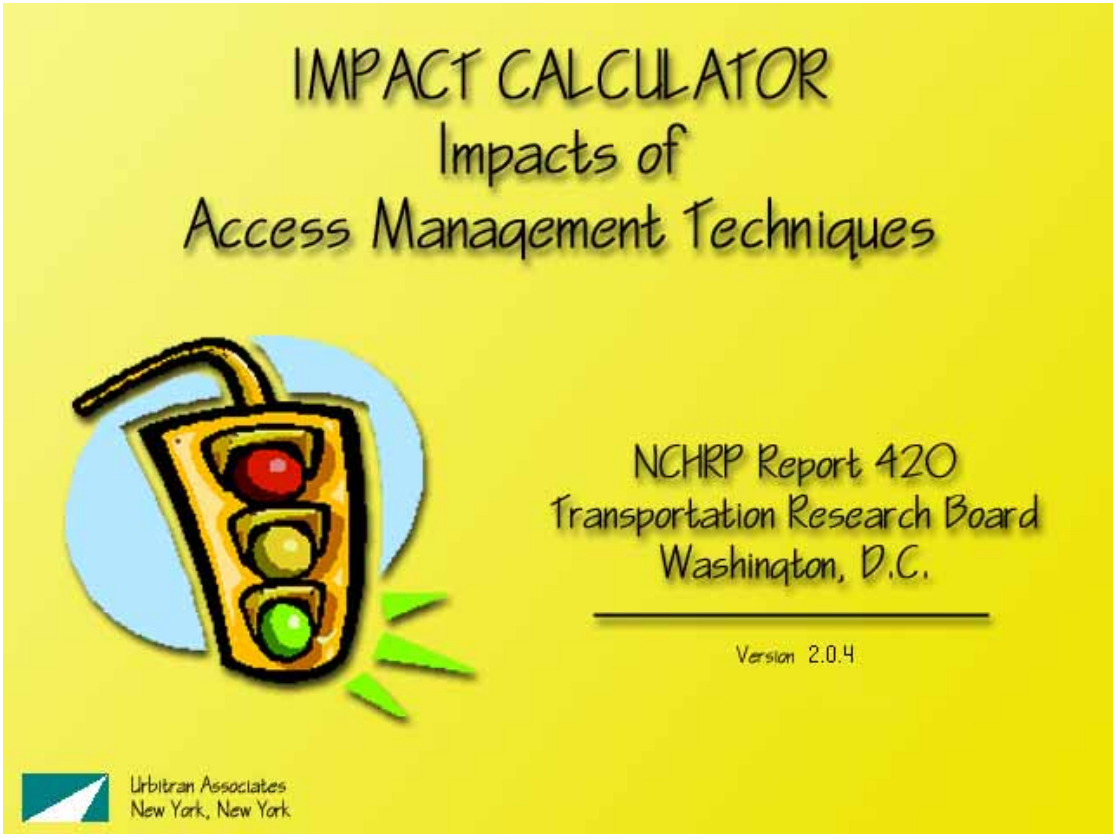
1. Welcome to the *Impact of Access Management Techniques (IAMT) Calculator*.



This software has been developed to complement the National Cooperative Highway Research Program (NCHRP) Report 420, Impacts of Access Management Techniques. It provides a set of tools to help calculate the effects of changing access conditions along a section of highway, using the applications that were developed in the NCHRP research.

A working knowledge of the terminology and methodology described in NCHRP Report 420 would be useful in the application of this software. The report is included on this CD.

