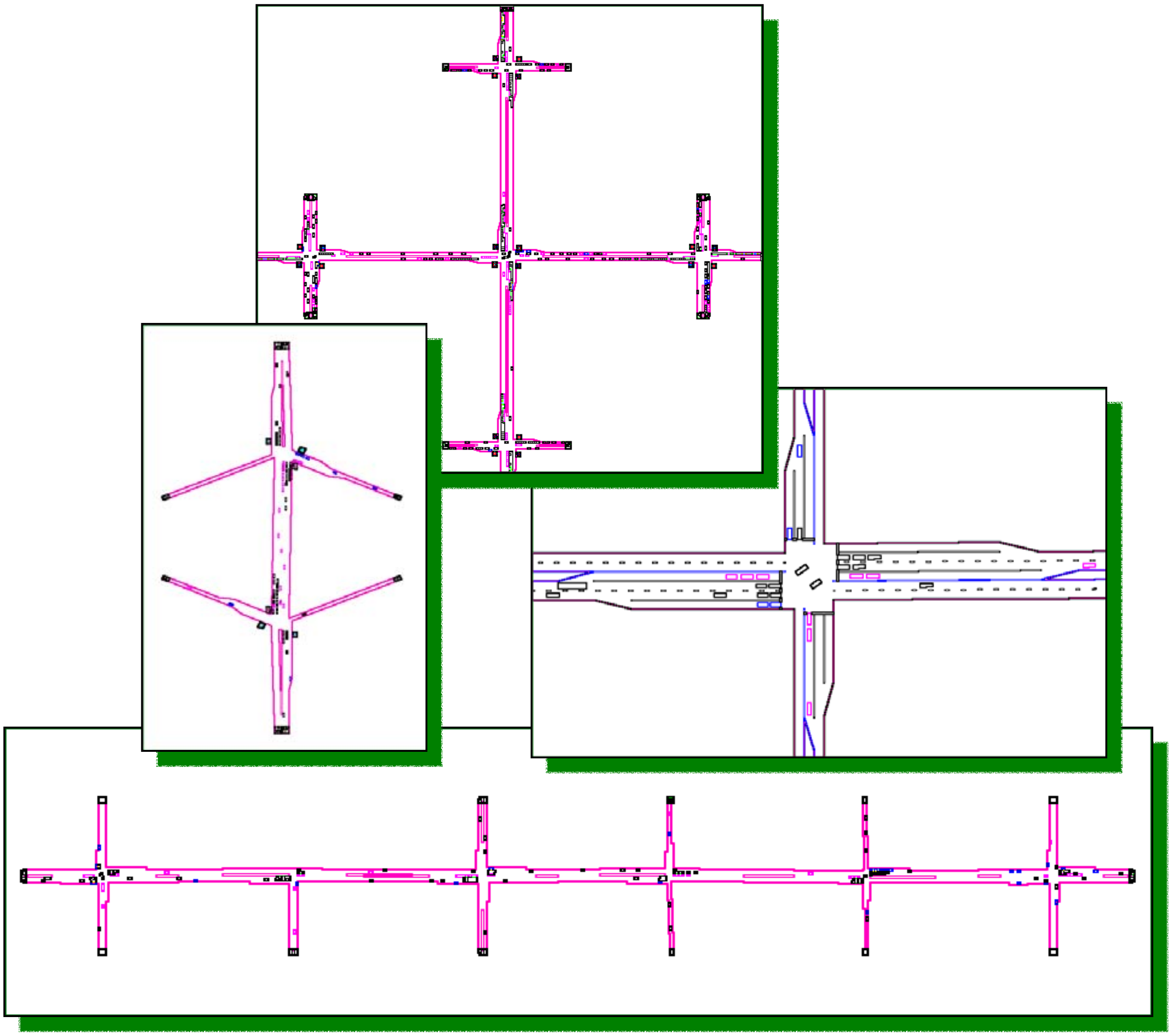

Development of Traffic Operations Software Tools

Prepared for the Florida Department of Transportation by the University of Florida Transportation Research Center

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UF Project 49104504685

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16. Abstract

The Florida Department of Transportation (FDOT) has led the way in developing and maintaining an integrated set of signal optimization and analysis tools. The new Windows computing environment has created a need to revisit these tools.

The objectives of this project were to provide the FDOT with improved preprocessor, postprocessor and communications support for traffic engineering and planning software to replace the existing MS-DOS versions with new versions compatible with the Windows environment.

The product of this research is a set of productivity enhancement tools that provide a high degree of connectivity between existing and future design, optimization and analysis models used by FDOT in planning, project development and engineering, roadway design, traffic operations and ITS. The tools are integrated into a single software product referred to as the "Arterial Analysis Package" (AAP) version 2K. This report describes the operation of the AAP. It provides full instructions for installation, setup and operation of the program. It is essentially the user's guide for the program.

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Disclaimer

Preface

The Florida Department of Transportation (FDOT) has led the way in developing and maintaining an integrated set of signal optimization and analysis tools. Collectively, these tools have contributed significantly to the productivity and credibility of Department staff at the central and district office levels. The importance of effective software tools has continued to grow as congestion management and intelligent transportation systems (ITS) functions expand throughout the state.

The new Windows-based computing environment created a need to revisit these tools. A complete redesign of the current package is required to meet the needs of the FDOT in planning, project development and engineering, roadway design, traffic operations and ITS.

The objectives of this project were to provide the Department with improved preprocessor, postprocessor and communications support for traffic engineering and planning software to replace the existing MS-DOS versions with new versions compatible with the Windows environment.

The product of this research is a set of productivity enhancement tools that provide a high degree of connectivity between existing and future design, optimization and analysis models used by FDOT. The tools are integrated into a single software product referred to as the "Arterial Analysis Package" (AAP) version 2K.

This report describes the operation of the AAP. It provides full instructions for installation, setup and operation of the program. It is essentially the user's guide for the program. The full contents of this report have been reformatted and incorporated into a context sensitive HTML-based help feature that may be accessed from any point in the program.

The program has been completed and is able to perform useful work for arterial signal system design and evaluation. The architecture has been designed to facilitate future enhancements. Because of the extensive on-line help, the training requirements are minimal. These requirements will be met by a post-project workshop conducted in coordination with other FDOT technology transfer activities.

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ARTERIAL ANALYSIS PACKAGE USER GUIDE

1 INTRODUCTION

The Arterial Analysis Package (AAP) was developed in the 1970s as an integrator of some commonly used software products that perform traffic signal timing design and evaluation. The AAP has evolved to keep pace with new computer platforms, beginning with the mainframe computer, progressing through MSDOS-based systems to the Windows-based system that is currently under development. The current version is referred to as AAP2K. This document summarizes the features of the AAP and provides instructions for its operation.

The AAP offers a powerful tool for integrating the design and analysis methodology for arterial traffic control systems. It brings together several widely used software products under a single umbrella and connects them with a common input data scheme. The software products accessible from the AAP are referred to as "component programs." The various configurations or systems of intersections are referred to as "facilities." An overview of the facilities and component programs supported by the AAP is shown in Figure 1.

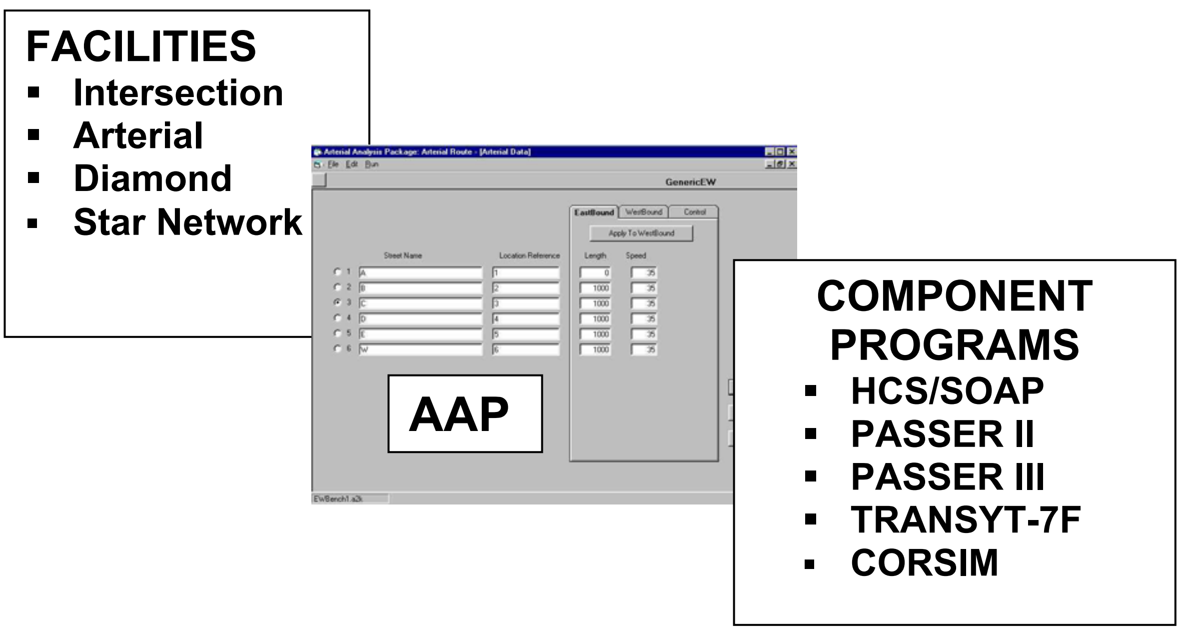


Figure 1. AAP Facilities and Component Programs

The AAP provides access to all of the component programs that support each facility. The component programs are all well documented and the discussion presented herein assumes that you are familiar with the purpose and operation of each component program that you intend to use. The details, scope and limitations are summarized as follows:

- Single intersections may be analyzed by the Highway Capacity Software (HCS), using the latest version of the Signal Operations Analysis Package (SOAP2K) as a signal timing design tool. Access is also provided to TRANSYT-7F and CORSIM for a more detailed treatment of the traffic flow. While TRANSYT-7F and CORSIM both accommodate complex intersections with more than four approaches, the AAP deals only with conventional four-legged intersections.

- Two-way arterial routes with a maximum of twelve intersections may be analyzed using TRANSYT-7F, PASSER II and CORSIM. Depending on the component program, the twelve intersections may be a mixture of signals, TWSC and dummy intersections. The arterial route must be a two-way street at all intersections. The cross streets may be two-way streets, one-way streets or T intersections. TWSC intersections are mapped explicitly into TRANSYT-7F and CORSIM.

- Conventional diamond intersections are accommodated by TRANSYT-7F, CORSIM and PASSER III. Each of these component programs models diamond interchanges in a different manner. The results from each program will often be different, but each program has some "wisdom" to offer the designer.

- Star networks include a central signalized intersection with an upstream (satellite) signal on each of the four approaches. The central intersection is the focus of star-network analysis in the AAP. The satellite intersections are recognized primarily because of their influence on the central intersection. Star networks are mapped only to CORSIM.

2 BACKGROUND DISCUSSION

2.1 Evolution of The Arterial Analysis Package (AAP)

The Arterial Analysis Package provides a powerful tool for integrating the design and analysis methodology for arterial traffic control systems. It brings together several widely used software products under a single umbrella and connects them with a common input data scheme. All of these programs have unique data coding formats. Applying the programs individually requires learning their respective coding schemes and user interfaces.

The AAP recognizes that the software above uses the same traffic data; the difference between them is the format in which the software stores the data. The AAP provides a simple, convenient method of data coding and automatically generates the more detailed data streams required by the component traffic programs.

The software products accessible from the AAP are referred to as “component programs,” and the various configurations or systems of intersections are referred to as “facilities.”

2.2 Component Programs of the AAP

There are five component programs that have been incorporated into the AAP, including PASSER II, PASSER III TRANSYT-7F, HCS Signals, and CORSIM. The component programs will be described briefly here. More detailed information may be found in the user documentation for each program. To use any of the programs effectively you will have to be familiar with the details of its operation. Note that the component programs are not supplied with the AAP.

The Progression Analysis Signal System Evaluation Routine Version II (PASSER II) is a macroscopic, deterministic optimization program developed to maximize timing-plan bandwidths on arterial highways. The Texas Transportation Institute (TTI) at Texas A&M University developed the original program in 1973. Since then, many updates have been made, the latest being PASSER II-02. TTI developed the program to overcome limitations of previous progression models, which were generally restricted to fixed time, two-phase signals, often with balanced progression speeds in the two directions. PASSER II overcame these limitations by being able to work with multiple-phase signals, variable speeds, and priority directional weighing. PASSER’s model calculates phase sequences, cycle lengths and offsets to maximize through bandwidth. A separate version of PASSER, known as PASSER III, deals exclusively with diamond interchanges.

Traffic Network Study Tool (TRANSYT) was developed in England by Dennis Robertson of the Transport and Road Research Laboratory. In 1980, the University of Florida Transportation Research Center was awarded a contract to develop an American version of the program. TRANSYT-7F was the result. TRANSYT-7F is a macroscopic, deterministic optimization model with time-scan simulation. The optimization algorithm is based on a hill-climbing technique. Hill climbing is accomplished by varying offsets and splits in time increments called “steps” and calculating the resulting effects on traffic. TRANSYT-7F offers several optimization objective functions. The Disutility Index (DI) is the default objective function. The default DI is a combination of minimizing both delay and stops. Other objective functions include progression, Progression/DI, queuing ratio, queuing ratio/DI, throughput, and throughput/DI. The current release of TRANSYT-7F (Release 9.6) includes many enhancements that may be invoked through its own interface.

HCS2000 was developed by the McTrans Center at the University of Florida. The Highway Capacity Software (HCS) implements the procedures defined in the 2000 Highway Capacity Manual (HCM2000), which is Copyright 2000 by the Transportation Research Board (TRB). Single intersections may be analyzed by the HCS using the Signal Operations Analysis Package (SOAP2K) as a signal timing design tool. The HCS accommodates pretimed and actuated signals as well as two-way stop control (TWSC) and all-way stop control (AWSC) intersections.

