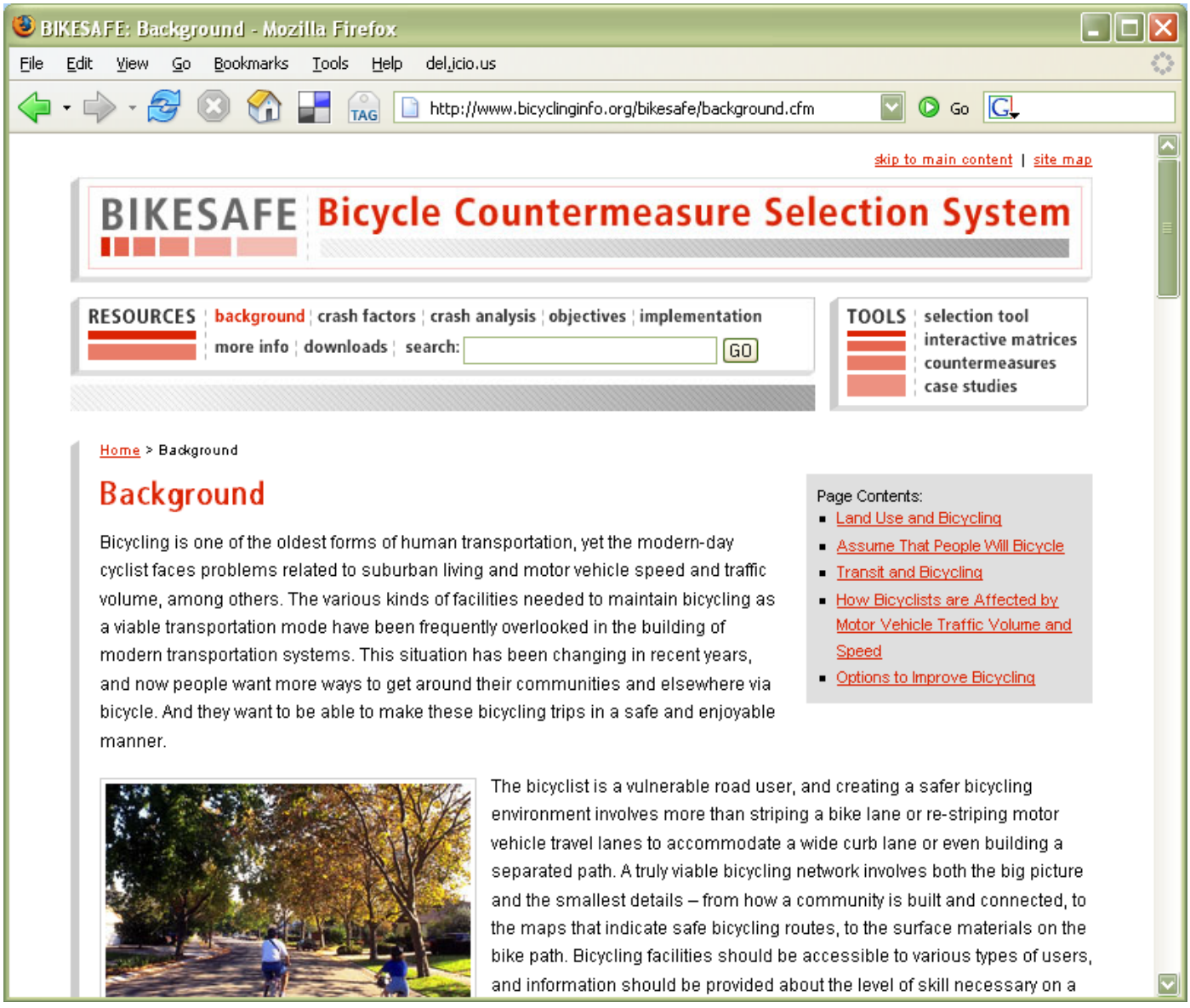
Chapter 4 – The Expert System



How to Use BIKESAFE

Selection Tool

Interactive Matrices

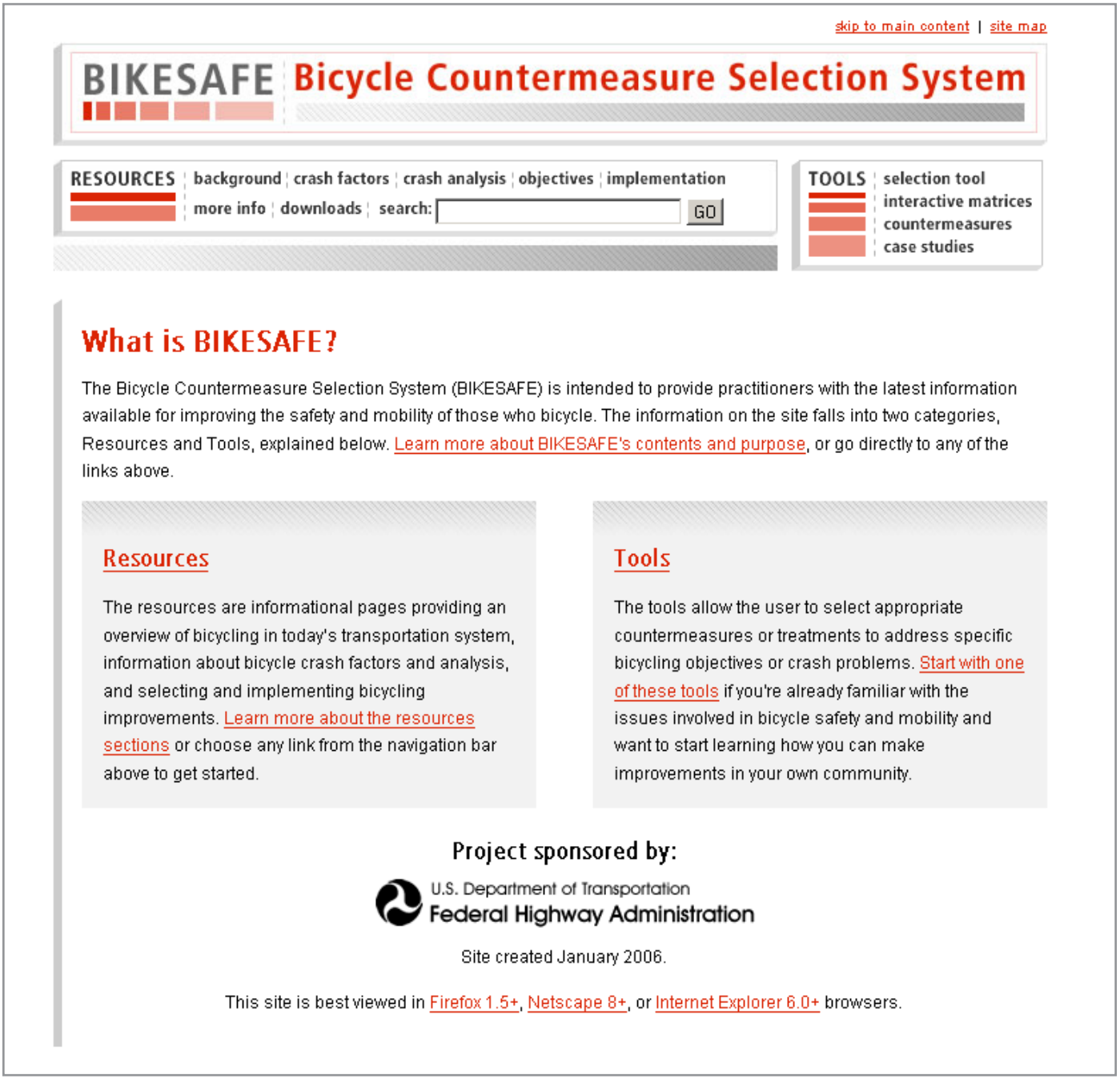
Countermeasures

Case Studies

The BIKESAFE expert system is provided on the enclosed CD-ROM and is available online at http://safety.fhwa.dot.gov/bikesafe and at http://www.bicyclinginfo.org/bikesafe. This chapter provides an overview of the application and specific instructions on how to access and use the tools available. The application is designed to:

- Provide information on the countermeasures available to prevent bicycle crashes and improve motorist and bicyclist behavior.
- Highlight the purpose, considerations and cost estimates associated with each countermeasure.
- Provide a decision process to select the most applicable countermeasures for a specific location.
- Provide links to case studies showing the various treatments and programs implemented in communities around the U.S.
- Provide easy access to resources such as statistics, implementation guidance, and reference materials.

The expert system combines the resources provided in this document with online tools (see home page below) to enable practitioners to effectively select engineering, education, or enforcement treatments to mitigate a known crash problem or achieve a specific performance objective.



The home page of the BIKESAFE Web application introduces the site and highlights the Resources and Tools sections.

The resource materials included in the Web/CD-ROM application are related to this document as follows:

WEB/CD-ROM	PRINT DOCUMENT*
Background	Chapter 1: The Big Picture
Crash Factors	Chapter 2: Bicyclist Crash Factors
Crash Analysis Objectives	Chapter 3: Selecting Improvements for Bicyclists
Implementation Publications	Chapter 7: Implementation and Resources

*Chapters 5 and 6 include the countermeasures and case studies, which are available as Tools on the Web/CD-ROM application.

HOW TO USE BIKESAFE

The opening page gives a brief explanation of BIKESAFE and then highlights the "Resources" and "Tools" sections. The "Resources" section provides an overview of bicycling in today's transportation system, information about bicycle crash statistics and analysis, and selecting and implementing bicycling improvements. "Tools" allows the user to select appropriate countermeasures or treatments to address specific objectives, such as the need to make intersections safer for bicyclists, or crash problems, such as overtaking motorists striking bicyclists from the rear on a busy corridor with inadequate space. This section also includes a large number of case studies to illustrate treatments implemented in communities throughout the United States.

Resources page.

The rest of this chapter focuses on the four tools available on the Web/CD-ROM application. Each can be used to enter the system, as described below:

- Selection Tool – This interactive tool allows the user to develop a list of possible countermeasures on the basis of site characteristics, such as geometric features and operating conditions, and the type of safety problem or desired behavioral change. The decision logic used to determine when specific treatments are and are not applicable is based on input from an expert panel of practitioners.
- Interactive Matrices – This tool shows the relationship between the countermeasures and the performance objectives or crash types and can be used to display applicable countermeasures.
- Countermeasures - Details of 50 engineering, education, enforcement, and other treatments or programs for improving bicycle safety and mobility are provided in the categories of shared roadway treatments; on-road bicycle facilities; intersection treatments; traffic calming applications; trails/shared-use paths; markings, signs, and signals; education and enforcement; and support facilities and programs.
- Case Studies – More than 50 real-world examples illustrate various treatments or programs as implemented in a state or municipality.

BIKESAFE is designed to allow the tools and information to be accessed from multiple points of entry. Links are provided to allow users to easily navigate between the tools and to quickly access the resource materials. Provided below are four examples of how a user may choose to enter the system and access the tools.

Tools page.

1) Selection Tool – The user may have information available about geometrics and operating conditions of a particular location and either has a specific type of crash problem or desires to change motorist/bicyclist behavior at the site. Known location information may be entered by answering a series of questions. The system will then display the countermeasure options to be considered.

2) Interactive Matrices – The user has a specific type of crash problem or desires to change motorist/bicyclist behavior but does not have specific information about the characteristics of the site. The matrices can be used to view and access the types of countermeasures available for further consideration.

3) Countermeasures – The user is interested in acquiring information about a particular treatment or program. The countermeasures page can be directly accessed and displays the nine categories of treatments included. Detailed descriptions of the 50 countermeasures can be accessed from this point. Links to relevant case studies can then be accessed from the description pages.

4) Case Studies – The user wishes to see specific examples of treatments that have been installed. The case studies page provides a list of all case studies assembled, as well as the option of selecting a specific implementation example by type of treatment or by location (state and municipality). From there, the user can access the countermeasure description pages that are relevant to a particular example.

Each of these tools is described in more detail in the remainder of the chapter.