The TOUR

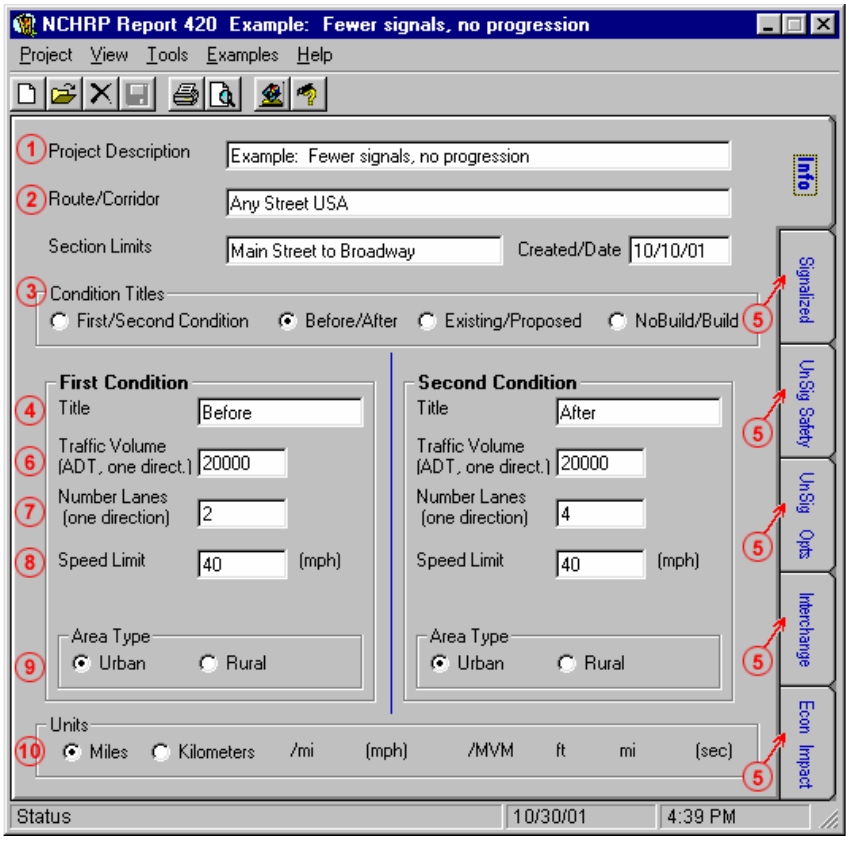
The TOUR that you are now reading is a companion to the IAMT Calculator. As you view your computer screen, you can see two windows:

- This window contains the TOUR. You can navigate from section to section in the TOUR using the above VCR-like arrows. Clicking the 'X' will close the TOUR window.
- The other window contains the CALCULATOR. You may click on that window at any time, make changes to the input values, and watch how the results change. If you leave the TOUR, the CALCULATOR window will remain fully operational.

The TOUR and CALCULATOR windows are independent; you may use or close the CALCULATOR without affecting the TOUR window. However, as you move through the TOUR, the CALCULATOR will move from tab to tab in sync with the TOUR.

Click the above Right Arrow (">") to move to the next screen.

2. Organization of the IAMT CALCULATOR



The CALCULATOR is organized to help quantify the impacts of techniques and decisions regarding access management for specified "projects". A "project" generally is viewed as one section of roadway, from a beginning to an ending milepost. The "Info" tab of the CALCULATOR is used to describe the general characteristics of the project:

- In the **Project Description** (1) the project is named. This can be free-flowing text, and should be short enough to fit into the box yet long enough to be uniquely descriptive. All the project data described below are saved into the IAMT database using this Project Description field as a reference.
- The **Route / Corridor** and **Section Limits** (2) provide for inputting a further description of the project, typically referring to a highway and location. One could, for example, have a number of projects relating to the same Route / Corridor.

Within the "project" two conditions can be compared – typically a "Before and After", an "Existing and Proposed", a "Build and No-Build", or whatever the user chooses to call them. All the screens are organized to provide a side-by-side comparison of these two conditions.

You may either select one of the pre-named **Condition Title** sets (3) or you may select your own by typing a name into each condition **Title** box (4). These titles will need to fit in the box provided.

The CALCULATOR computes impact measures for each of five analysis types:

- The **Signalized** analysis estimates the effect of changes in traffic signal density on arterial travel times and speeds.

- The **Unsignalized - Safety** analysis estimates the effect of access conditions and decisions (e.g. access spacing/density and median type) on the crash or accident rate.
- The **Unsignalized - Operations** analysis estimates the effect of right-turns into unsignalized driveways on through traffic conditions based on the access density, the right-turn volume, and the segment length. This analysis reflects the interference caused by multiple access points.
- The **Interchange** analysis estimates the access separation distance needed along interchanging arterial roadways between a ramp and cross street.
- The **Economic Impact** analysis estimates the maximum effects resulting from median closures.

In the CALCULATOR each of these analyses is selected by clicking on one of the tabs (5) along the right side of the window.