CORSIM is actually the combination of two models, FRESIM and NETSIM. FRESIM and NETSIM are microscopic, stochastic simulation models for freeway and urban traffic respectively. The combination, CORSIM, is for corridor-microscopic simulation. The CORISM model is able to address fluctuating traffic demand at a detailed level, by modeling time-varying entry volumes at boundary nodes and time-varying turning fractions at urban intersections and freeway off-ramps for each time period. CORSIM is implemented within the Traffic Software Integrated System (TSIS), Developed by FHWA over the years by several contractors. The current version is TSIS 5.1.

3 SETTING UP THE AAP

The AAP must be installed and configured before it will run. The installation and configuration steps will be described separately.

3.1 The Installation Step

The AAP runs in the Windows ™ (95 and beyond) environment. The operation has been tested in Windows 95, 98, ME, 2000, XP and NT. Windows 2000 and NT users must be aware of the restrictions that may apply to accessibility of drives and directories for storing data. You should consult your system administrator if you are not sure of you access privileges.

The AAP uses a standard installation scheme; one that should be familiar to anyone who routinely installs Windows application software. Windows 2000 and NT systems incorporate various levels of access privileges to facilitate system maintenance. If you are installing the AAP in either of these operating systems, you must pay particular attention to access privileges for subsequent users. The overall file structure is illustrated in Figure 2.

- The "AAP Program Folder" identifies the folder in which all AAP programs reside. The program installer must have access privileges to this folder at installation time, and at the time that the program is first executed. Subsequent users do not need to be able to write files to the AAP program folder.

- The "AAP Working Folder" identifies the folder in which the AAP must write its working files, including parameter files that may be changed by any user. This folder must be accessible for writing data by all users.

- The sample data files are set up at installation time in a folder immediately below the program folder. These are "read only files and should not be modified, otherwise their contents will not match the documentation.

The AAP-Program and Working folders must be specified at the time of installation:

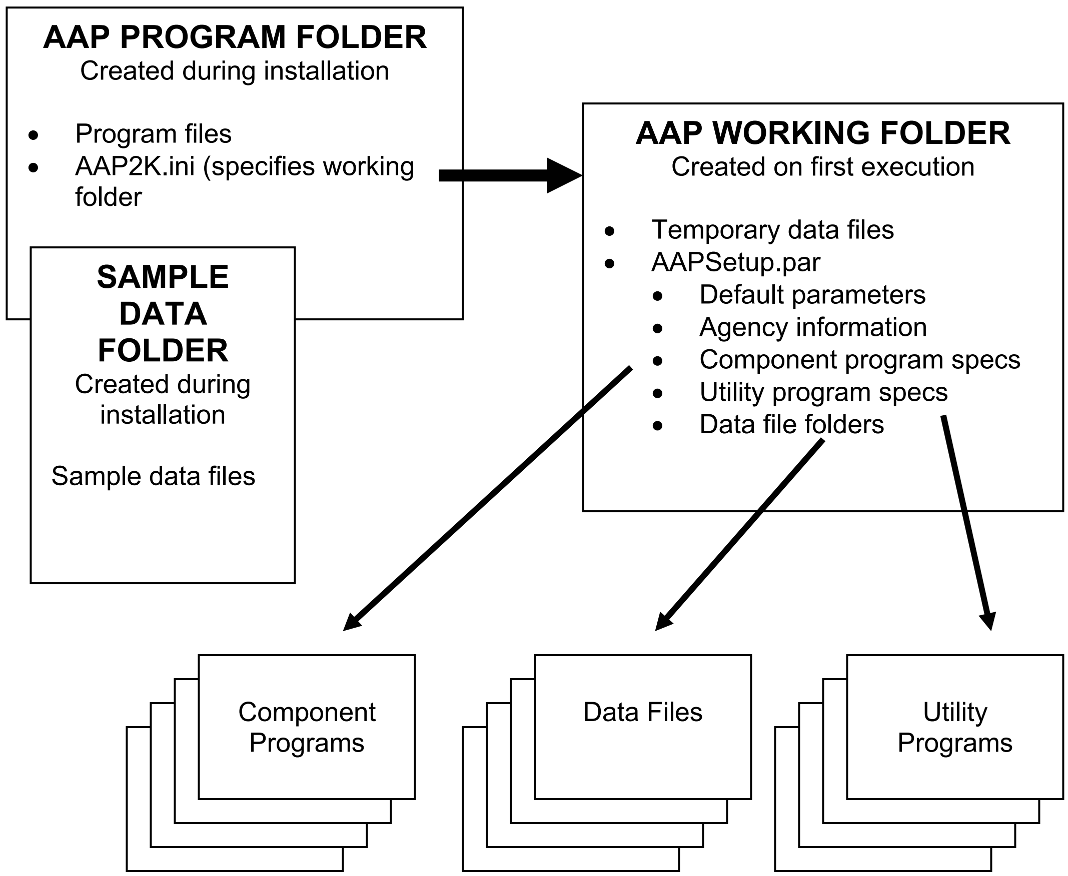


Figure 2. AAP File Structure and Relationships

The AAP runs in the Windows ™ (95 and beyond) environment. The operation has been tested in Windows 95, 98, ME, 2000, NT and XP. Windows 2000, NT and XP users must be aware of the restrictions that may apply to accessibility of drives and directories for storing data. You should consult your system administrator if you are not sure of you access privileges.

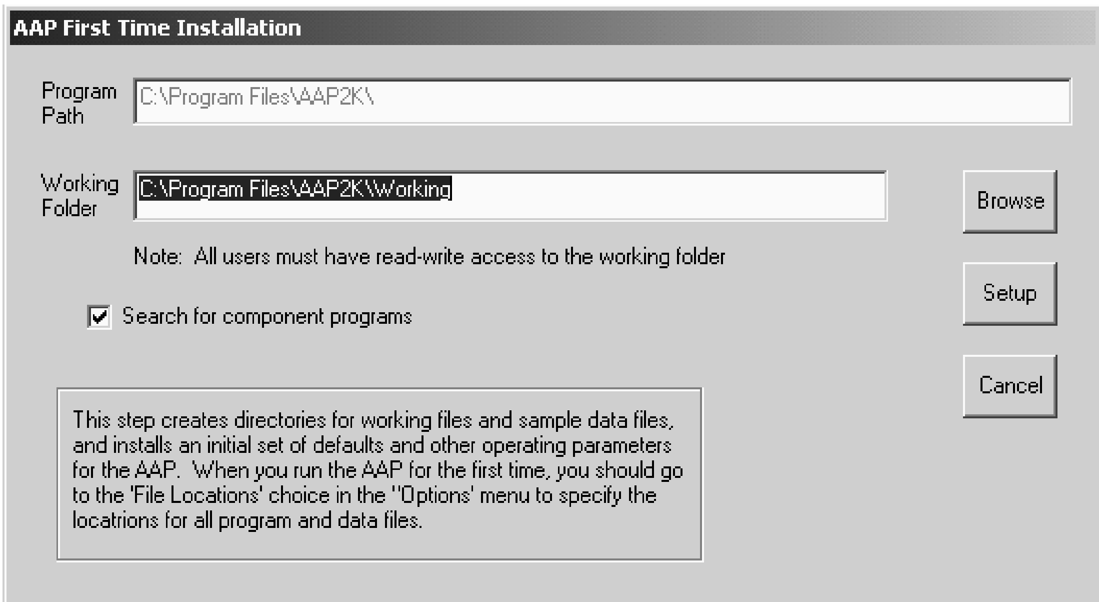
The AAP uses a standard installation scheme; one that should be familiar to anyone who routinely installs Windows application software. Windows 2000 and NT systems incorporate various levels of assess privileges to facilitate system maintenance. If you are installing the AAP in either of these operating systems, you must pay particular attention to access privileges for subsequent users. Two AAP-specific folders must be specified at the time of installation:

After the program has been installed, users will have full flexibility to change the location of their data files. Some users will want to set up several data folders to accommodate different projects, clients, etc. If you are using Windows 2000, XP or NT, it is your responsibility as a user to ensure that you have access privileges to whatever folders you decide to use for your data. The AAP is no different than any other Windows 2000, XP or NT application in this regard.

3.2 The Configuration Step

The configuration step is carried out the first time the AAP is executed. On the first run it searches for a file called AAP2K.INI in the program directory. If this file is not found, the "First Time Installation" procedure is invoked. When this procedure has been completed, the AAP2K.INI file will be written to the program folder and the AAPSetup.par file will be created in the working folder.

The first-time installation procedure begins with the following dialog box.



The configuration step requires the selection of a working folder. The working folder is central to the operation of the AAP. This folder contains the default operating parameters, temporary data files, log files generated by the various mapping routines, etc. All AAP users must have read/write access privileges to the working folder. It is not possible to change the working folder after the installation has been completed, except by deleting the AAP2K.INI file and reinstalling the program.

The working folder defaults to a folder called *Working* under the AAP program folder. You may select a different folder using the browse button, but only existing folders may be selected in this manner.

A check box is provided on the first-time installation form that instructs the program to search for installed versions of the component programs. For this reason, it is better to install the AAP after the component programs have been installed and tested.

When you have selected the working folder, click the *Setup* button. The AAP setup will proceed as follows:

1. A *Samples* folder will be created under the program directory, and the sample data files will be copied to that folder.

2. A *Working* folder will be created under the program directory, unless an existing folder was specified on the first-time installation screen. The initialization and parameter files will be copied to the working folder.

3. An initialization file *AAP2K.INI* will be written into the program directory. This file contains the name of the working folder that the AAP will use to store parameter files and other files that must be created during normal execution. There are several of these files including log files that are generated by the routines that map the AAP data into the component programs.

4. The AAP File Locations screen will be displayed.

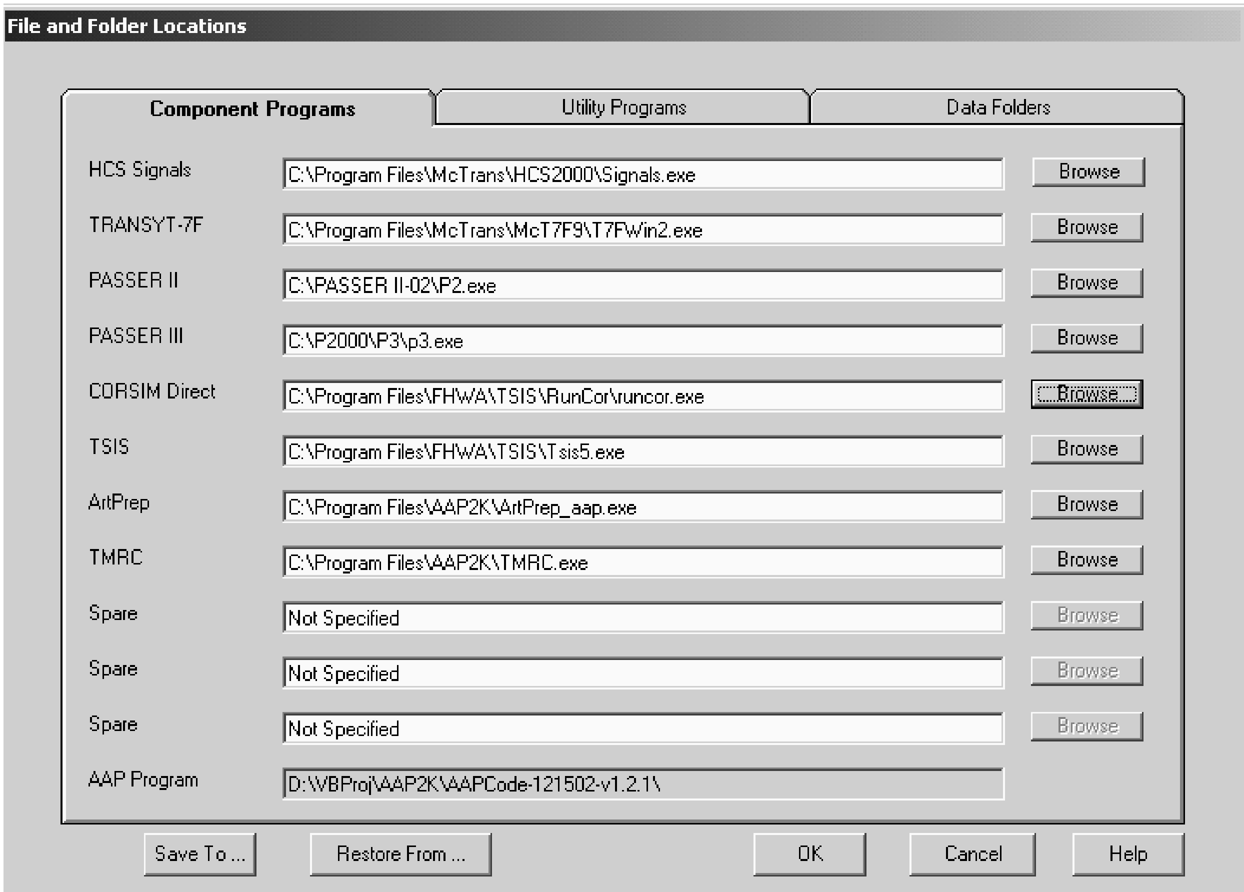
The File Locations screen is very important to the operation of the AAP. The entries on this screen tell the AAP where all of your component programs, utility programs and data files are located. The File Locations screen has three tabs, each of which will be discussed separately.

The first-time selection of programs and folders will take some time. Hopefully, future versions of this program will streamline this process. When you have a complete set of specifications, you may save it by clicking the *Save To* button, and specifying a filename. You may restore the settings from any file by clicking on the *Restore From* button. This will allow different users to establish their own parameters with a minimum of effort.

On subsequent runs, the AAP main menu screen will be displayed without the first time setup screens. You may return to the file selection display and edit screen at any time by choosing the *Options ... File Locations* item from the main menu. More information on this menu item is provided later in this document. You will probably want to refer to the on line help as you select the various files. Just click the *Help* button or press the F1 key for this purpose.

3.2.1 The Component Programs Tab

The first tab is the Component Programs Tab. From here you can select the location of the .exe files belonging to the component programs. Pressing the Browse key will bring up a file explorer.