SELECTION TOOL

The interactive selection tool allows the user to refine their selection of countermeasures on the basis of specific site characteristics and/or the type of safety problem or desired behavioral change. One begins by choosing selection tool from the Tools menu. A screen will appear with specific instructions on how to use the tool (see next page), and then allows the user to click on "Start the Selection Tool." This leads to a simple three-step process:

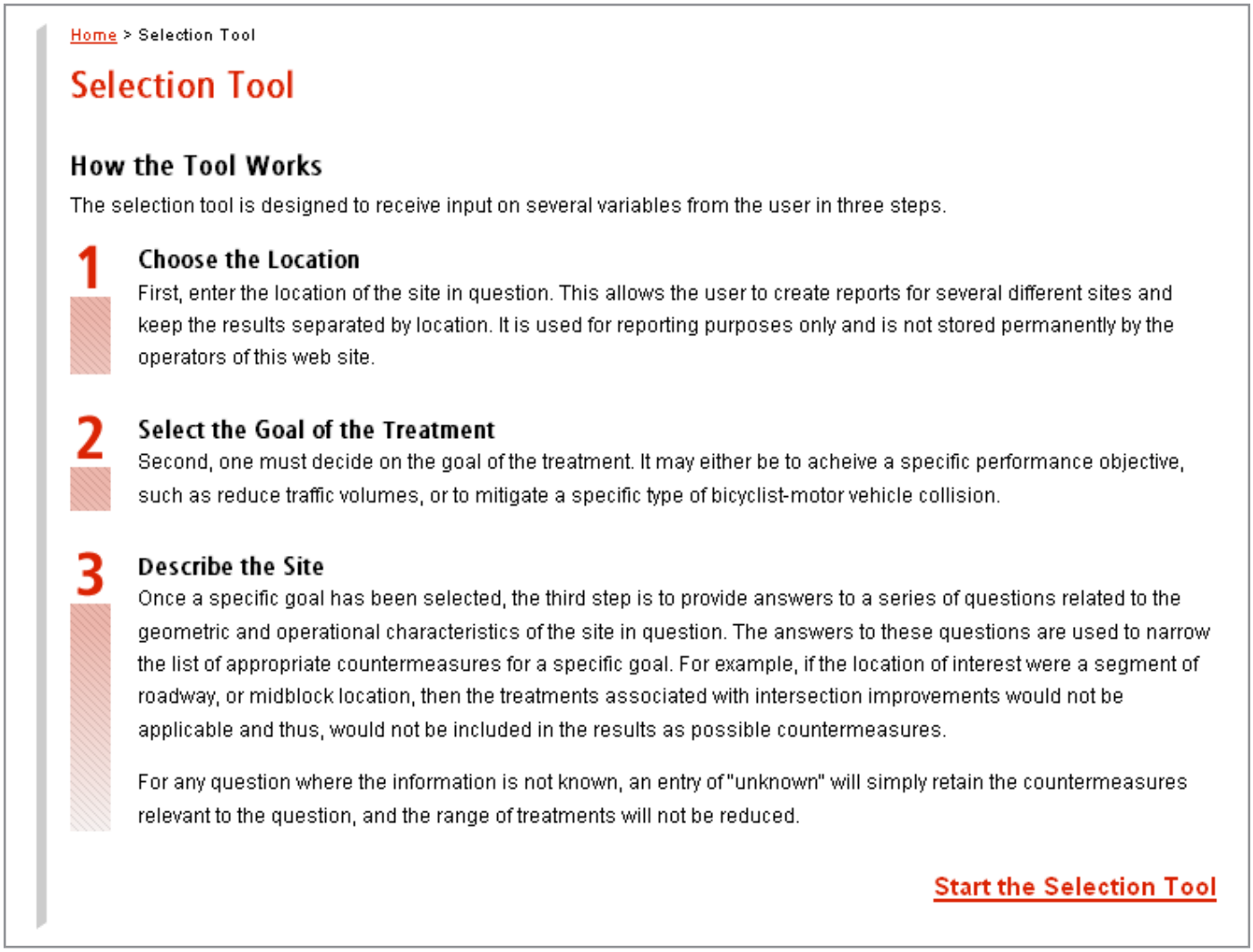
Step 1: Choose the Location — A text box is provided for the user to describe the location of interest (e.g., "Route 1 between Spring Ave. and Summer Ave." for a roadway segment, or "Intersection of Route 1 and Spring Ave." for an intersection). This is entirely for the benefit of the user and allows other descriptive information to be entered as well. This information will be stored and displayed as typed with the results so the project can be identified. In the figure on the next page, a specific intersection location — Main Street and Broadway Avenue — has been entered.

Step 2: Select the Goal of the Treatment — The user must then choose a particular type of crash problem to be mitigated or a performance objective to be achieved. As shown in the figure on page 42, there are seven performance objectives and 13 crash groups. Only one can be selected. As the user proceeds through the steps, the previous input is shown on the right side of the screen (in this example, the roadway location from Step 1).

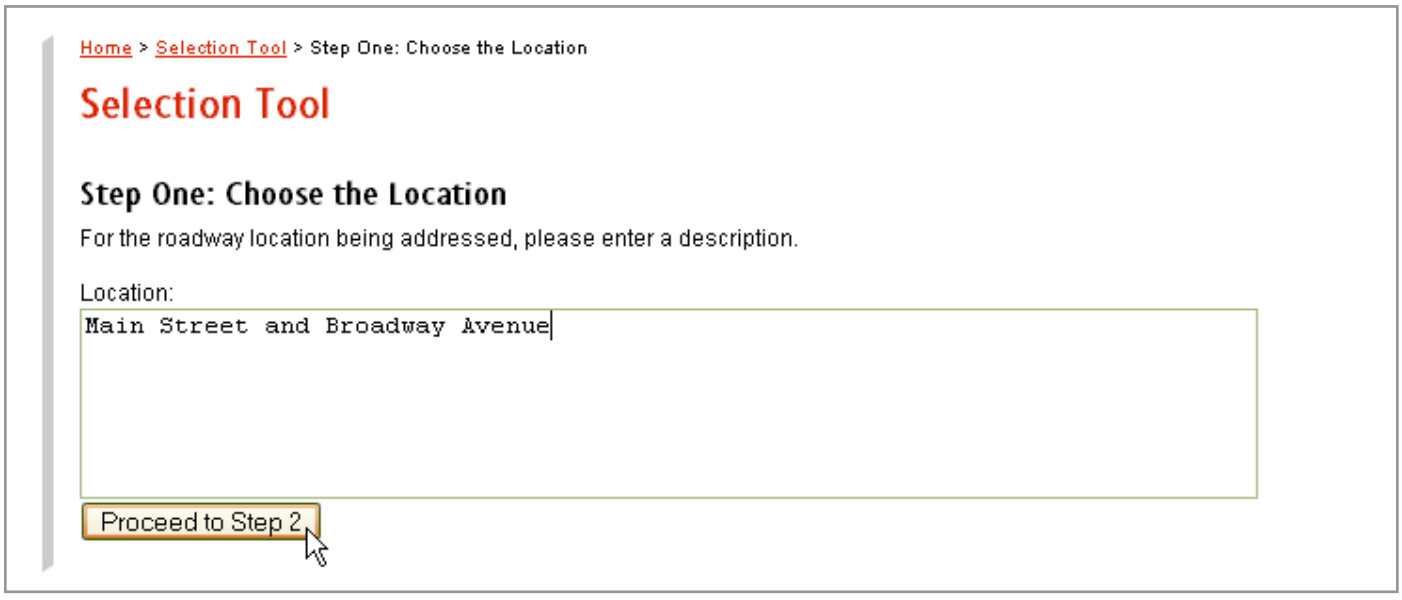
Step 3: Describe the Site — Finally, the user is asked to provide input about the characteristics of the site. As shown in the figure on page 43, there are nine questions that are asked in reference to the general location, geometric features, and operating conditions. The default value is "Not Applicable/Unknown" for each question. The answers to these questions are used to narrow the list of appropriate countermeasures for a specific goal or crash type. For example, if the location of interest was a roadway segment (midblock location), then the treatments associated with intersection improvements would not be applicable and would not be included in the results as applicable countermeasures.