Segment Characteristics

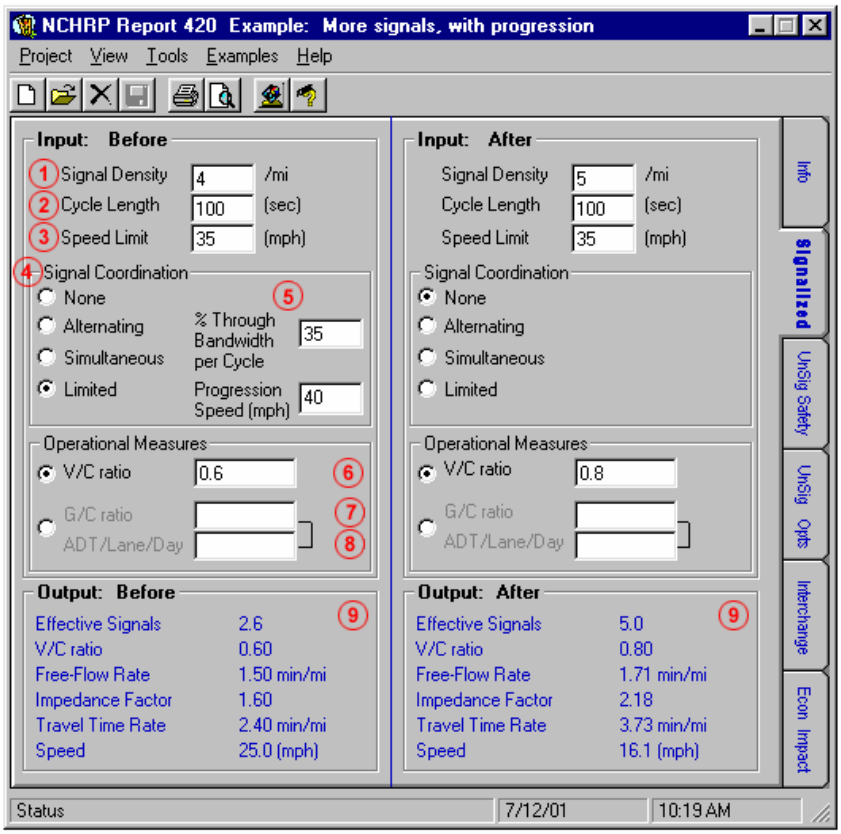
There are key data items that are used repeatedly in the various analyses. These data should be entered on the **Info** screen once. However, it should be noted that within each analysis these data may be overridden by simply typing the desired value into its box.

The following segment characteristic data should be entered on the **Info** screen:

- The **Traffic Volume** (6) is the *one-directional* Average Daily Traffic (ADT) in vehicles per day on the route/section being analyzed.
- The **Number of Lanes** (7) is the nominal number of through lanes, for one direction. Auxiliary or turning lanes are not counted.
- The **Speed Limit** (8) is the posted speed limit (mph or km/h).
- The **Area Type** (9) selects whether the segment is in an urban or rural area.

The CALCULATOR may compute its measures in either miles or kilometers. Select the desired **Units** (10).

3. TRAFFIC SIGNAL SPACING ANALYSIS



The first analysis section of the CALCULATOR is **Signalized Operations**. This section is accessed by clicking on the **Signalized** tab.

The spacing of traffic signals, in terms of their frequency and uniformity, governs the performance of urban and suburban highways. This section is based on the Application Guidelines of Chapter 3, Traffic Signal Spacing. It enables the user to estimate and compare the effects of changing the number of signals, cycle length, etc. on travel time and speed.

Inputs must be specified for one or both conditions. Some data items have been captured or imputed from the Info screen. These data may be used as is, or they may be changed on this screen. These changes will have no effect on the values on the Info or other screens.

As data are entered, the computed values in the Output section at the bottom of the screen will appear. Note that this only occurs when the needed input values have been entered.

Input Data

Input data fields are as follows:

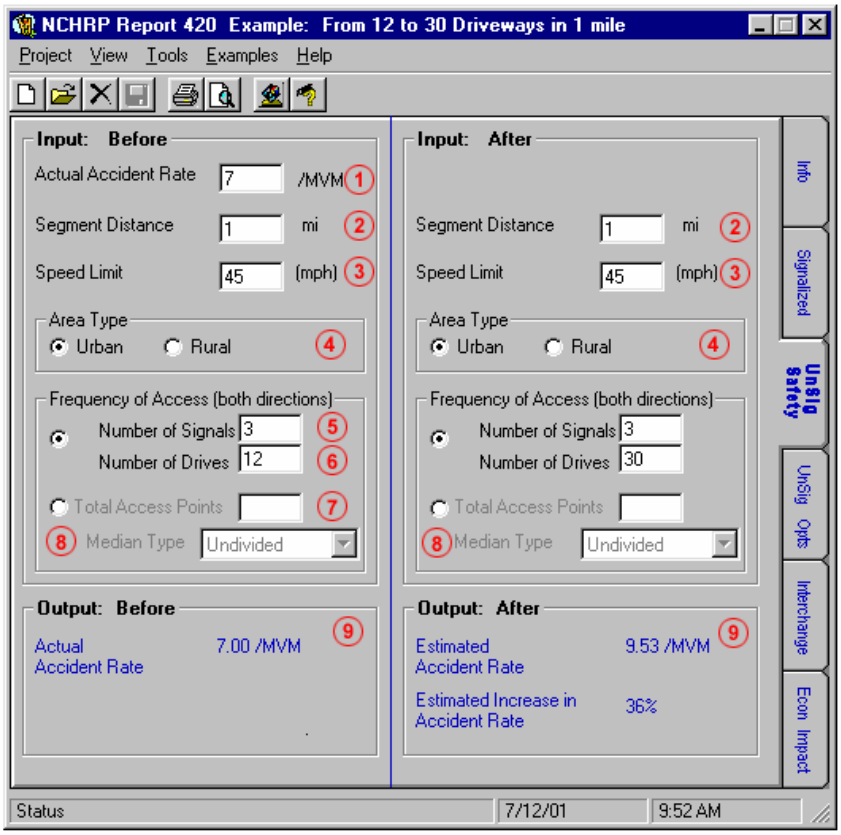
- Basic signal data are entered for both conditions. **Signal Density** (1) is defined as the average number of signals per mile or kilometer. The signal **Cycle Length** is entered in units of seconds (2). The segment **Speed Limit** (3) is entered in miles per hour or kilometers per hour.

- **Signal Coordination** (4) is specified by the user. Select either "None", "Alternating", "Simultaneous", or "Limited". If there is signal coordination indicated, then the **Bandwidth** (5) as the percentage of the cycle length and the estimated **Progression Speed** in miles per hour or kilometers per hour must be entered.
- Additional **Operational Measures** need to be specified. Either the **volume / capacity ratio** (6) is entered (as a decimal value between 0 and 1.0), or a combination of the **green time / cycle length (G/C) ratio** (7) as a percentage and the **Average Daily Traffic (ADT) per lane per day** (8) are entered. The v/c value can be estimated using the Highway Capacity Manual or Highway Capacity Software (HCS) Arterials Operational Analysis. The G/C ratio is computed as the arterial green time divided by the cycle length. When G/C and ADT values are available, the v/c value may be computed as explained in NCHRP Report 420 (Page 29, paragraph 1).

Output Data

Once the data have been entered, the computed results, including the travel time rate and speed, will appear in the **Output Section** (9) for each condition. Pages 29 and 30 of NCHRP Report 420 in Chapter 3, Traffic Signal Spacing, present examples that illustrate the computations that are performed in this analysis section.

4. UNSIGNALIZED SAFETY ANALYSIS



The second analysis section of the CALCULATOR is **Unsignalized Safety.** This section is accessed by clicking on the **Unsig-Safety** tab and is based on the Application Guidelines of Chapter 4, Unsignalized Access Spacing. Data must be entered into this section before the following one, **Unsignalized Operations**, can be used, because some data items are shared between the two programs.

Access points introduce conflicts and friction into the traffic stream. This section estimates the change in crash or accident rate based on an increase or decrease in access density. When the accident rate for the base case is known, the estimated percent change is applied to project the future accident rate.

Inputs to this section must be specified for one or both conditions. Some data items have been captured or imputed from the Info screen. These data may be used as is, or they may be changed on this screen. Those changes will have no effect on the values on the Info or other screens.

As data are entered, the computed values in the Output section at the bottom of the screen will appear. Note that this only occurs when the needed input values have been entered.

Input Data

Input data fields are as follows:

- Basic segment data are entered for both conditions. The **Actual Accident Rate** (1) is defined as the recorded accident rate for this or similar highway sections, and is expressed as the number of accidents per million vehicle miles (MVM) or million