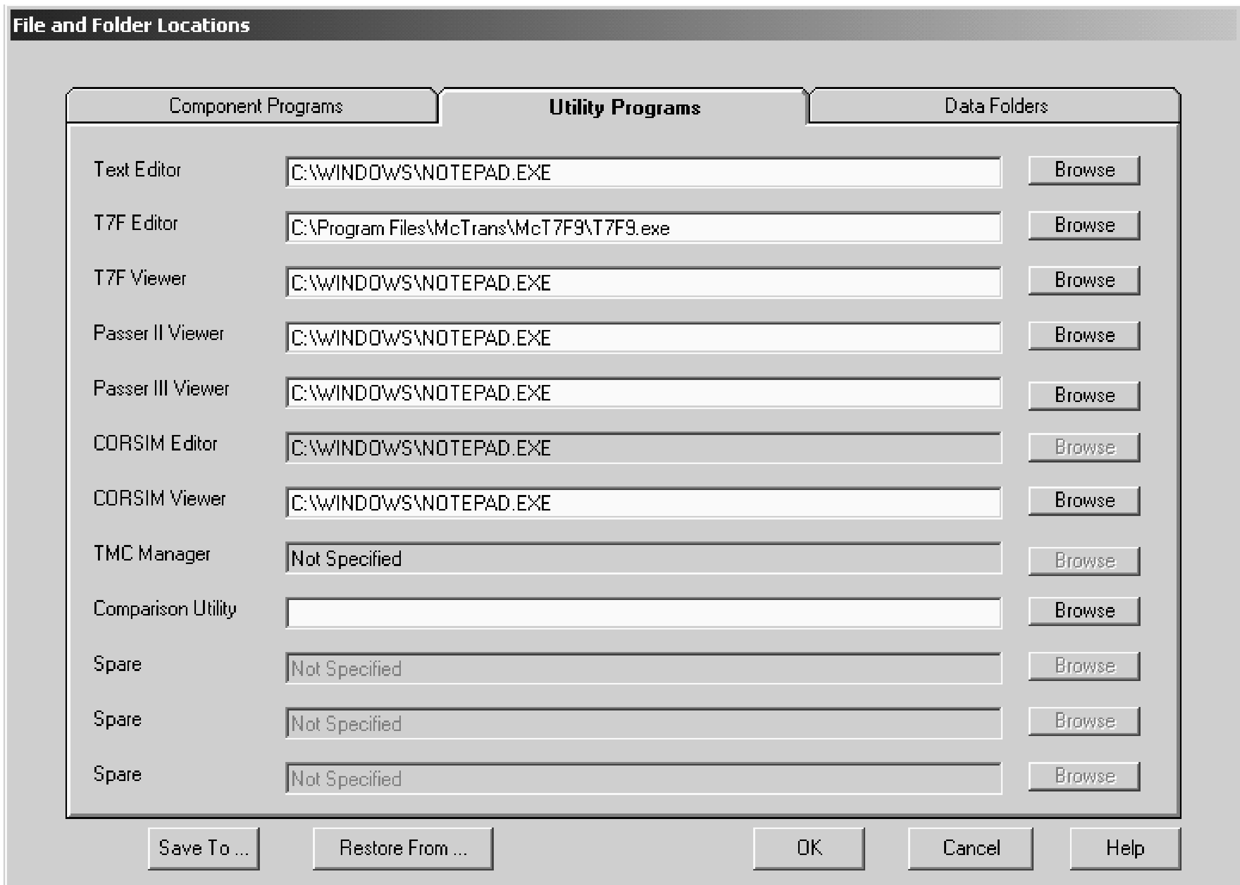


If you requested the component program search, you will see some entries. Otherwise, none of the component programs locations will have been specified at this point. Each of the component programs to be connected to the AAP must be located by clicking the associated Browse button. If you do not have a particular component installed on your system, you will not be able to connect it to the AAP.

The entries shown in the sample screen below reflect the default locations that will be suggested at the time that each of the component programs is installed.

3.2.2 The Utility Programs Tab

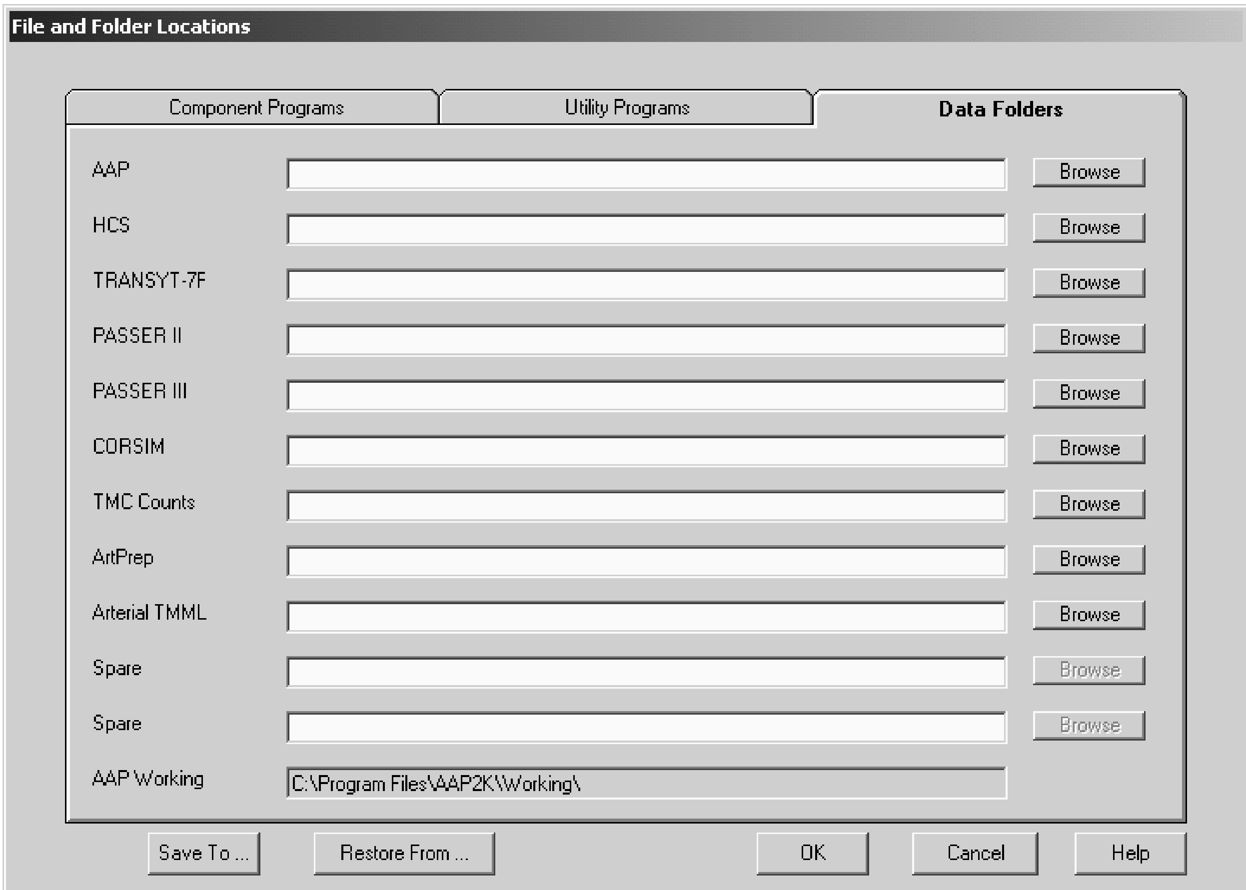
The second tab is the Utility Programs Tab. From here you can select the location of the editing programs belonging to the component programs. Generic editing programs such as Notebook can also be used. Pressing the Browse key will bring up a file explorer.



Several commercial programs are available for viewing and editing the component programs, and may be connected to the AAP by browsing for their location on this screen. This screen lets you make your own choices. Note that the first item in this list is the text editor that was selected on the First Time Installation Setup Screen.

3.2.3 The Data Folders Tab

The last tab is the Data Folders Programs Tab. From here you can select the location of all the data files you create or access. They are arranged according to what component program you are using. Pressing the Browse key will bring up a file explorer.



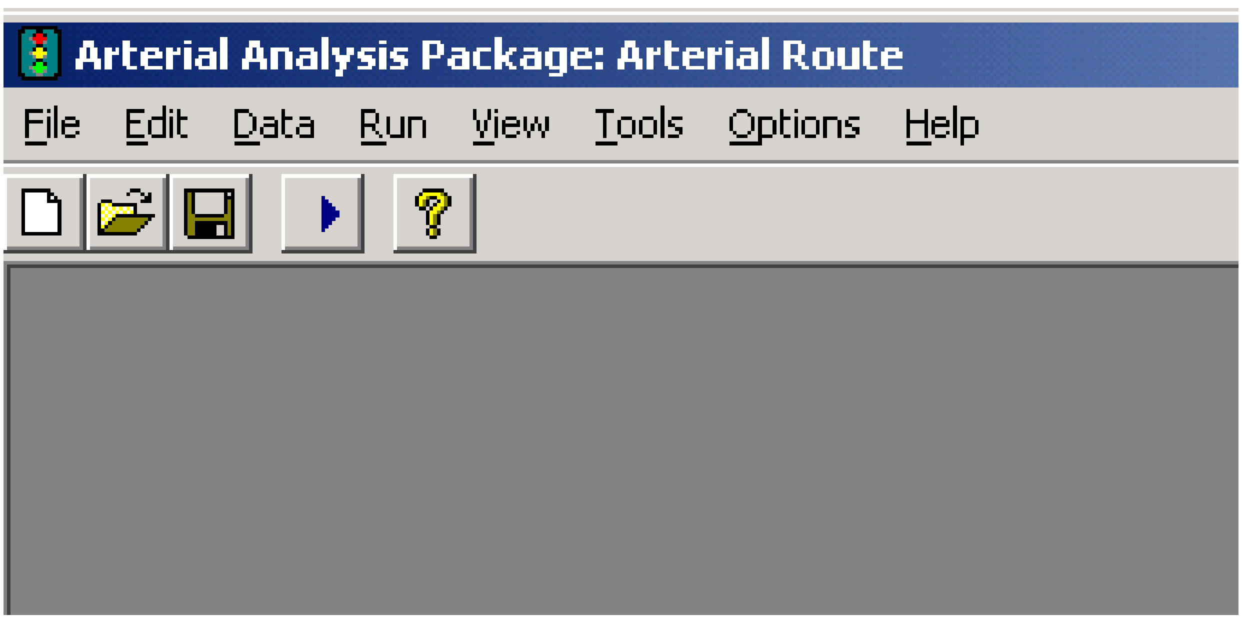
The data folders specification screen allows you to select a different folder for storing each of the data types used by the AAP. The first item on the list is the location for storing the AAP data itself. This choice defaults to the *Samples* folder that was created as a part of the installation process. All other folders default to the *Working* folder that was created during the installation process. You may make your own choice of folders here. Note that the folders to be selected must have already been created using the Windows Explorer.

4 RUNNING THE AAP

The balance of this document provides instructions for running the AAP. All of the information contained here is also available as online help, which may be accessed by selecting "Help" from the menu bar, clicking the "Help" button on each screen, or pressing the F1 Key.

4.1 Main Menu

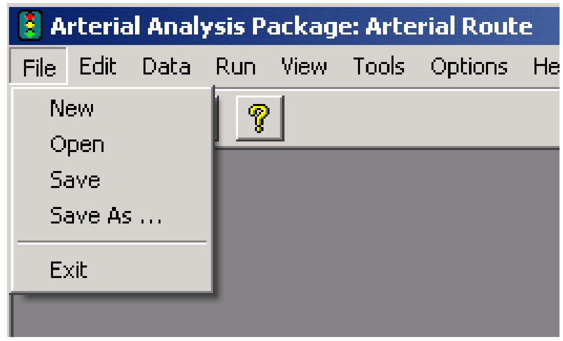
This is the main menu window, which contains the features found in most Windows programs. From this screen you can select from the pull-down menus and choose the task you want to accomplish. Each of the menu selections will be described individually.



4.2 File Menu

The following screen shows the File pull-down Menu.

The file operations are performed on the AAP database and may be accessed at any time. The AAP database resides in a specially assigned block of memory that is preserved at all times. It is saved on disk as a random access file with an ".a2k" extension.



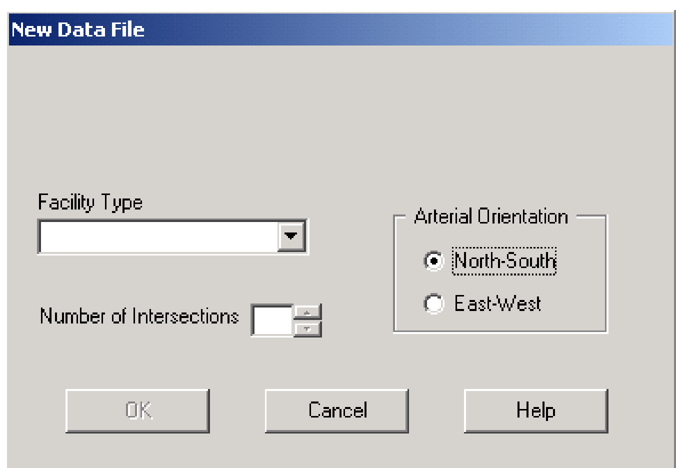
The submenu choices should be familiar to all Windows program users. The creation of a new file is specific to the AAP and will therefore be explained in more detail.

4.2.1 New File

Creating a New A2K file

This item clears memory to establish a new problem. Selecting this submenu item displays a dialog box that contains the entries and options that may be made.

The following screen shows the options available when creating a new A2K file.



Facility Type

AAP 2K lets you choose between four different facilities.

1. Intersection
2. Arterial
3. Diamond Interchange
4. Star Network

Depending on the facility chosen, the following options may differ.

Number of Intersections

You can choose up to 12 intersections in an Arterial facility. On the other facilities, the number of intersections is selected automatically.

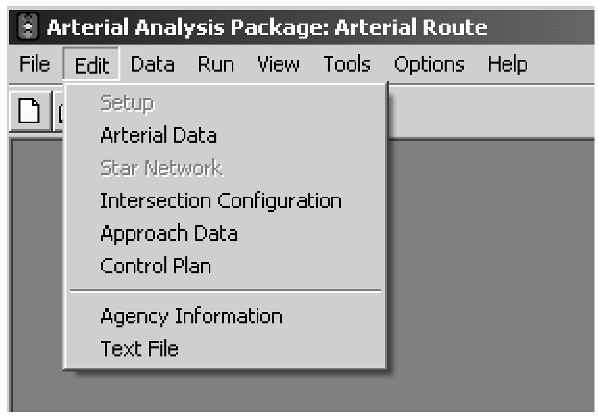
Arterial Orientation

The orientation of the arterial is very important to the logic of the AAP. All movement-specific data (volume, saturation flow rates, etc) are entered with directional designations. The AAP will automatically choose the proper bi-directional approaches to link together to form an arterial route. For example, if East-West is selected, then all the east-west approaches will be put together in the proper sequence. The AAP assumes the facility is linear. If you have a route that is not, some of the intersection orientations may have to be manipulated.

