- Identify key implementers
- Structure the program
- Choose appropriate parking devices
- Develop location criteria
- Implement
- Evaluate

Bicycle Parking Classes:

- Class I
- Class II
- Class III

Lesson Summary:

- Bicycle parking is a key factor in encouraging bicycle use

- Bicycle parking should not “just happen,” but should be part of a larger implementation strategy

LESSON 23: EUROPEAN APPROACHES TO BICYCLE AND PEDESTRIAN FACILITY DESIGN (INSTRUCTOR'S NOTES)

Objectives:

Upon completion of this lesson, students will be able to:

1. Describe European pedestrian facilities.

2. Describe European bicycle facilities.

Pre-Instruction:

Components	Activities
Motivation	If anyone in the class has been to Europe, have them describe their experiences walking and/or biking there. Ask them to compare their experiences in Europe to those they have had in the United States.
Objectives	Present and explain the two lesson goals listed above (V-23-1).

Information Presentation:

Components	Activities
Information Sequence	Outline the presentation of the lecture (V-23-2).
Information	Tell the students about different European pedestrian facilities (V-23-3 and V-23-4). Tell the students about different European bicycle facilities (V-23-5 through V-23-7).
Example(s)	Show examples (e.g., slides, videotape) of the different types of pedestrian and bicycle facilities cited in the text.

Student Participation:

Components	Activities
Practice	Have the students identify locations in your community where European-type pedestrian or bicycle improvements would be appropriate.
Feedback	Provide comment and feedback to the class as appropriate.

Follow-Up:

Components	Activities
Enrichment	Assign reading for Lesson 24.
Review	Provide a summary of Lesson 23 (V-22-8).

Lesson Objectives:

- Describe European pedestrian facilities
- Describe European bicycle facilities

Lesson Outline:

- Pedestrian facilities
- Bicycle facilities

European Pedestrian Facilities:

- Zebra crossing
- Pelican crossing
- Toucan crossing
- Puffin crossing

European Pedestrian Facilities (continued):

- Messages on the pavement
- Traffic signals
- Pedestrian zones

European Bicycle Facilities (Netherlands):

- Bike lanes
- Signals
- Bicycle rental

European Bicycle Facilities (Germany):

- Bike lanes
- Intersection improvements
- Parking
- Signals

European Bicycle Facilities (Great Britain):

- Bike lanes
- Bike trails
- Bus lanes

Lesson Summary:

- There are many different practices related to pedestrian and bicycle design used in Europe
- Some of these European techniques could be applicable in the United States

LESSON 24: EDUCATION, ENCOURAGEMENT, AND ENFORCEMENT (INSTRUCTOR'S NOTES)

Objectives:

Upon completion of this lesson, students will be able to:

1. Describe strategies for educating people about walking and bicycling.

2. Describe strategies for developing an effective program of enforcement of laws that will help pedestrians and bicyclists.

3. Describe strategies for encouraging people to walk and bike.

Pre-Instruction:

Components	Activities
Objectives	Present and explain the three lesson goals listed above (V-24-1).

Information Presentation:

Components	Activities
Information Sequence	Outline the presentation of the lecture (V-24-2).
Information	Tell about the different ways of educating people about walking and bicycling (V-24-3). Describe enforcement practices that help pedestrians and bicyclists (V-24-4). Talk about what information can be used to encourage people to walk and bike (V-24-5 and V-24-6).
Example(s)	Show examples (e.g., slides, videotape) of different types of education or public service campaigns related to pedestrian and bicycle activities.

Student Participation:

Components	Activities
Practice	Have the students design an education, enforcement, or encouragement campaign for your community.
Feedback	Provide comment and feedback to the class as appropriate.

Follow-Up:

Components	Activities
Review	Provide a summary of Lesson 24 (V-24-7).

Lesson Objective:

- Describe education strategies related to walking and bicycling
- Describe enforcement strategies that help pedestrians and bicyclists
- Describe strategies for encouraging people to walk and bike

Lesson Outline:

- Education strategies
- Enforcement practices
- Encouragement strategies

Education Strategies:

- Teach walking and biking skills to children
- Teach walking and biking skills to adults
- Train drivers about walkers and bikers
- Develop and use safety messages

Enforcement Practices:

- Review/Modify existing pedestrian/bike laws
- Aggressively enforce pedestrian/bike laws
- Review/Modify young violator practices
- Reduce bicycle theft
- Reduce assaults on pedestrians and bicyclists
- Implement non-motorized patrolling

Encouragement Strategies:

- Add non-motorized options to motor pools
- Require TDM plans from industry
- Include walking and biking in local recreational programs

Encouragement Strategies (continued):

- Promote use of non-motorized travel through special events
- Inform target audiences
- Develop a public service announcement (PSA) ad campaign

Lesson Summary:

- Aggressive campaigns related to education, enforcement, and encouragement can be effective means for increasing walking and bicycling