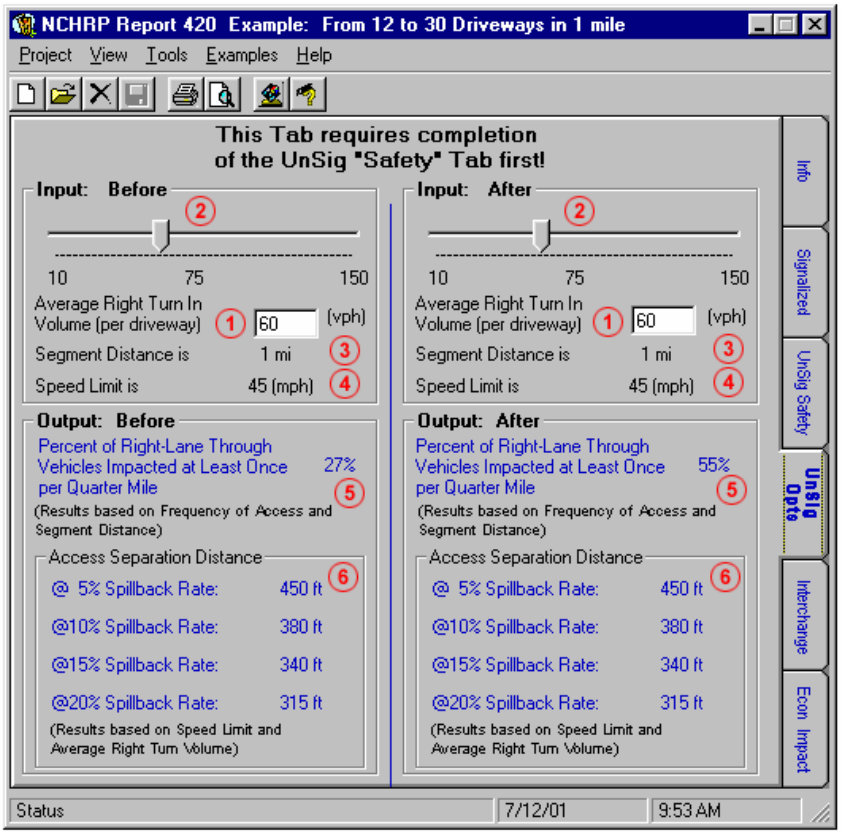
vehicle kilometers (MVKm). The **Segment Distance** (2) and the **Speed Limit** (3) will be captured automatically from the **Info** screen, or can be entered on this screen. They are entered in miles and miles per hour, or kilometers and kilometers per hour, depending upon which units were selected on the **Info** screen.

- **The Area Type** (4) is specified. Select either "Urban" or "Rural". This selection will initially be captured from the **Info** screen, but it can be overridden here.
- The **Frequency of Access** prevailing on the section, accounting for both directions, must be specified. Either the number of **Existing Signals** (5) (number of signalized intersections) and **Existing Driveways** (6) (total for both directions) can be entered, or the number of **Total Access Points** (7) can be specified. If the latter is selected, the **Median Type** (8) must be selected from the pull-down list of undivided, two-way left-turn lane (TWLTL), or non-traversable cross sections.

Output Data

Once the data have been entered, the computed results will appear in the **Output Section** (9) for each condition. If an Actual Accident Rate is input for the base condition, a percent change and the projected accident rate will be estimated for the second condition (e.g. "Proposed", "After", etc.). If an Actual Accident Rate is not input for the base condition, only the percent change in accident rate will appear as the output. If the total number of signals and driveways were input, NCHRP Report 420 Figures 24 or 25 would be used for urban and rural areas, respectively. If the numbers of signalized and the number of unsignalized access points were specified for a segment in an urban area, NCHRP Report 420 Figure 26 would be used.

5. UNSIGNALIZED OPERATIONS ANALYSIS



The third analysis section of the CALCULATOR is **Unsignalized Operations**. In general, the data for this section are captured from the previous section, **Unsignalized Safety**, or from the **Info** screen. The **Unsignalized Safety** screen must be completed before this one, since some data items are shared between the two programs.

Field data were collected for NCHRP Report 420 on the number and percentage of through vehicles affected by right turns into a driveway. The impact distances of through vehicles affected were determined and, in turn, influence areas were computed. These results were used to quantify the effects of multiple driveways and to develop inputs for establishing unsignalized access spacing guidelines. Chapter 4, Unsignalized Access Spacing, of NCHRP Report 420 describes these analyses procedures and results.

Input Data

Input data fields are as follows:

- The **Average Right Turn In Volume (per Driveway)** that was entered on the Unsignalized Safety screen may be revised either by entering the value (1) or by adjusting the slide bar (2) so the desired value is displayed.
- The **Segment Distance** (3) and the **Speed Limit** (4) will be captured automatically from the **Info** screen, or can be entered on this screen. They are entered in miles and miles per hour, or kilometers and kilometers per hour, depending upon which units were selected on the Info screen.