North-south arterial routes are assumed to proceed in the northbound direction. In other words, the first intersection will be at the south end. East-west routes are assumed to be eastbound, with the first intersection at the west end. This is an important consideration for planning your subsequent data entry.

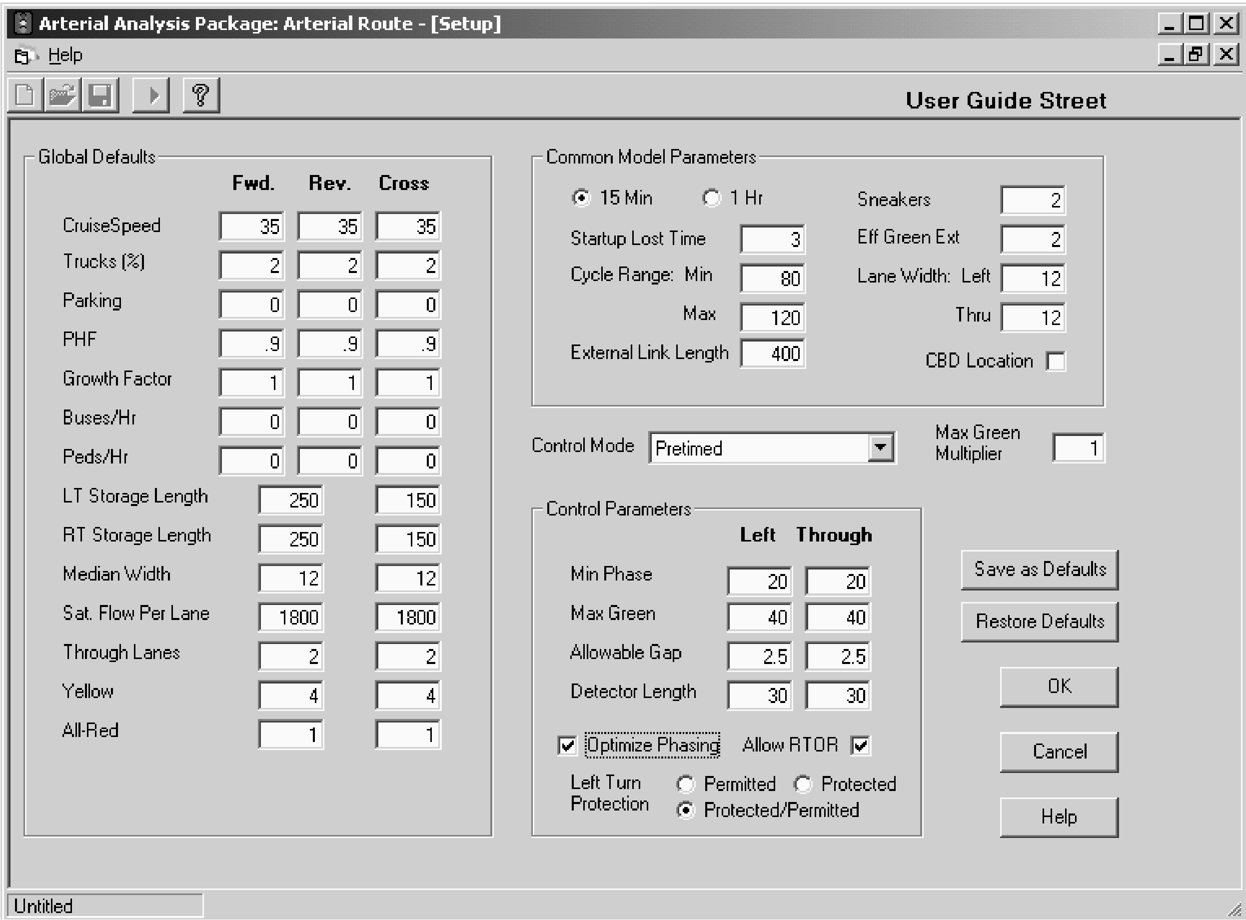
4.3 Edit Menu

This is the Edit pull-down menu screen. This menu item allows access to the edit screens for all AAP Data. The submenu choices are shown below and are discussed separately. All of the screens will be discussed, but only the edit screens that are appropriate to the facility type will be enabled on the edit menu.



4.3.1 The Setup (Default Parameters) Screen

This is the AAP Data Setup Screen, which sets up the default values to be applied to all intersections on the facility. The application of default values will facilitate the entry of intersection, approach, and movement specific data later.



This screen is divided into three frames as follows:

The Global Defaults Frame

Global default valued may be applied separately to the arterial (forward. and reverse. directions) and the cross street (common to both directions).

The Common Model Parameters Frame

This frame contains the operating parameters that are common to all component programs, including

- The analysis period (15 Min to 1 Hr)
- Startup Lost Time
- Cycle Range
- Sneakers
- Effective Green Extension
- External Link Length (will be mapped to all approaches external to the arterial)
- Lane Width for left and thru lanes
- Central Business District (CBD) or not?, indicated by a check box

The Control Parameters Frame

This frame contains the default minimum and maximum green times for the left and through movements. For actuated control, the allowable gap and detector lengths may be specified. The left turn protection can also be selected as well as RTOR treatment. The "optimize phasing" option applies only to PASSER II.

Control Mode

A pull-down list offers a selection between pretimed and actuated (isolated dual-ring and coordinated dual-ring) control modes.

Max Green Multiplier

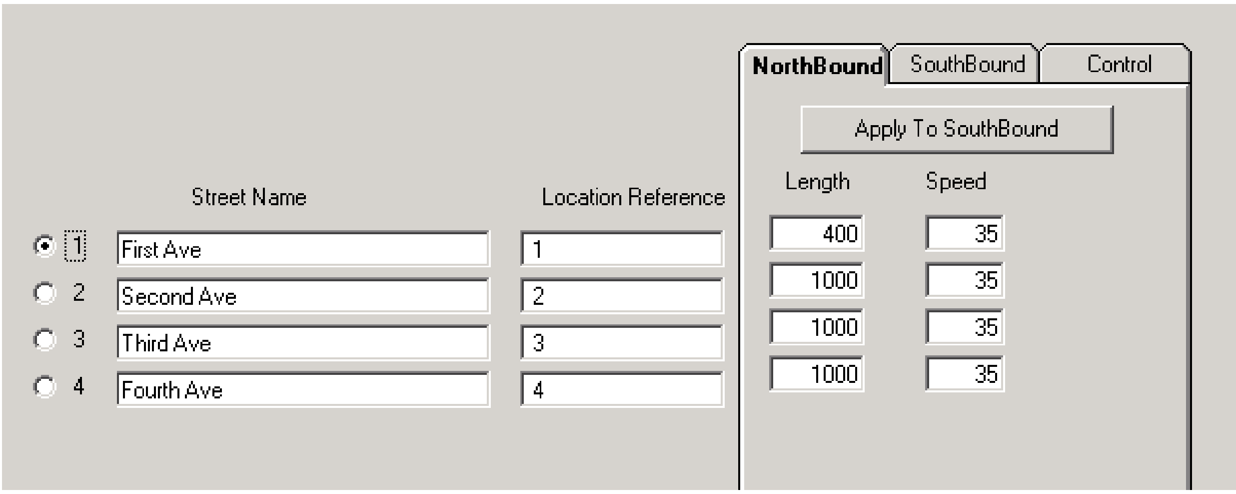
This parameter is used to compute the maximum green times per phase for traffic-actuated control. The multiplier expands the specified green time for a pretimed phase to be used as the maximum green time for a traffic-actuated phase. The value of 1.0 on the above screen will produce no expansion. In other words, the specified green time would be set as the maximum green time. This parameter may be edited for each intersection on the Control Plan screen

Command Buttons

Command buttons are provided to save and restore default values to and from this screen. The OK button will exit the screen and apply the default values to all approaches, movements, etc. on the facility. The Cancel button will exit without applying defaults. You will not be able to proceed with further data entry if you cancel this screen.

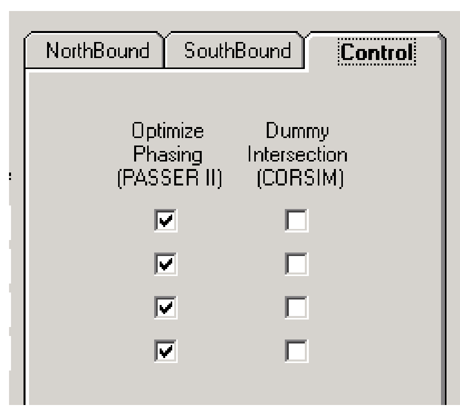
4.3.2 Arterial Data Screen

The following edit screen is displayed when this item is selected.



The numbers along the left side of the screen are fixed numbers. They represent the intersections from 1 to 12 in ascending order beginning with the first intersection proceeding in the arterial orientation chosen in the new data window. The intersecting street names can be entered and edited from this screen, as are the reference numbers. The reference numbers are provided for agencies that assign unique numbers to each intersection.

All speeds in the forward direction initially default to the system speed, but these may be changed on an individual basis. The link lengths, however, cannot have defaults. These must be entered individually, by intersection, for the forward direction. The "Apply to Westbound (Southbound)" button automatically enters the speeds and distances for the reverse direction. You can also individually edit these by pressing the Westbound (Southbound) tab. You may need to edit the reverse direction information because of variations in speed between the two directions, or because of unusual link geometrics that could cause different lengths in different directions.



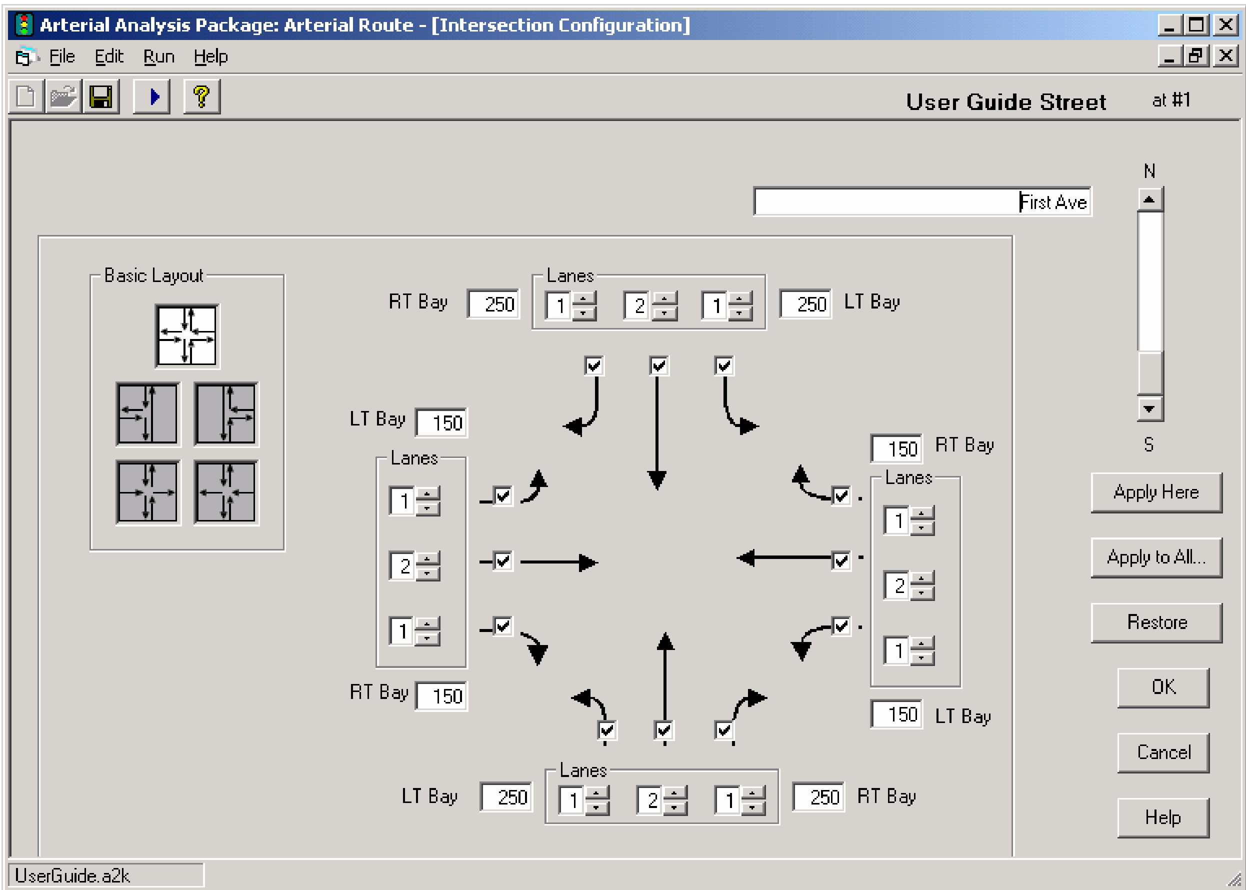
Control Tab

This is the Control Tab screen. From this screen you can also choose which intersections are going to be optimized and which ones are to be dummy intersections. Phasing optimization is applied to PASSER II only, and dummy intersections are mapped only into CORSIM. A dummy intersection in CORSIM simply establishes a node with no cross street activity. This facilitates the entry of special features, such as lane drops, using the CORSIM editor.

Note that the current version of TRANSYT-7F has some phasing optimization features that may be invoked from its own user interface.

4.3.3 The Intersection Configuration Screen

The following window appears when the "Intersection Configuration" submenu is chosen. The basic layout of the intersection can be modified from here.