The field investigation form included in Appendix A can be used for site visits to obtain the information asked for in this last step. For any question where the information is not known, an entry of "Not Applicable/Unknown" will simply retain all countermeasures relevant to the question, and the choice of treatments will not be reduced.

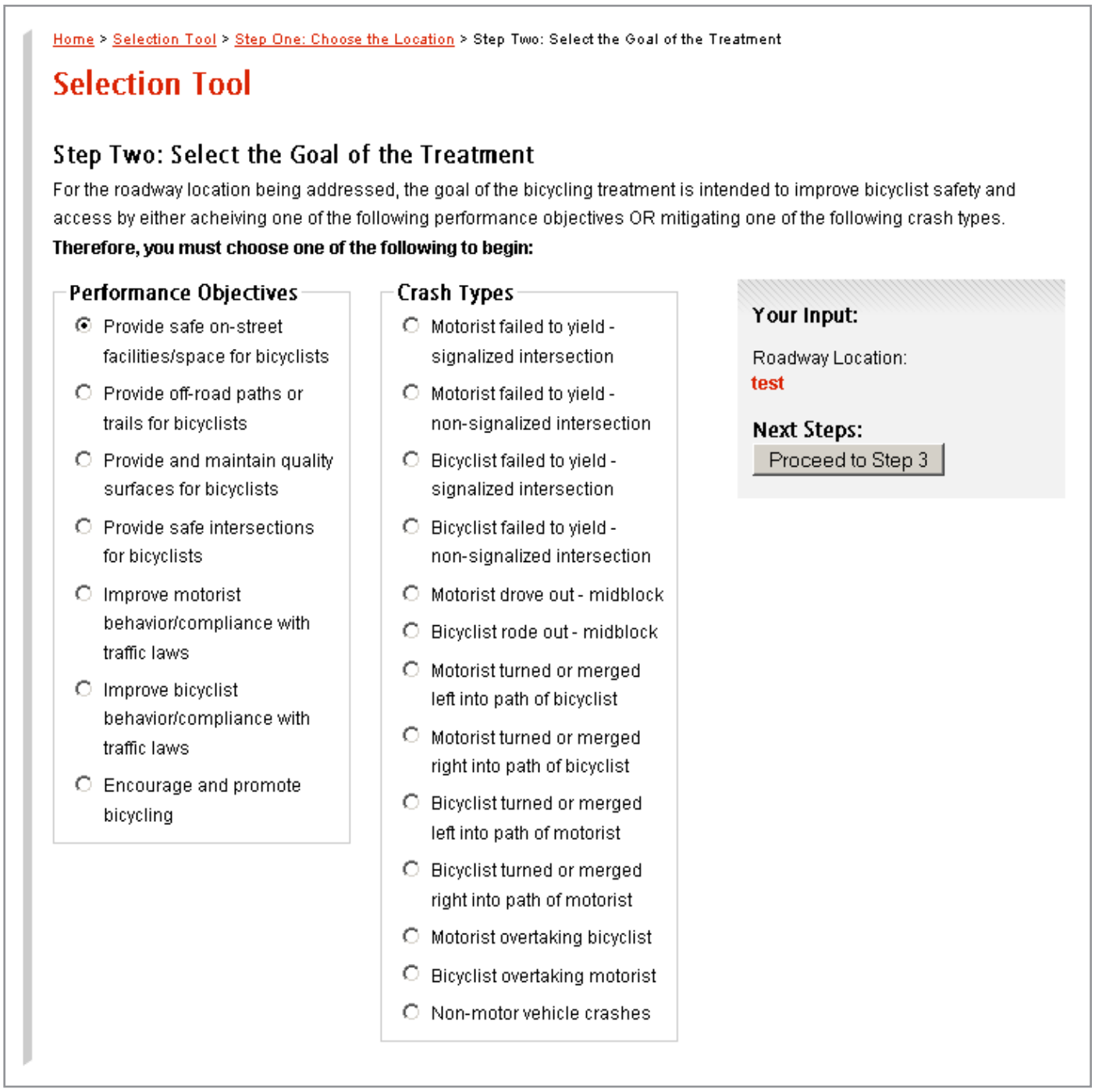
After completing these three steps, the user clicks Get Results. The information entered is used to develop a list of applicable countermeasures, which are presented as shown on page 44. The user can then read more about a specific countermeasure by selecting it, which takes the user to the countermeasure description page. The user is advised to carefully read the countermeasure description page, especially if some of the suggested treatments seem "inappropriate." The description of the countermeasure, along with the "Considerations" section, hopefully will clear up questions. As an example, "Reduce Lane Width" is displayed for the crash type of motorist overtaking bicyclist on a shared roadway. While this may seem counterintuitive, reducing lane width is one way to reduce motor vehicle speed. If speed is reduced, then some overtaking crashes may be averted (e.g., on curves with poor sight distance).