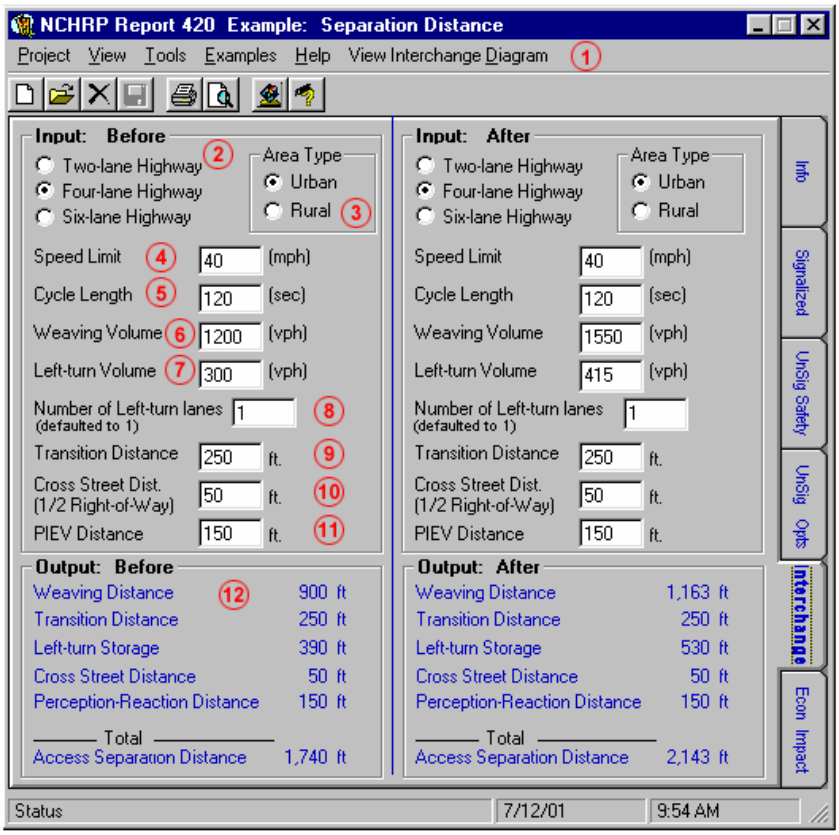
Output Data

Once the data have been entered, the computed results will appear in the **Output Section** for each condition.

This section computes two statistics:

- The **Percent of Right-Lane Through Vehicles Impacted** (5) indicates the proportional impact of turning traffic on the traffic stream. A through vehicle is deemed to be impacted if its driver activates the brake lights or performs an evasive maneuver as a result of another vehicle turning right into an unsignalized driveway. It is given as the percentage of through vehicles that are impacted at least once per quarter mile. The three inputs used to perform this calculation are Average Right-Turn-In Volume (per driveway), Segment Distance, and Frequency of Access.
- The **Access Separation Distance** (6) needed for various probabilities of spillback interference is also computed. Spillback occurs when an impacted through vehicle is influenced at or beyond the driveway upstream from the right-turn-in driveway. The spillback rate is defined as the percentage of through vehicles that experience spillback at least once per quarter mile. The Average Right-In Volume (per driveway) and Speed Limit are used as input for this calculation. For example, a 10% spillback rate indicates that, if the computed spacing is provided, 10% of the right-lane through vehicles would be influenced at or beyond the driveway upstream from the right-turn-in driveway.

6. INTERCHANGE OPERATIONS ANALYSIS



The fourth analysis section of the CALCULATOR is **Interchange Operations**. It computes the **Access Separation Distance** needed between ramp terminals and cross-route access points to allow for proper merging, weaving, and diverging of ramp and arterial traffic.

Although access is controlled on a freeway within the interchange area, there is often little, if any, access control along the arterial roads. Existing intersections along the arterial are often spaced too close to interchanges. In addition, curb cuts and median breaks for large and small traffic generators compound the problem. There is growing recognition that access separation distances and roadway geometry should be improved from an access management perspective.

The analysis in this section is based on Chapter 9 of NCHRP Report 420 and refers to several dimensions that are illustrated in an interchange diagram. The diagram can be viewed by clicking on the **View Interchange Diagram** menu item (1).

Input Data

Input data fields are as follows:

- The **Number of Lanes** (2) on the arterial for both directions combined.
- The **Area Type** (3) selects whether the segment is in an urban or rural area.
- The **Speed Limit** (4) is the posted speed limit (mph or km/h).
- **Cycle Length** (5) is expressed in seconds.
- **Weaving Volume** (6) includes the ramp volume that is estimated to be turning left and the estimated through volume on the arterial.