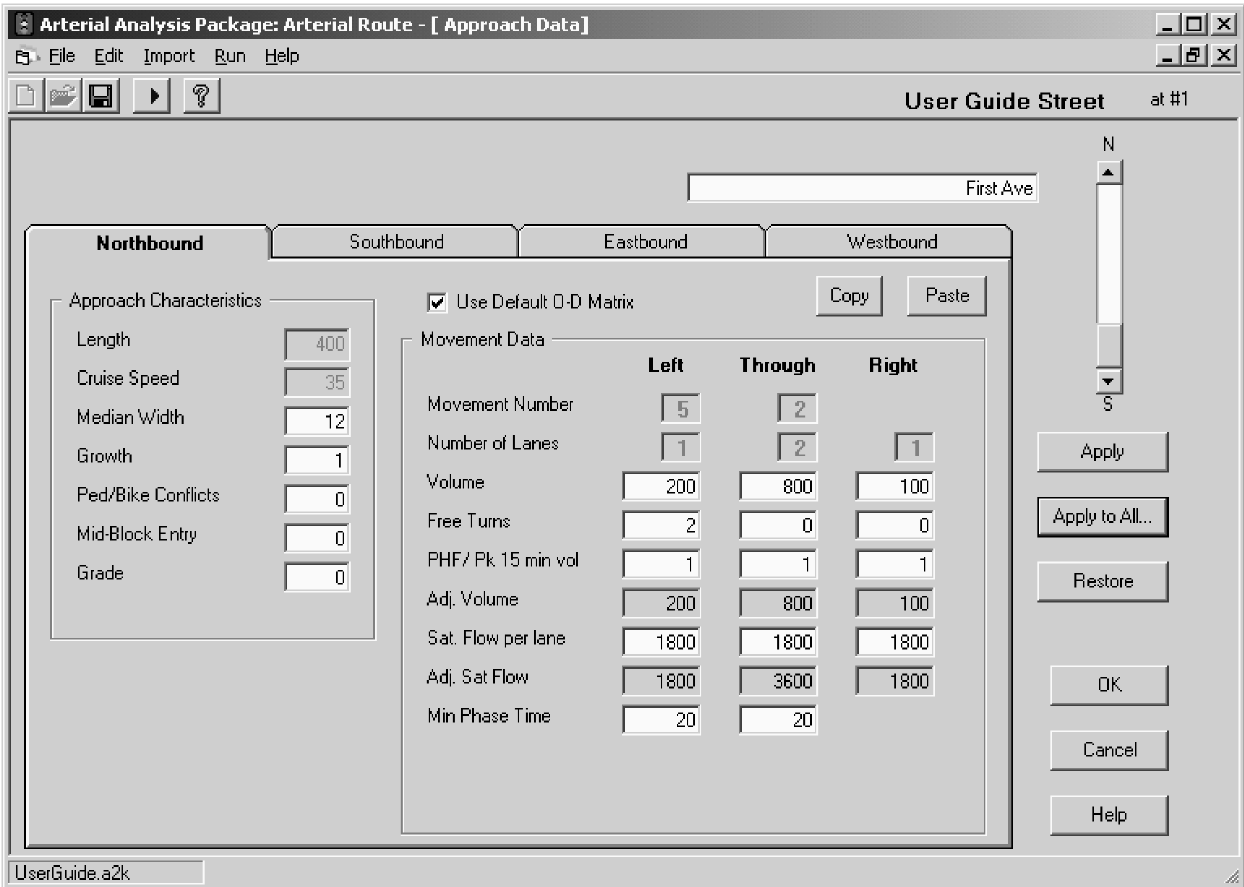
In the "Basic Layout Box" on the left, you can select between a full intersection, T-intersections or one-way intersections on the cross street. The arterial must have all of its approaches present.

The check boxes in the configuration diagram are used to establish that a movement exists.

From here the number of lanes and turning bays can be specified. The length of the right turn and left turn bays can also be specified. The default values are automatically placed in the appropriate boxes.

4.3.4 The Approach Data Screen

The following edit screen is displayed when this item is selected.



Approach Characteristics

These characteristics have been transferred from the *Setup* screen. All fields may be edited here except the lengths of the arterial approaches, which are taken from the *Arterial Data screen*. Each Tab represents one of the four approaches at the intersection.

Movement Data

The directional approaches are fixed. The turning movements are Left, Thru and Right. The numbers below the movements are NEMA phase numbers that are sensitive to the orientation.

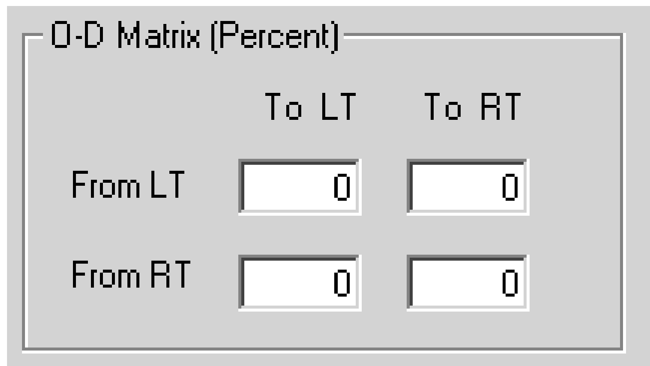
The "Volume", "Free Turns" and "PHF/Pk15 Min Vol" can be entered directly into the screen. The "Adjusted Volume" is calculation of these three values, using the growth factor for the approach.

The "Saturation Flow Rate" has been inserted from the *Setup* Screen. The "Adjusted SatFlow" is calculated by multiplying this value by the number of lanes and adjusting for right turns. These values will be mapped directly to the component programs.

Origin-Destination Matrix

Traffic may enter a typical link as a through movement or as a right or left turn from the upstream intersection. It may then leave the link at the downstream intersection with the same options. This creates a matrix of nine possible origin-destination (OD) combinations. Models that treat the flow of traffic in discrete time steps must make assumptions about the nature of this matrix. Different models make different assumptions, thereby introducing systematic differences in their results.

For internal links (i.e., those with both an upstream and downstream intersection on the arterial) the percent of traffic entering and leaving as turns may be specified in the OD Matrix frame of this screen. As shown here, the nine cell matrix has been reduced to four cells by assigning all traffic that does not turn left or right to the through movement.

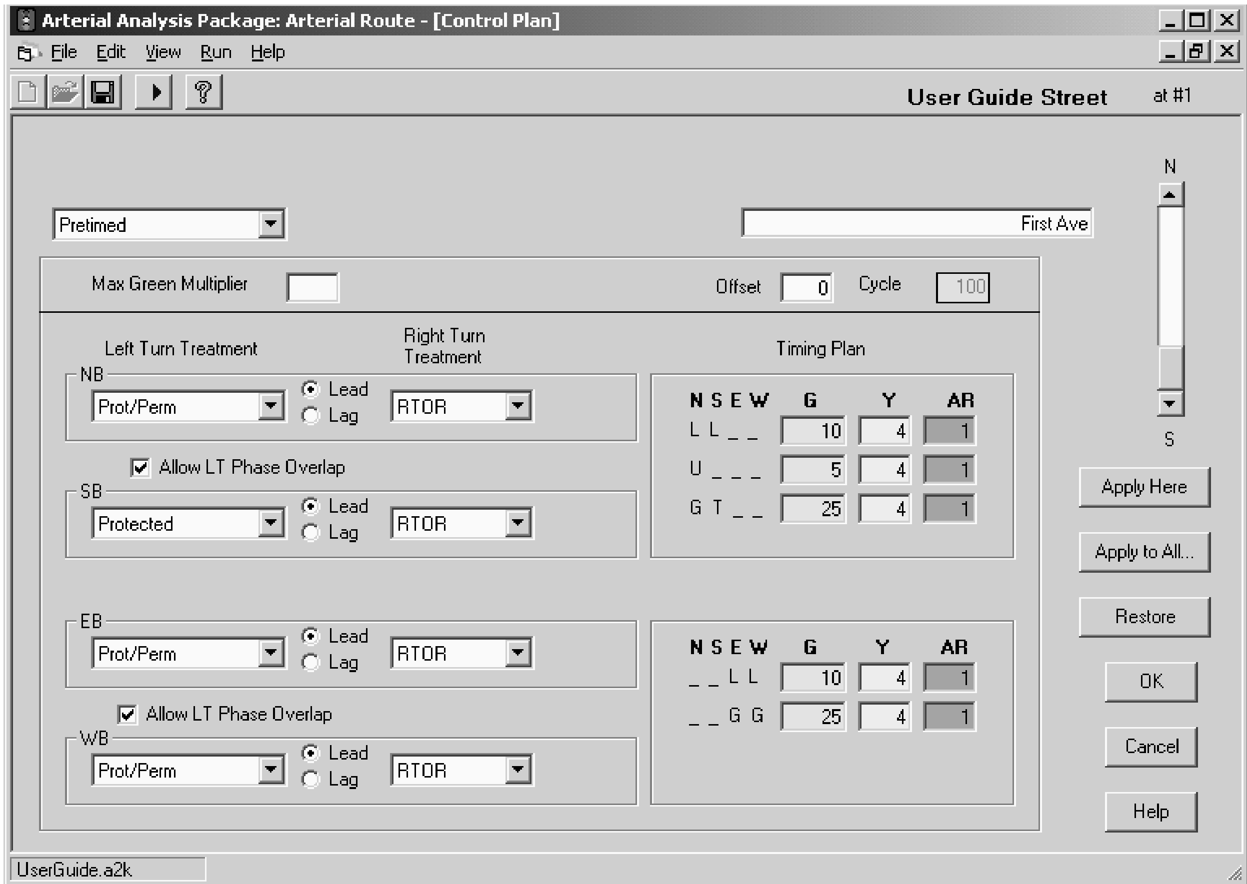


The box is located on the lower left side of the Approach Data Screen, and can only be seen when the “Use Default O-D matrix” check box is not selected.

Some caution must be used when entering these relative volume values. It is important to make sure that the sum of the rows (ie From LT-To LT plus From LT-To RT) is equal to or less then 100, otherwise a negative value could be applied to the through movement percentage.

4.3.5 The Control Plan Screen

The following window appears when the "Control Plan" submenu is selected. The timing plan consists of a specification for the sequence, phase lengths, and offset at each intersection.



Controller Operation Mode

This pull-down menu allows you to select between pretimed, actuated (isolated and coordinated), Two-Way Stop Control and All-Way Stop Control. When the Actuated Control Mode is chosen, the *Edit Actuated Control Settings* button appears and can be selected.

Traffic Engineering Decisions

The signal phasing is not entered explicitly, but is derived by the AAP from the traffic engineering decisions that must be made for each movement. These decisions include

- Type of left turn protection
- Whether or not phase overlap is allowed (i.e., must leading left turns terminate at the same time?)
- Position of the left turn in the sequence (leading or lagging)
- Right turn treatment

The pull-down menu allows you to select left and right turn treatments. You can also select the order of your left turns (lead or lag).

Turn Treatments

The left turn treatments include:

- Permitted
- Protected
- Protected/permitted
- Not opposed.

The “not opposed” treatment applies to one-way streets, T intersections and Split phasing. In these cases, the left turns are always able to proceed with the through traffic without having to yield to oncoming traffic.

The right turn treatments include:

- RTOR
- No RTOR
- Overlapped with a shadowing left turn (e.g., the NBRT would have a green arrow display with the WBLT)
- Free

The right turn treatments are mapped differently into each component program depending on its ability to model each of the treatments. Free right turns are not mapped explicitly into any of the programs. In most cases, the right turn volumes are simply ignored for free tight turns.

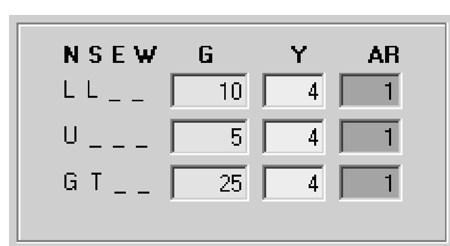
Phasing Plan

The phasing plan is synthesized automatically from the traffic engineering decisions.

The phasing is represented by a table indicating the display given to each approach on each phase. The display codes include:

- L = Left only
- T = Through only (the right turn is assumed to proceed concurrently)
- R = Right only: used only for right turns overlapping a shadowing left turn
- G = Green: all movements allowed with the left turn yielding to oncoming traffic
- U = Unopposed: all movements allowed with no opposing traffic for the left turn

The box at the right depicts a common scenario for 8-phase traffic actuated control, indicating that:



- The first phase accommodates the NB and SB lefts
- The second phase accommodates all NB movements with no opposition for the left turn. In other words, the SBLT has yielded control to the NB through traffic

- The third phase accommodates the SB thru (and RT), as well as the all NB movements with no opposition for the left turn.

This table is consistent with the traffic engineering treatments indicated on the control plan screen shown previously for the NB and SB movements. The third phase shows different displays for NB and SB because of different left turn treatments indicated for these approaches.

Close examination of the EB and WB control plan data indicates that, even though the "overlap allowed" box was checked for the EB and WB approaches, there are only two phases shown in the E-W phasing plan. This would indicate that the difference in the left turn volumes for the two directions was not sufficient to assign an overlap (i.e., "U") phase. The important lesson here is that, to take advantage of this feature, the traffic volumes must be specified on the *Approach Data* screen. Before the control plan is selected.

Timing Plan

Separate fields are provided for entering green, yellow and all-red (indicated by "AR") intervals. The green intervals must be entered for each phase. The yellow and all-red intervals are pre-selected from the global defaults values entered on the *Setup* screen, but may be edited here. The cycle length is computed automatically as the sum of all intervals. Note that changing the number of phases will require reentry of green times for some phases.

Offset

For coordinated operation the offset must be entered for each intersection. For purposes of mapping this data to the component programs, the offset is defined by the AAP as the elapsed time in seconds from the system reference time to the beginning of the first arterial phase.