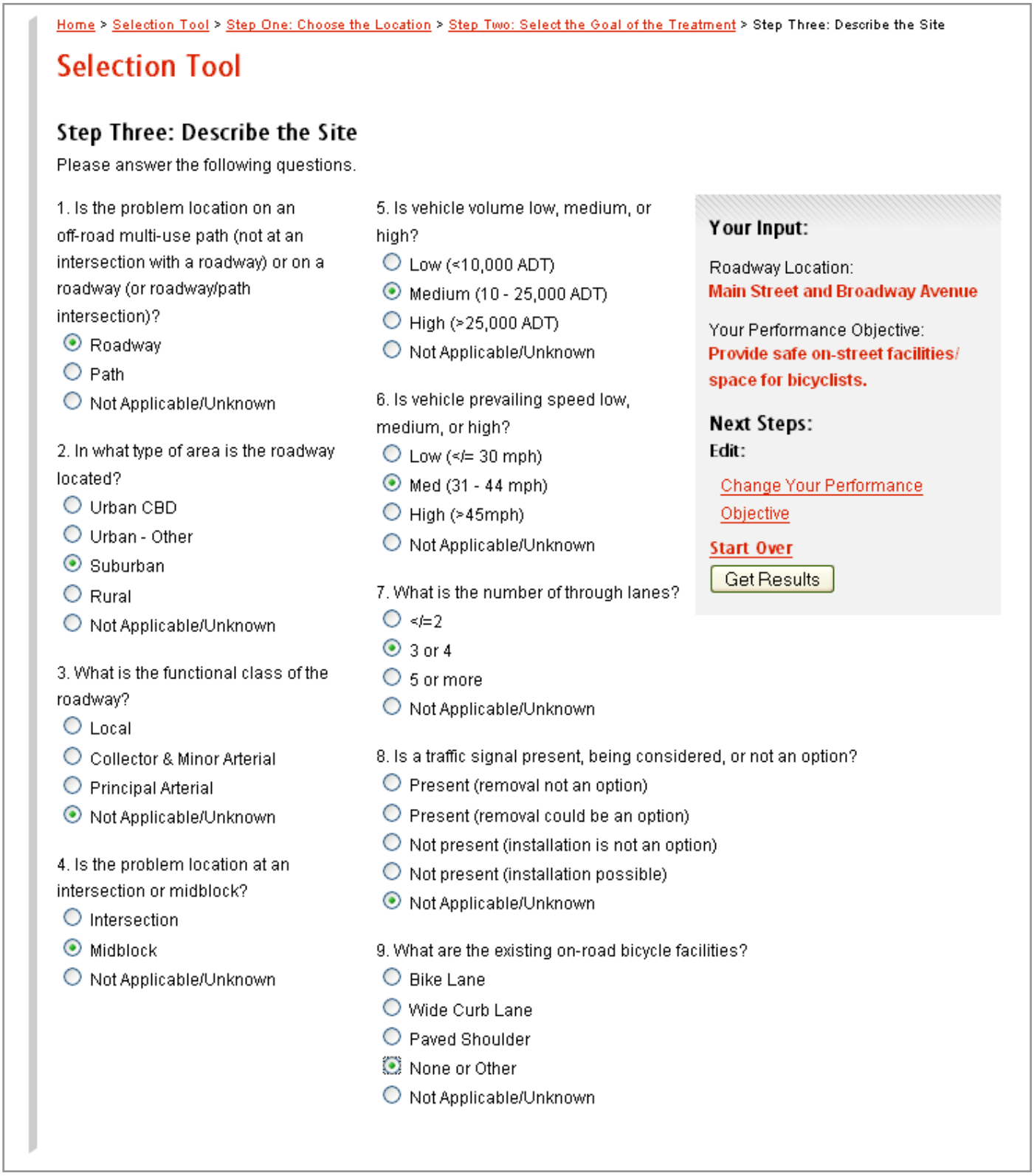
The Selection Tool includes three simple steps that are described on its opening page.



The user may enter any combination of text and numbers to describe the location of interest.