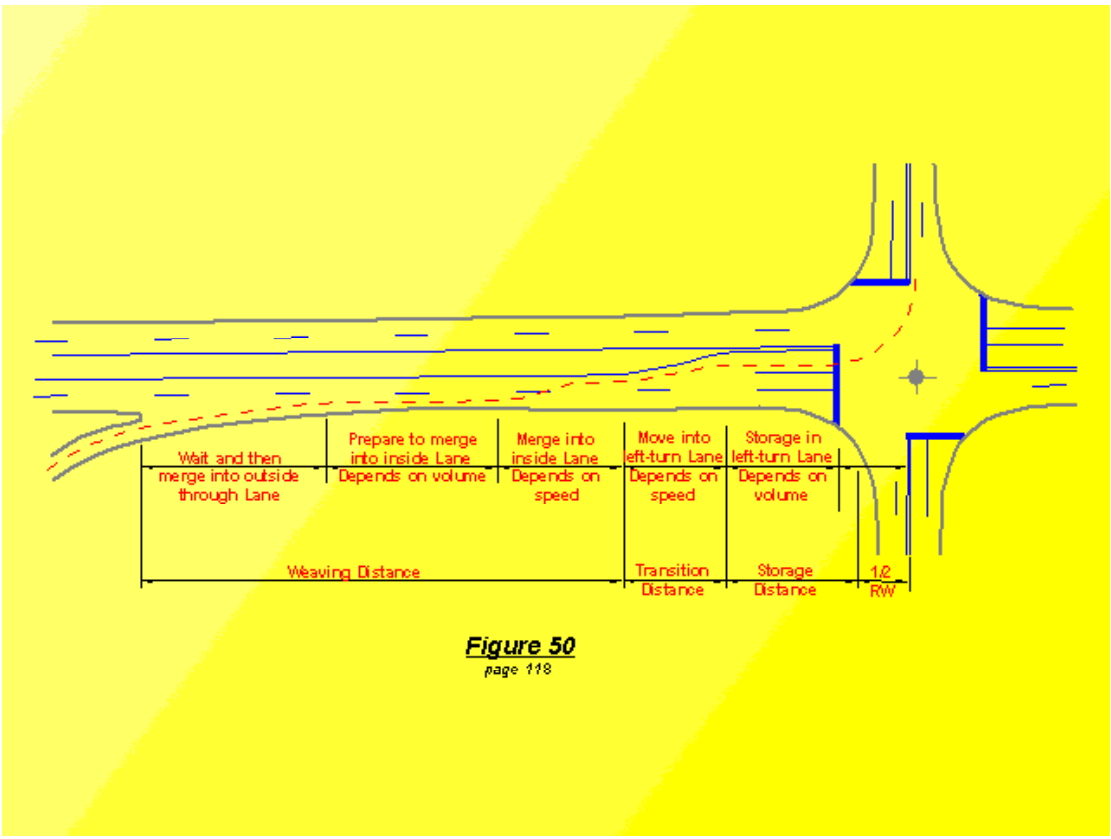
- **Left-turn Volume** (7) is the traffic volume in vehicles per hour that is estimated to turn left at the downstream cross street.
- **Number of Left-turn Lanes** (8) to accommodate the left-turn volume at the downstream cross street.
- The **Transition Distance** (9) is the lane-change distance to enter the left-turn storage lane (ft or m). A distance of approximately 150 to 250 ft. is usually reasonable.
- The **Cross-Street Distance** (10) is half of the street right-of-way (ft. or m) where separation distances are measured from the centerline of the road crossing the arterial. This distance will normally approximate 50 ft.
- **PIEV Distance** (11) may be added to account for perception-reaction distance. This distance will normally approximate 100 to 150 ft.

Output Data

Once the data have been entered, the computed result for the Total Access Separation Distance will appear in the **Output Section** (12) for each condition based on the weaving, transition, cross-street, and perception-reaction distances as well as the left-turn storage. The weaving distance is estimated using Table 85 in NCHRP Report 420. The left-turn storage length is estimated using equation 12 in Chapter 9 of that document.

7. Interchange Diagram

This **Interchange Diagram** is from the NCHRP Report 420, and illustrates the key dimensions that are inputs to the **Interchange Operations** analysis.