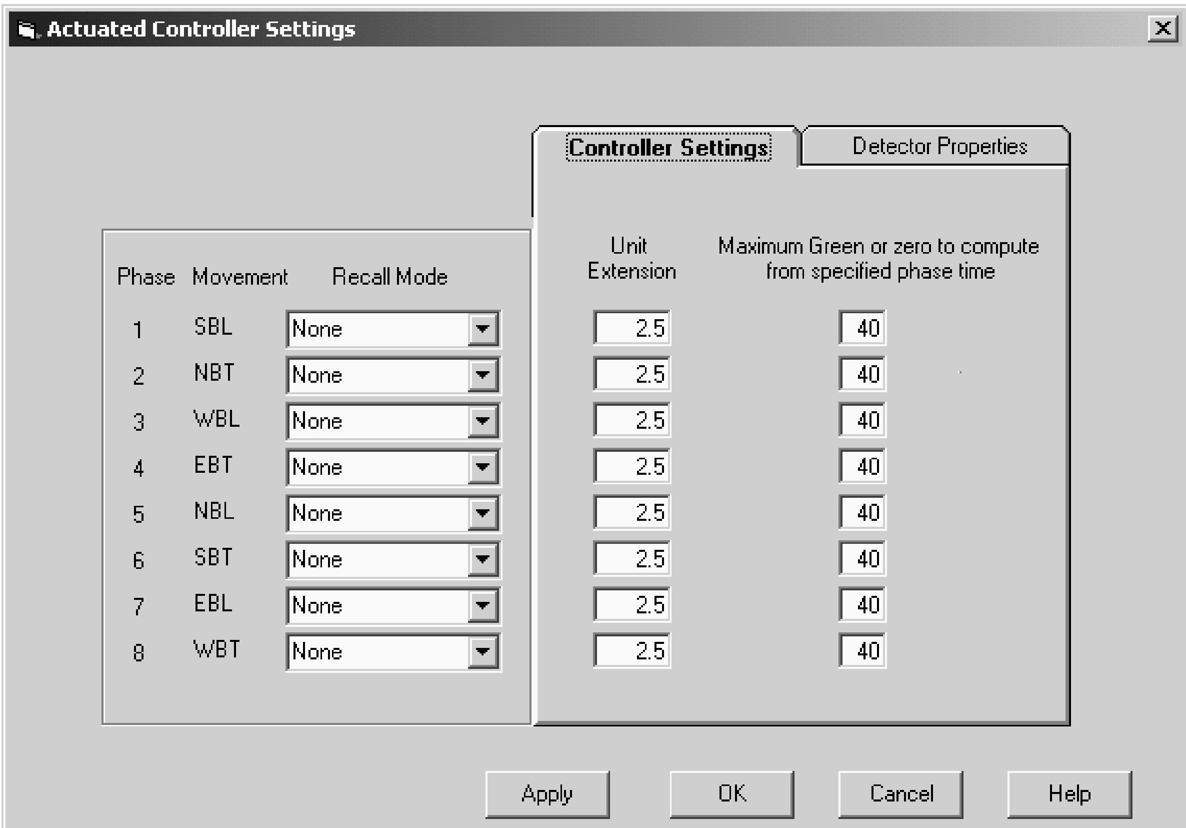
Max Green Multiplier

This value is used in determining the maximum greens per phase for traffic-actuated control. The maximum green values for each phase will be determined by the specified green times, using the maximum green multiplier. The default value is 1.0, which indicates that the specified green times will be used as maximum green times if the intersection is actuated.

Maximum green times may also be entered individually for each phase on the *Actuated Settings* screen.

4.3.6 The Actuated Controller Settings Screen

This screen is only accessible from the Control Plan screen, and only when a traffic-actuated control mode has been selected for the intersection. Traffic-actuated control is mapped explicitly to CORSIM only. The following window appears when the "Edit Actuated Controller Settings" button is selected on the Control Plan screen.



The eight phase numbers and their corresponding movements are located on the left side of the screen. All of the eight phases are represented on the screen shown here, indicating that all left turns are protected, and therefore all phases are required. All phases that are not required by the left turn treatment for their associated movement will be disabled on this screen.

Phase Recall

Next to the movement designation is the "Recall Mode" pull-down list. The recall mode can be set as None, To Minimum, To Maximum or To Ped Phase.

Unit Extension

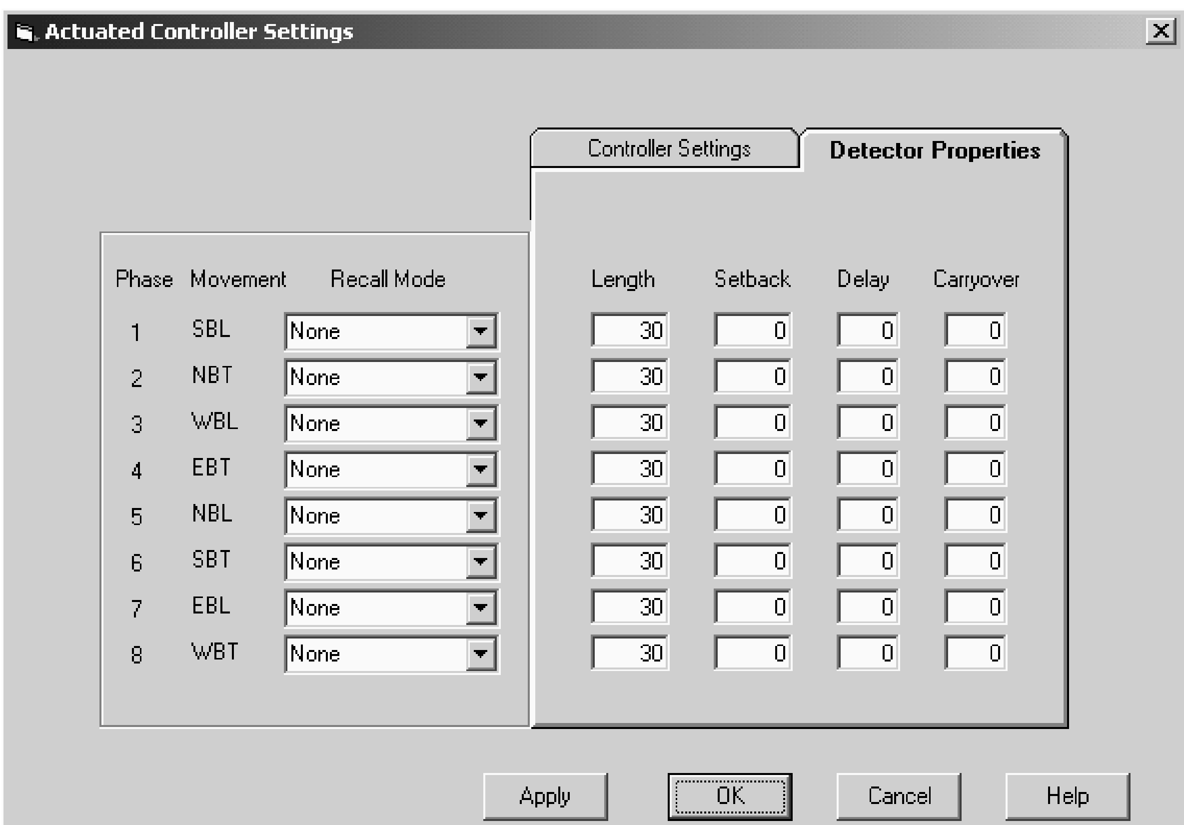
The unit extension represents the gap between vehicles that will cause the associated phase to terminate. This is a universal parameter found on all traffic controllers. Defaults values are transferred to this screen from the *Setup* screen, and may be edited here.

Maximum Green

The maximum green setting for each phase may be entered here. If this field is left blank, or a zero value is entered, the maximum green time will be computed from the specified green time and the *Max green multiplier* entered on the *Control Plan* screen.

Detector Properties

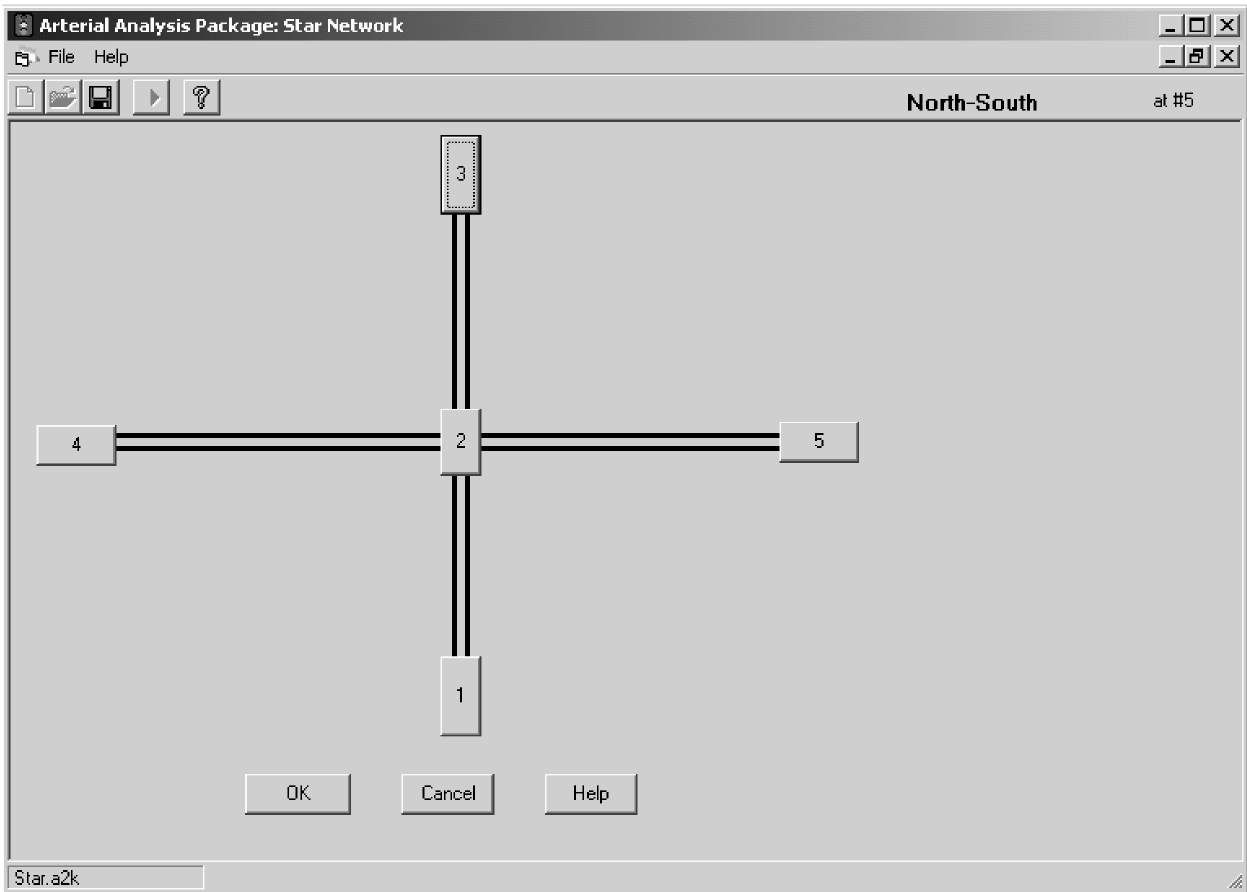
Under this tab, the screen that appears allows the Length, Setback, Delay, and Carryover properties to be edited for each individual detector. These values are mapped directly to CORSIM. A default value is automatically inserted for the length from the *Setup* screen.



4.3.7 Star Network Configuration

The following edit screen (next page) is displayed when this item is selected.

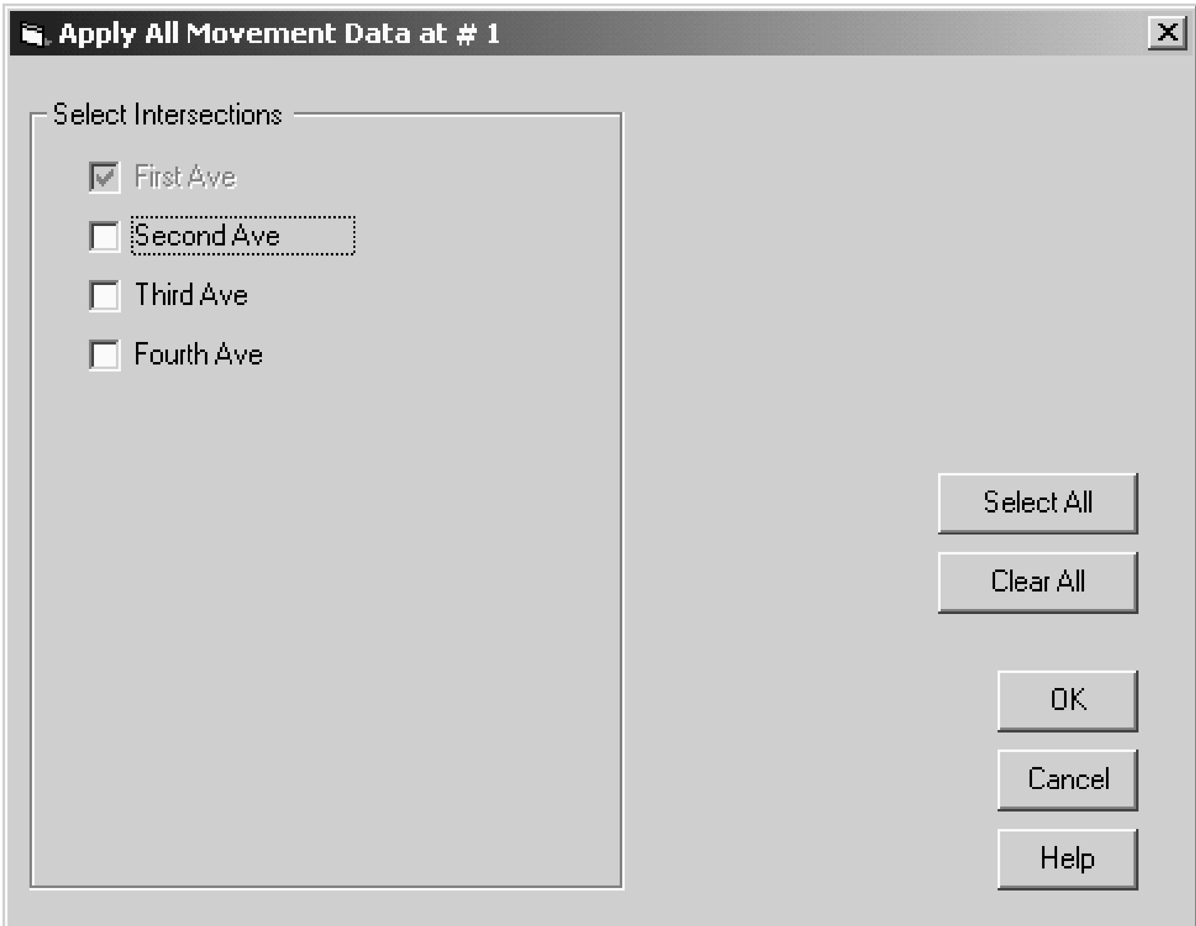
Star networks include a central signalized intersection with an upstream (satellite) signal on each of the four approaches. Only CORSIM, can accommodate star networks. The central intersection is the focus of star-network analysis in the AAP. The satellite intersections are recognized primarily because of their influence on the central intersection.