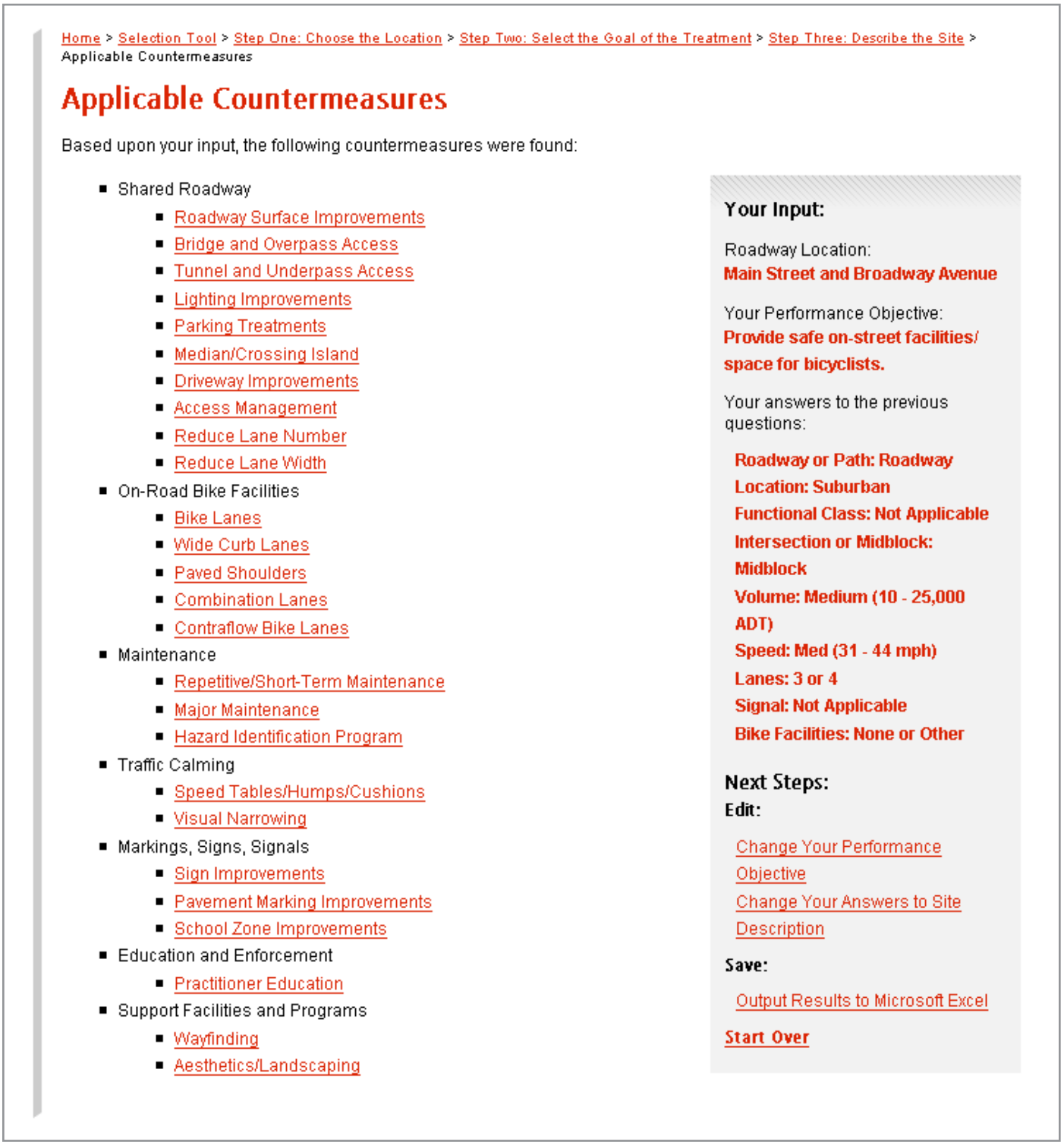


A specific performance objective or crash type to be mitigated must be selected in step two.



The characteristics of the location are provided in step three by answering nine questions.

In addition to the applicable countermeasures, the results page also provides the user with a list of the inputs made in the three steps. Options are provided for changing these inputs for the location of interest, exporting the results to Microsoft Excel, or starting over with a new location.



Home > Selection Tool > Step One: Choose the Location > Step Two: Select the Goal of the Treatment > Step Three: Describe the Site > Applicable Countermeasures

Applicable Countermeasures

Based upon your input, the following countermeasures were found:

- Shared Roadway
  - Roadway Surface Improvements
  - Bridge and Overpass Access
  - Tunnel and Underpass Access
  - Lighting Improvements
  - Parking Treatments
  - Median/Crossing Island
  - Driveway Improvements
  - Access Management
  - Reduce Lane Number
  - Reduce Lane Width
- On-Road Bike Facilities
  - Bike Lanes
  - Wide Curb Lanes
  - Paved Shoulders
  - Combination Lanes
  - Contraflow Bike Lanes
- Maintenance
  - Repetitive/Short-Term Maintenance
  - Major Maintenance
  - Hazard Identification Program
- Traffic Calming
  - Speed Tables/Humps/Cushions
  - Visual Narrowing
- Markings, Signs, Signals
  - Sign Improvements
  - Pavement Marking Improvements
  - School Zone Improvements
- Education and Enforcement
  - Practitioner Education
- Support Facilities and Programs
  - Wayfinding
  - Aesthetics/Landscaping

Your Input:

Roadway Location:
Main Street and Broadway Avenue

Your Performance Objective:
Provide safe on-street facilities/ space for bicyclists.

Your answers to the previous questions:

Roadway or Path: Roadway
Location: Suburban
Functional Class: Not Applicable
Intersection or Midblock: Midblock
Volume: Medium (10 - 25,000 ADT)
Speed: Med (31 - 44 mph)
Lanes: 3 or 4
Signal: Not Applicable
Bike Facilities: None or Other

Next Steps:

Edit:

Change Your Performance Objective
Change Your Answers to Site Description

Save:

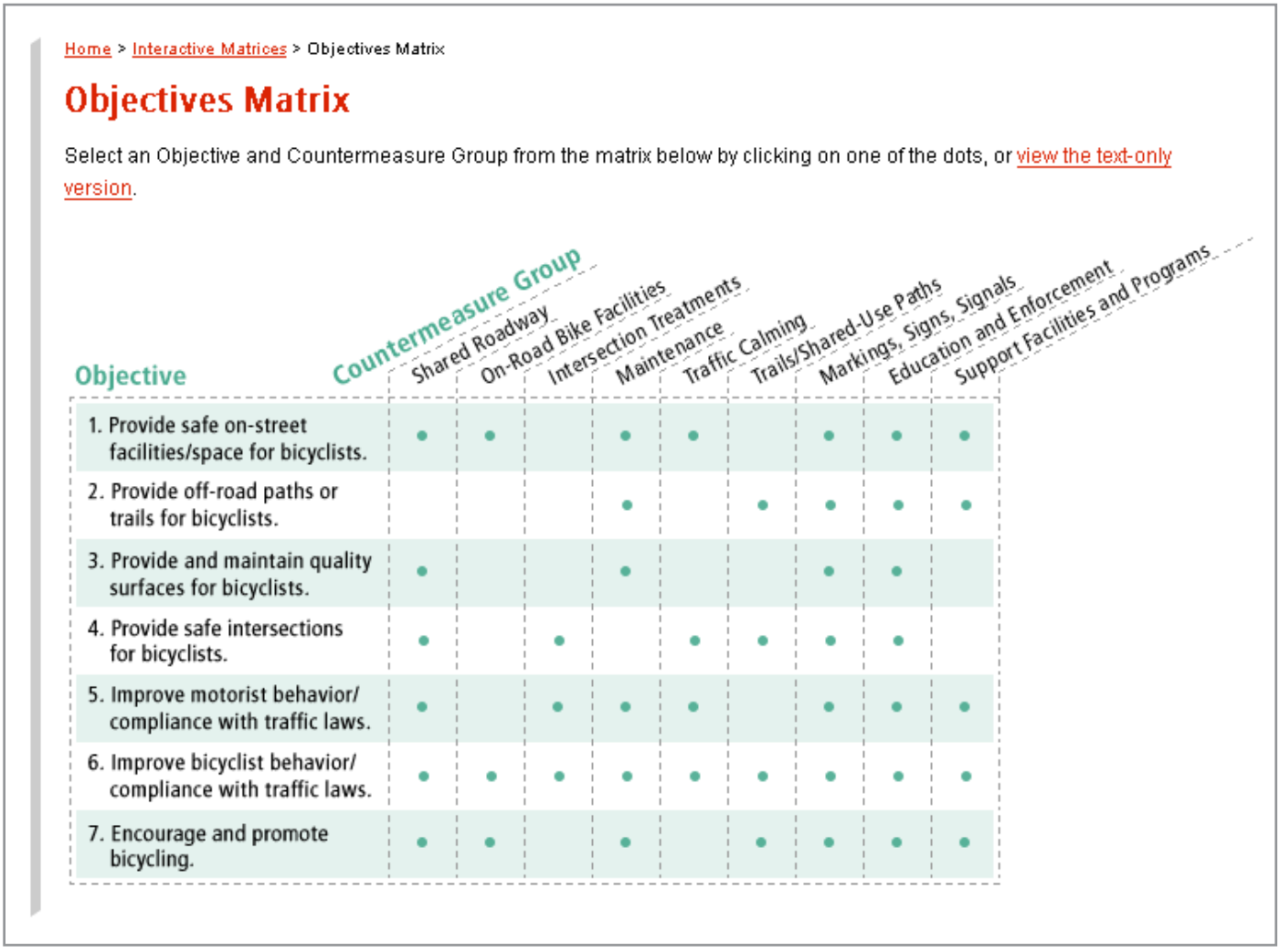
Output Results to Microsoft Excel

Start Over

The results produced from the Selection Tool provide a list of applicable countermeasures and present the user with options to edit the responses, save the results, or start over..

INTERACTIVE MATRICES

Also included in the Web/CD-ROM application are two matrices that may be accessed by selecting "interactive matrices" from the Tools menu. The objectives matrix (shown below) provides the user with a quick view of the relationship between the seven performance objectives and the nine countermeasure groups. The crash analysis matrix (shown on the following page) allows the user to see the relationship between the 13 crash type groups and the nine countermeasure groups. In either matrix, a filled cell indicates that there is a specific countermeasure within the countermeasure group (shown in the columns) that is applicable to the crash group or performance objective listed in each row. The user can click on the bullet in any filled cell to obtain a drop-down list of the specific applicable countermeasures. From there, the user can select a countermeasure and be linked to the countermeasure description page or select another cell within the matrix.



Cells with a bullet indicate there are one or more countermeasures within a countermeasure group that are applicable to a specific performance objective.

Home > Interactive Matrices > Crash Matrix

Crash Matrix

Select a Crash Group and Countermeasure Group from the matrix below by clicking on one of the dots, or view the text-only version.

Crash Group \ Countermeasure Group	Shared Roadway	On-Road Bike Facilities	Intersection Treatments	Maintenance	Traffic Calming	Trails/Shared-Use Paths	Markings, Signs, Signals	Education and Enforcement
1. Motorist failed to yield – signalized intersection	•		•		•	•	•	•
2. Motorist failed to yield – non-signalized intersection	•		•		•	•	•	•
3. Bicyclist failed to yield – signalized intersection	•		•		•	•	•	•
4. Bicyclist failed to yield – non-signalized intersection	•		•		•	•	•	•
5. Motorist drove out – midblock	•					•	•	•
6. Bicyclist rode out – midblock	•				•	•	•	•
7. Motorist turned or merged left into path of bicyclist	•	•	•		•	•	•	•
8. Motorist turned or merged right into path of bicyclist	•	•	•		•	•	•	•
9. Bicyclist turned or merged left into path of motorist	•		•	•	•	•	•	•
10. Bicyclist turned or merged right into path of motorist	•	•	•	•	•	•	•	•
11. Motorist overtaking bicyclist	•	•		•	•	•	•	•
12. Bicyclist overtaking motorist	•	•		•		•	•	•
13. Non-motor vehicle crashes	•			•		•	•	•

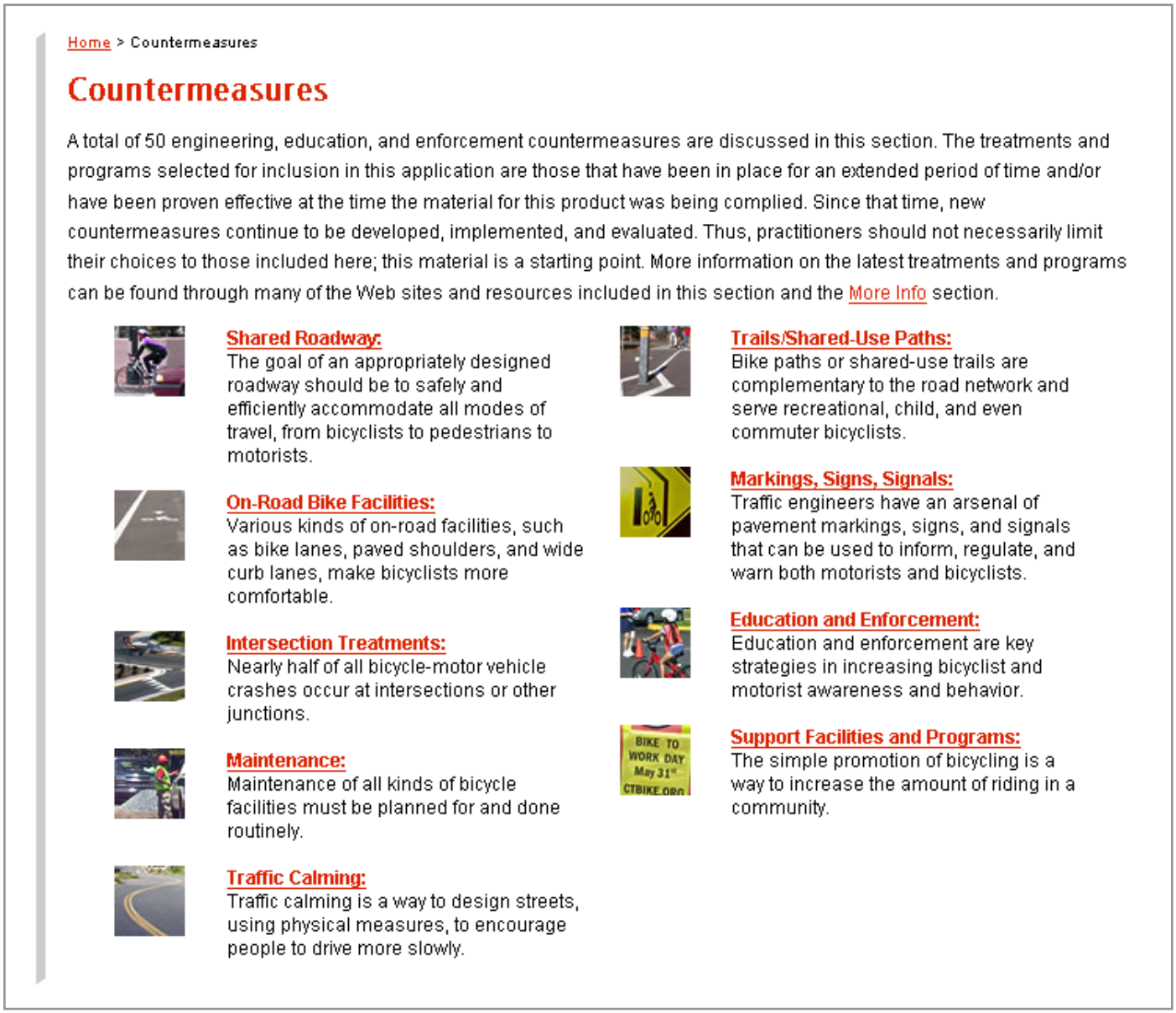
Cells with a bullet indicate there are one or more countermeasures within a countermeasure group that are applicable to a specific crash group.