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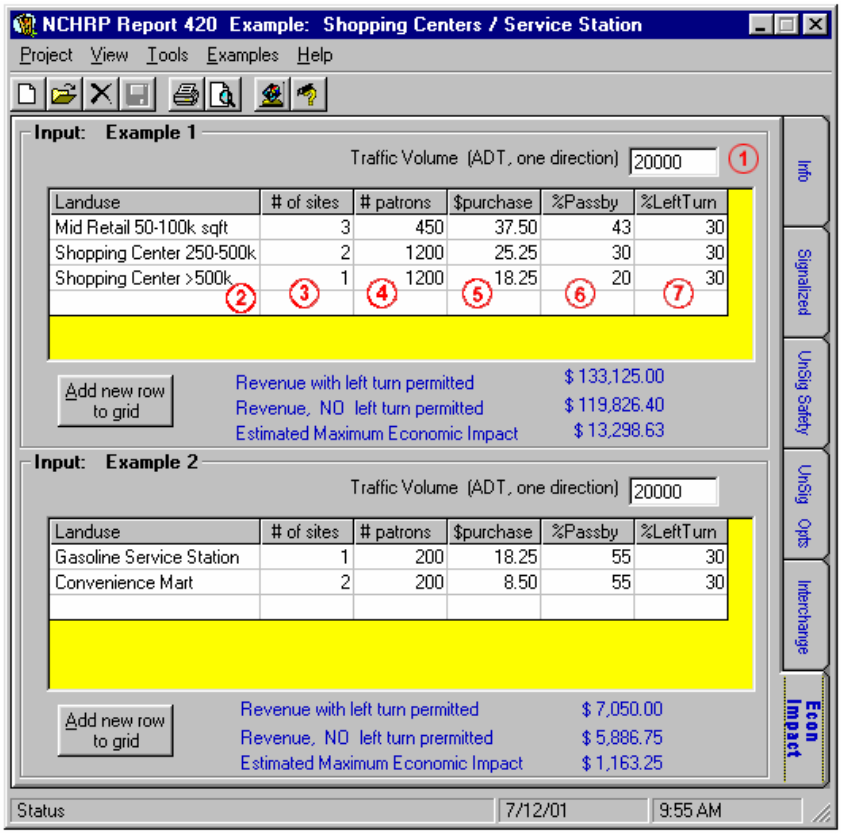
8. ECONOMIC IMPACT ANALYSIS



The fifth analysis section of the CALCULATOR is **Economic Impact**. It applies a simplified approach from Chapter 6, Median Alternatives, of NCHRP Report 420 to estimate the maximum economic effects on commercial sites of installing a raised median and limiting certain access points to right turns only.

The economic effects of various median alternatives depend on the extent that access is improved, restricted, or denied. The effects on specific establishments also depend on the type of activity involved and on the background economic conditions. Where direct left turns are prohibited, some motorists will change their driving or shopping patterns or use U-turn facilities to continue patronizing specific establishments. In some cases, retail sales may increase as overall mobility improves.

Input Data

Input data fields are as follows:

- The **Traffic Volume** on the arterial in terms of the average daily traffic per direction (1). This is used as the basis for estimating the % left turns.
- A type of **Land Use** (2) that is being affected by the installation of a raised median on the arterial and the **# of sites** (3) that are occupied by that land use type.
- The estimated average **# of patrons** (4) by each land use type.
- The estimated average **$ purchase** (5) for each customer by each land use type.

- The estimated **% pass-by** (6) by each land use type. Where field data are not available, Table 66 of NCHRP Report 420 provides pass-by estimates for various land uses.
- The estimated **% left turns** (7) by each land use type. Where field data are not available, Table 66 of NCHRP Report 420 provides estimated % left turns for various ADTs.

For user convenience, the input table is pre filled with most common land use types and estimates of # of patrons and $ per purchase. These may be used as a starting point, but need to be adjusted to reflect specific conditions in the project area. The # of sites needs to be specified for each land-use type for the calculator to estimate the economic impacts. Additional land uses may be input, but the required parameters must be specified.

Output Data

Once the data have been entered, the revenues are estimated for the land uses input to reflect conditions with and without left turns permitted. The difference between the two revenue estimates represents the maximum economic effect for each condition. These estimates represent maximum impacts, because repetitive pass-by traffic might change travel patterns, stop on the return trip, or use U-turn facilities. Impacts would also be less where an alternate left-turn access into a property remains open. There may be no overall impact on the community because this business traffic would be diverted to other area establishments. Moreover, sales at establishments along a section of road might show an increase in sales as a result of improved accessibility.

Notes