There is no data to be entered on this form. It is provided to simplify the selection of intersections for further data entry and editing. Clicking on one of the intersection buttons takes you directly to the Intersection Configuration submenu.

4.3.8 Apply To All Intersections Option

This feature copies information from the currently selected intersection to other intersections. It applies to the *Intersection Data, Approach Data and Control Plan* screens. On the *Approach Data* screen, only the movement data will be copied to avoid disturbing approach lengths, etc.



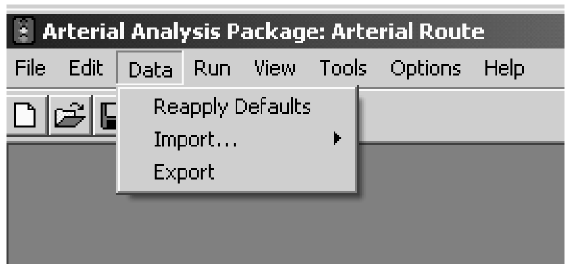
All intersections can be selected and cleared by using the check boxes on the left or the buttons on the right of the screen. Note that it is not possible to de-select the current intersection because the data values have already been applied to that intersection.

4.3.9 The Agency Information Screen

On this screen, you can enter pertinent information about your organization. The AAP maps this information to the component programs as appropriate.

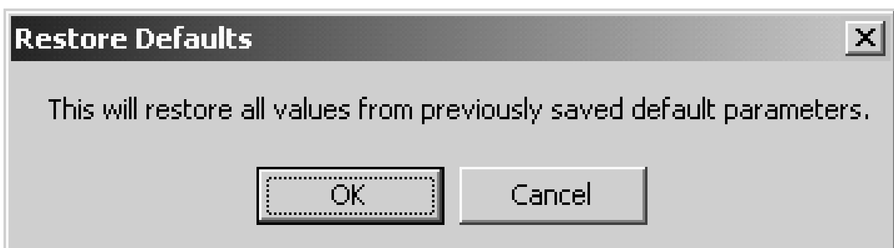
4.4 The Data Menu

This is the Data Pull-down Menu screen. This menu item allows you to manipulate data within the AAP. The submenu choices are shown below and are discussed separately.



4.4.1 The Reapply Defaults Option

This option displays the Setup screen and allows you to modify and reapply all of the default parameters to each approach, movement, phase, etc. If you reapply the defaults, you will return all data fields to their default values and destroy all data entry that was made since the default values were last applied. The following warning message will be displayed to give you one last chance to change your mind.



4.4.2 Import and Export Features

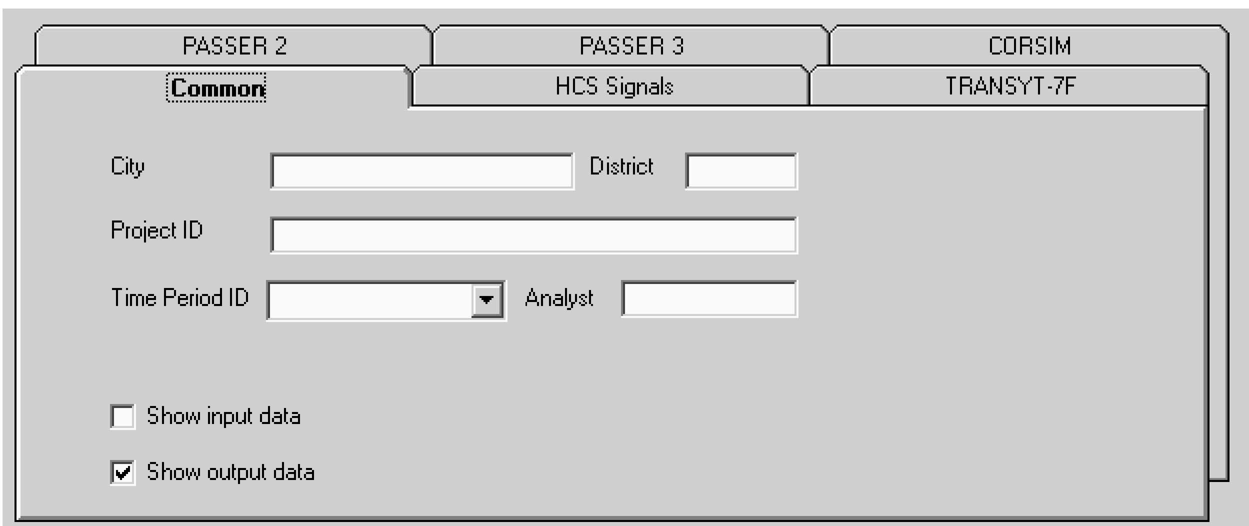
The function of these two features is to import and export data in XML format from other programs that offer this format. The import and export features are primarily a provision for future expansion of the AAP functionality

4.5 The Run Control Screen

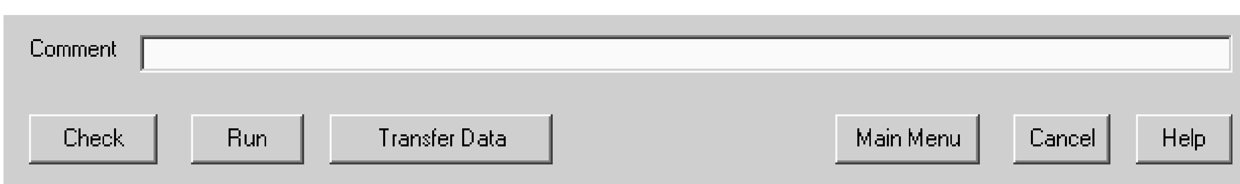
The Run Control screen contains instructions that control the component program execution. The screen is divided horizontally into three sections:

The top section contains the scoping parameters common to all runs. A frame is provided for the selection of intersections to which the run should be applied. The options are one intersection, all intersections or a range of contiguous intersections. The cycle length range is also specified in this section.

The center section contains a tab control that shows the run-specific parameters. The example screen above shows the parameters common to all component programs. The run parameters for each component program will be discussed separately.



The bottom section contains a set of command buttons and a comment line. The comment line will be mapped to all of the component programs that accept comment lines.



The command buttons perform the following functions:

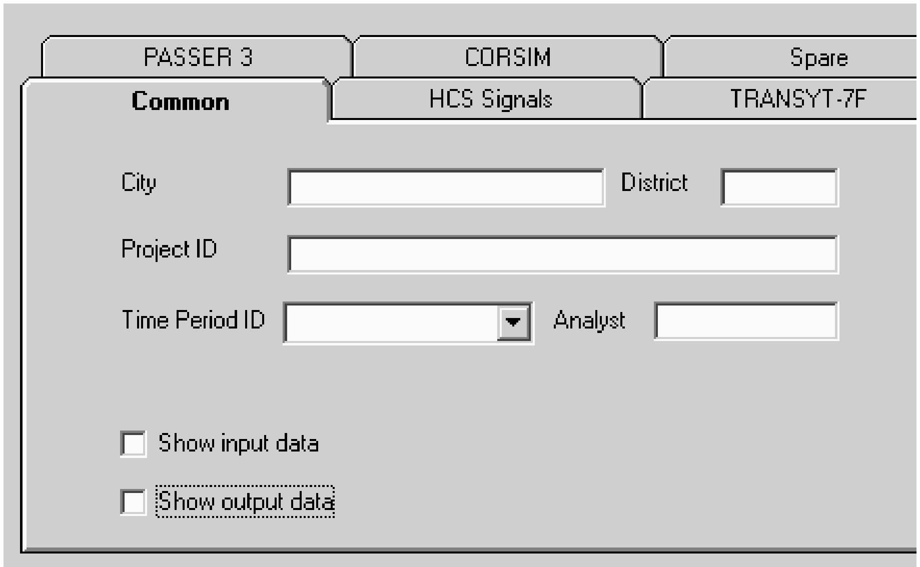
Run Control Screen Command Button Functions	
Check	Performs a data validity check for the selected component program, but does not run the program
Run	Maps the data for the component program, runs the computational engine for the program and lists the outputs if requested
Transfer Data	Maps the data for the component program and runs the user interface for the program. The computational engine may be run from the user interface. Each of the component programs deals differently with this procedure. Some programs load automatically, while others require you to browse for the data
Main Menu	Saves the most recent run control parameters and returns to the main menu
Cancel	Returns to the main menu without saving the most recent run control parameters.
Help	Invokes the help display for this screen. The help feature may also be invoked from the menu bar, or by pressing the F1 key.

The treatment of the “Run” and “Transfer Data” commands among the various component programs is summarized as follows:

Component Program Treatment of “Run” and “Transfer Data” Functions		
Program	**Run**	**Transfer Data**
HCS	Not supported by component program.	Data file is loaded automatically, and may be modified before running the program
TRANSYT-7F	Enabled for evaluation runs with specified timing. Runs the computational engine directly	Data file is loaded automatically, and may be modified before running the program
CORSIM	Enabled if the RUNCOR program has been installed. Runs the computational engine directly, using RUNCOR	Data file is loaded automatically, and may be converted to a “network” file for the TSIS editor. A project file is also created to enable the data to be opened in the TSIS explorer frame.
PASSER II	Not supported by the component program.	Data file must be loaded using the component program’s “Open File” command. The browser window must be set to search for “.DAT” files.
PASSER III	Not supported by component program.	Data file must be loaded using the component program’s “Open File” command. The browser winfow will automatically search for “.P3I” files

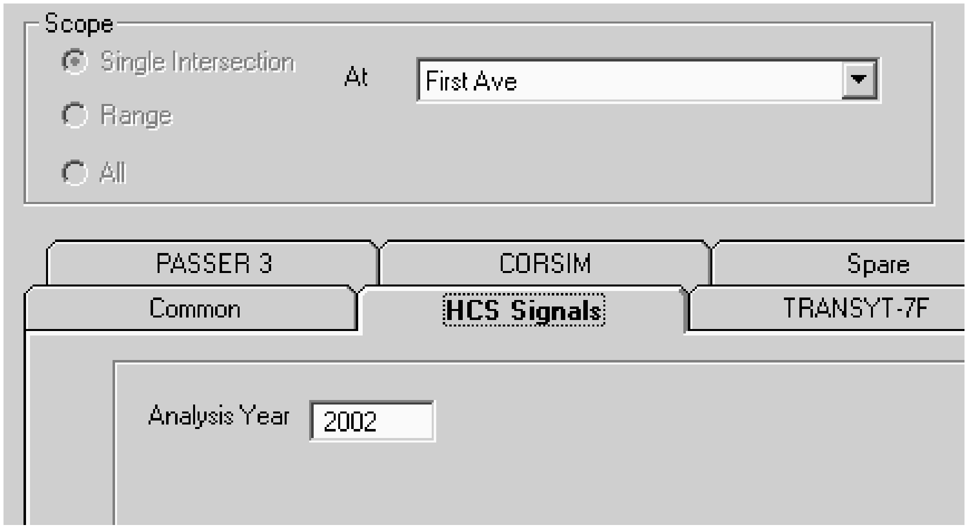
The component programs shown in the different tabs will be discussed separately.

4.5.1 The Common Tab



The common tab window contains data items (mostly labels) that will be passed to the component programs that have input fields for this information. There are also two check boxes that determine whether the input and output data will be displayed automatically before or after running the component programs. The input data would normally be displayed for debugging purposes, or to facilitate minor editing before the file is passed on to the component program. The output data display works only with the "Run" command. You must use the *View* menu to see the outputs of programs executed by the "Transfer Data" command.

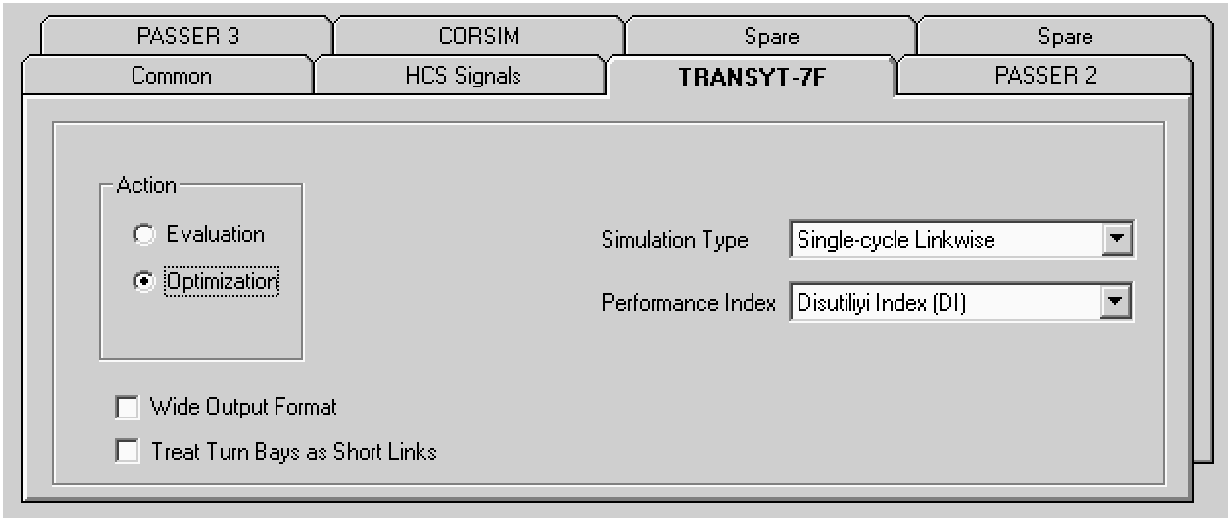
4.5.2 The HCS Signals Tab



The AAP data may be transferred to the HCS by selecting a the desired intersection from the arterial route and clicking the "Transfer Data" command button. Only signalized intersection data may be transferred in this manner. The transfer of TWSC data to HCS is not supported.