COUNTERMEASURES

Each of the 50 engineering, education, and enforcement countermeasures described in Chapter 5 are included in the Web/CD-ROM application. After selecting "countermeasures" within the Tools menu, the user may select one of the following nine categories of treatments:

- Shared Roadway
- On-Road Bike Facilities
- Intersection Treatments
- Maintenance
- Traffic Calming
- Trails/Shared-Use Paths
- Markings, Signs, Signals
- Education and Enforcement
- Support Facilities and Programs

A specific countermeasure may then be selected from those listed for each category. Each countermeasure includes a description of the treatment or program, purpose(s), considerations of which one should be aware, and cost estimates. Finally, there are links to specific case studies (if available) where the particular countermeasure has been implemented. An example countermeasure description page is shown on the following page for Bike Lanes.

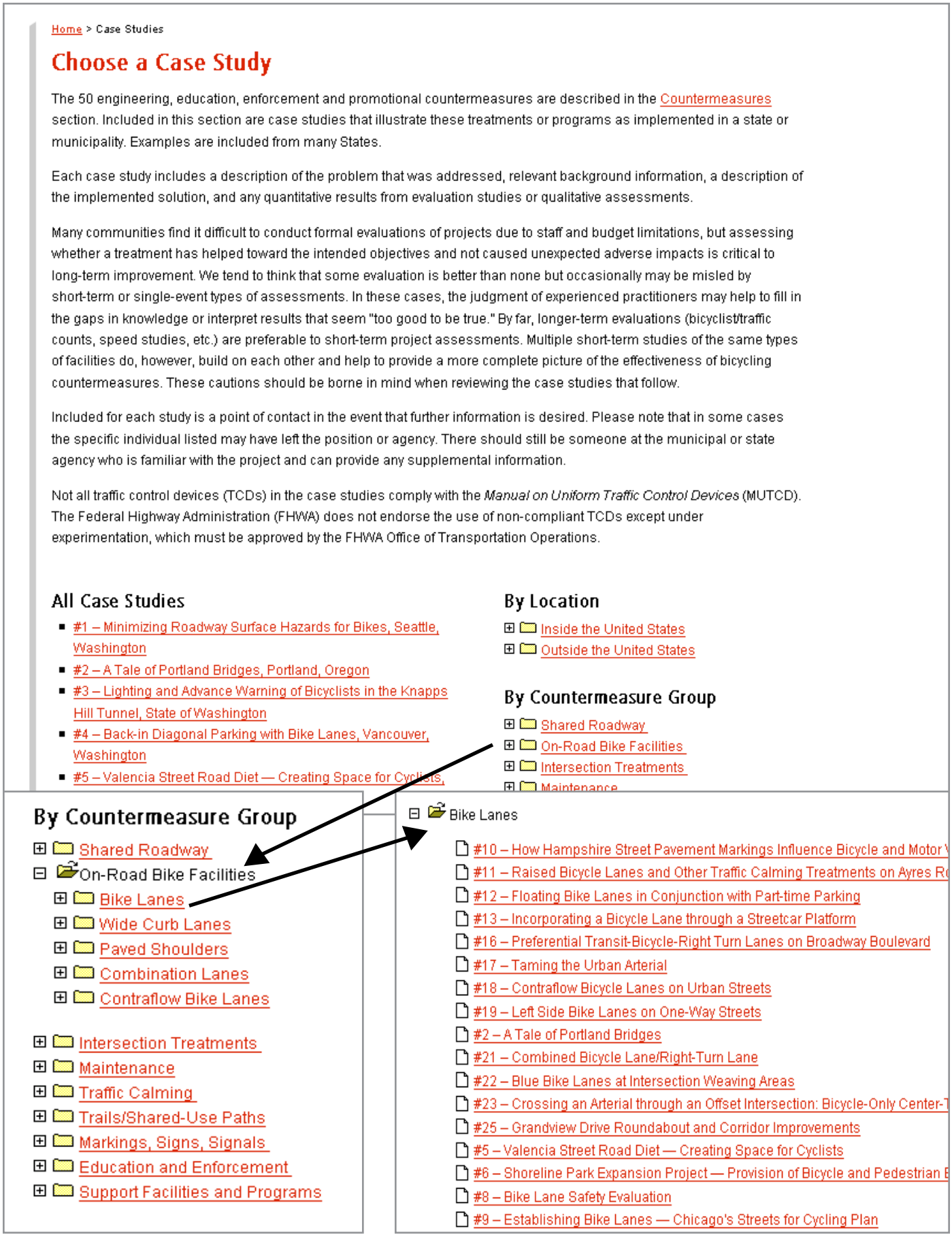


The 50 countermeasures are divided among the nine categories of improvements shown here.

Each countermeasure includes a description, purpose, considerations, estimated cost, and links to case studies where the treatment or program has been implemented.

CASE STUDIES

The case studies described in Chapter 6 are included in the Web/CD-ROM application. The user can access the implementation examples by selecting "case studies" within the Tools menu. As shown on the following page, the user then has the option of selecting a case study on the basis of location or type of countermeasure. The figure on the following page provides an example of selection by countermeasure. The selection of the On-Road Bike Facilities countermeasure group produces a list of the five treatments included in the application. The selection of Bike Lanes produces a list of 16 case studies in which a bike lane was a component of the treatments implemented. Accessing each of these case studies provides information about the specific problem that was addressed, the solution implemented and the results achieved.



The case studies may be selected by location or countermeasure. Opening a countermeasure group folder reveals the list of countermeasures included. Selecting a specific countermeasure reveals the case studies in which that treatment/program was a component.