The only program specific data that may be entered on this screen is the analysis year. This field is optional and may be left blank.

4.5.3 The TRANSYT-7F Tab



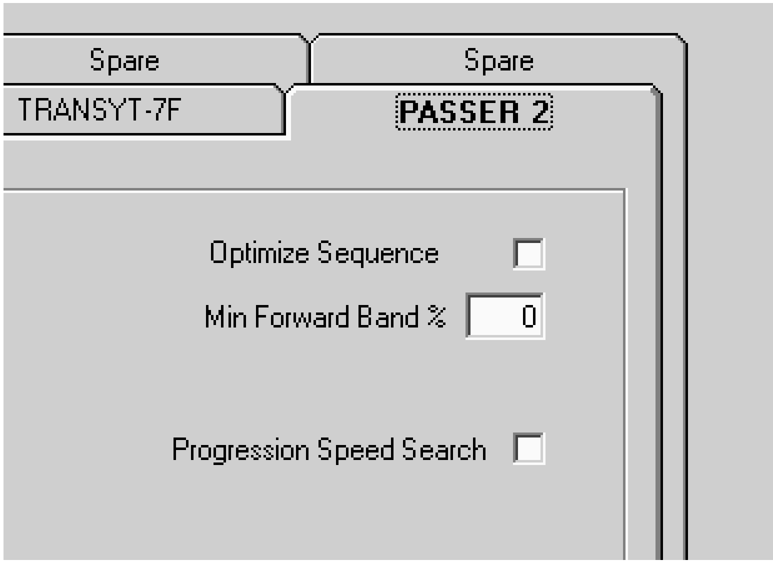
TRANSYT evaluates or optimizes your signal-timing plan depending on the action you select. If the optimization box is checked, then the minimum and maximum cycle times must be specified. If the evaluation box is checked then the single cycle box on top of the screen is automatically checked and a single cycle length is used. All timing data must be entered for the evaluation mode.

The type of simulation the TRANSYT engine runs can also be chosen using the pull-down menu labeled "Simulation Type". You can choose between *single-cycle linkwise, single-cycle stepwise,* or *multi-cycle stepwise*. You may also select two options using the check boxes at the left side of the screen:

- The “Wide Output Format” option will deliver the output in a more detailed format. This option adds significantly to the size of the output file, but offers more data and more complete descriptions of the dada items.

- The “Treat Turn Bays as Short Links” option is suggested by the TRANSYT documentation to model turning bays more realistically, but it produces several warning diagnostics about unequal link lengths.

4.5.4 The PASSER II Tab



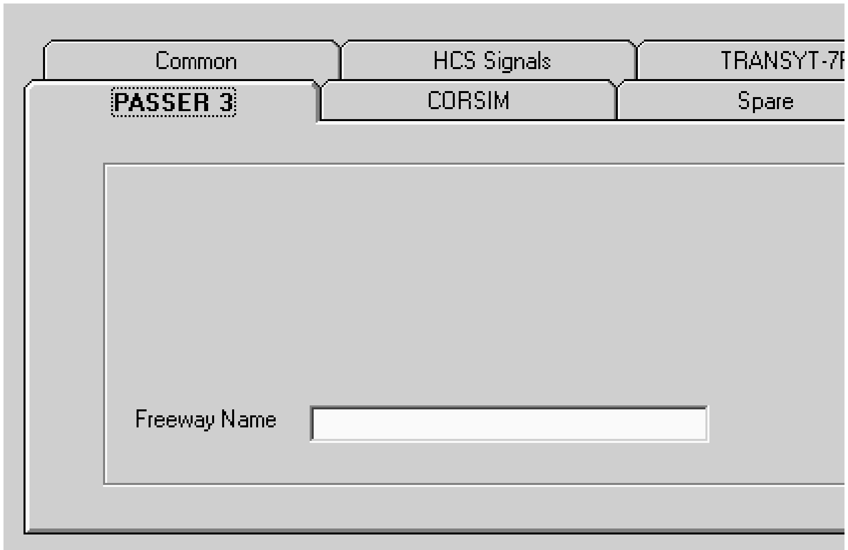
PASSER II offers several parameters that control its optimization and evaluation. Default values are mapped for most of the PASSER II-specific data items. These values may be changed using the PASSER II user interface for increased control over the modeling process.

The three most commonly used parameters that are unique to PASSER II may be specified in this tab window before the component program data file is created.

- The "Optimize Sequence" check box will request a sequence optimization. The sequence optimization may be disabled at selected intersections using the check boxes provided on the control tab of the *Arterial Data* screen
- The "Min Forward Band" controls the balance between inbound and outbound progression. Please refer to the PASSER II documentation for details on this parameter.
- The "Progression Speed Search" check box invokes a feature in PASSER II that searches for the best progression within a 2 mph range of the specified travel speeds.

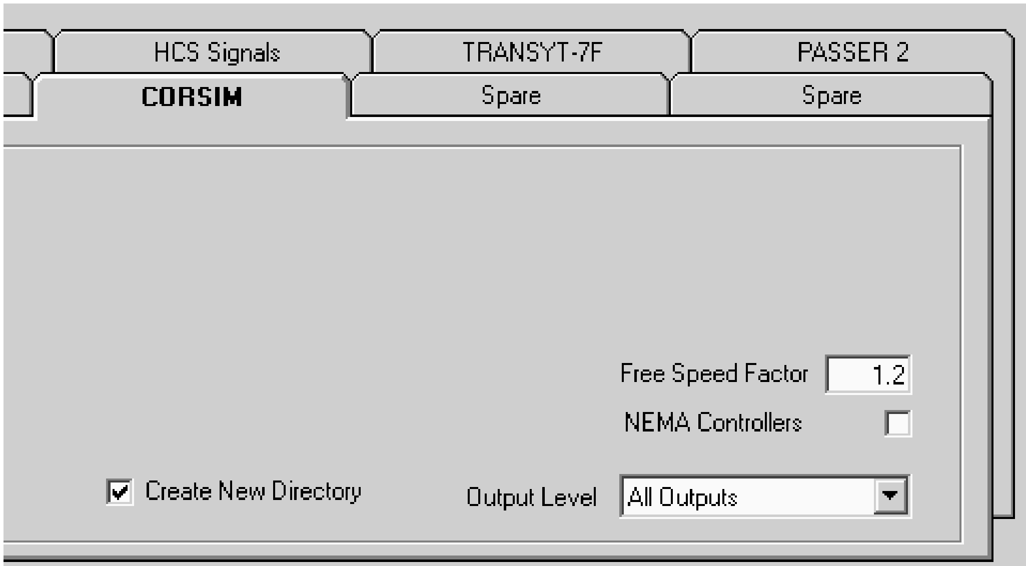
The design of PASSER II is such that its computational engine must be launched from its own user interface

4.5.5 PASSER III Tab



Data for diamond interchange facilities may be transferred to the PASSER III user interface. The only parameter needed in addition to the normal AAP data is the name of the freeway. The design of PASSER III is such that its computational engine must be launched from its own user interface.

4.5.6 The CORSIM Tab



The CORSIM simulation engine can be launched either directly or through TSIS. One of the benefits of running the file through TSIS is the ability to convert the text file (.trf) into a network file (.tno) for editing by the TSIS editor program.

The CORSIM-Specific parameters that may be entered or selected on this screen include:

- The Free Speed Factor: The CORSIM definition of speed differs from the other component programs. The speeds entered on the approach data screen are mapped into TRANSYT-7F, PASSER II and PASSER III as actual running speeds. As such, they represent the average speed of vehicles for progression computations. The speed value required by CORSIM is the “free-flow” speed. This value represents the speed at which vehicles will travel when they are not constrained by slower vehicles in front of them. CORSIM establishes a stochastic range of speeds around the free flow speed such that there will always be slower vehicles that will cause the average speed to be lower than the free flow speed. So, to produce comparable results between CORSIM and the other models, it is necessary to provide CORSIM with a slightly higher speed value. A lower average speed will be produced implicitly by the modeling process. The default value is 1.2. Lower values may be appropriate under very light traffic conditions.

- The “NEMA” controller check box: CORSIM offers traffic control emulation for the two most common traffic actuated control standards (NEMA and Type 170). This check box determines which standard will be invoked.

- The "Output Level" pull-down list allows you to reduce the volume of text produced by CORSIM, thus simplifying the interpretation of outputs for many purposes. The output level choices are:
    - All outputs
    - Suppress inputs
    - Suppress details
    - Suppress both

- The "Create New Directory" checkbox facilitates conformance with the TSIS convention of keeping a separate directory (i.e., folder) for each CORSIM project. If this box is checked, a new directory will be created with the same name as the data file if one does not already exist. A TSIS project file (.tcf) will be placed in that directory. This will make it easier to organize your TSIS projects in the TSIS explorer pane. All directories will be created as subdirectories of the folder selected on the "options" screen for TSIS data. If this box is not checked, the project and data files will be placed in the CORSIM data folder itself.

4.5.7 Data Validity Checks

The Data Validity Checker (DVC) is launched from the Run Control screen. Its purpose is to check the data file for any inconsistencies and/or errors. With each component program selected, the DVC knows which specifications to look for. It then checks the data and gives a warning or an error message, depending on the severity of the problem.

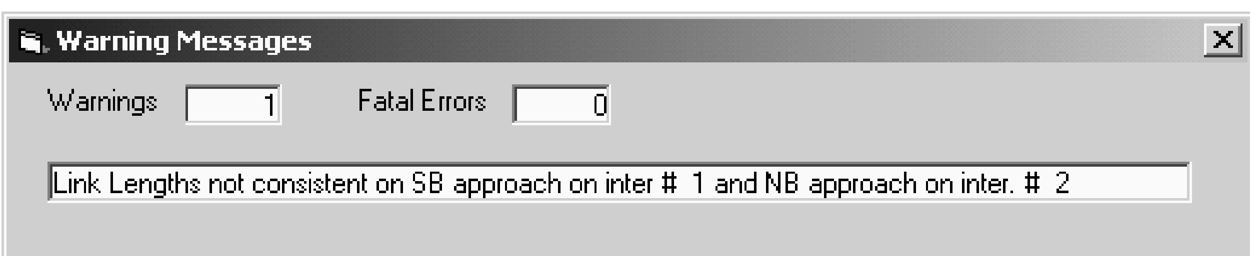
The data utility checker makes sure that the following objectives are followed.

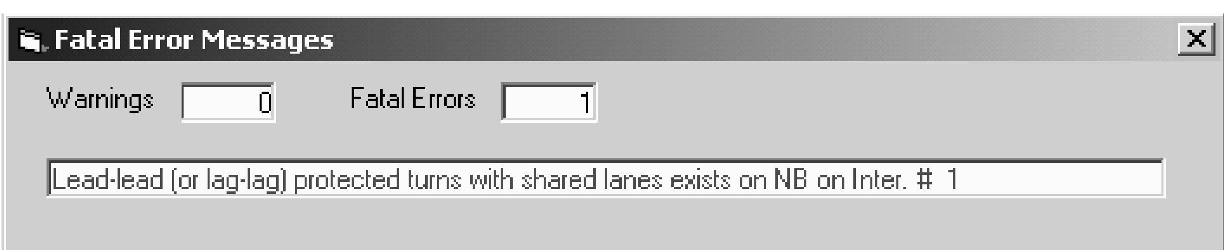
- The structure of the input stream is correct and that no significant information has been omitted.
- The data must be valid and it must lie within a specified range.
- The data items must be internally consistent and no items may be missing.

If there is a problem in the data, a message is displayed. Each message contains additional information to help you locate and correct the problem.

There are two different errors the DVC can find: warnings and fatal errors. Warning messages are caused by conditions that may or may not represent errors in the data. You should investigate the validity of all warning messages. Warning level problems will usually not stop the component programs from running, but the results of the simulation or optimization will be affected. Fatal errors are caused by missing or incorrect data that prevent the component programs from running.

Examples of warning and fatal error messages are shown below.





If the DVC identifies warning level problems, you may decide to run the component program anyway, or to return to the run control screen. If fatal errors are discovered, the component program may not be run. The following table summarizes the DVC operation

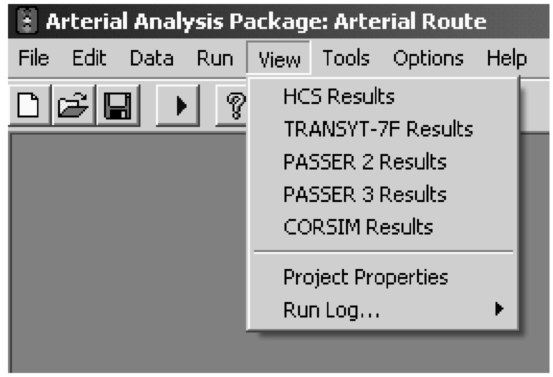
Summary of Diagnostic Checks for AAP Data

Levels: W= Warning, E = Error
[xx] indicates example number or direction

Common Data Checks	Level	Cause
Zero link length on [WB] approach at Intersection [4]	E	Missing or zero link length
Check PHF on the [WB] movement at Intersection [4]	E	PHF does not match time period for analysis
The Grade on the [WB] approach, Intersection [4] does not match the opposing [EB] approach.	W	Two different values for the link grade
Link Lengths not consistent on [WB] link on intersection [1] and [EB] link on intersection [2].	E	Two different values for the same link length
No Movements exists on [WB] approach on Intersection [4]	E	Missing movement in an existing approach
Lead-lead (or lag-lag) protected turns with shared lanes exists on [WB] on Intersection [4]	E	Protected left-turn movements exist with shared lanes unless phasing is lead-lag
TRANSYT-7F Data Checks		
Volume must be at least 10 vph! Check [WB] movement on Intersection [4]	E	Volumes less than ten
Min and Max Cycle Lengths should be the same! Check Intersect. [4] Or try using the SingleCycle box.	W	Different cycle lengths when an evaluation is selected
Intersection Cycle Lengths should be the same for Evaluation!	W	Cycle length between intersections are different
CORSIM Data Checks		
Link Length on [WB]" approach on Intersection "[4] " is out of range (50-4000)!	E	Link length is out of range
Left [or Right] turn pocket is out of range (20-1000) on [WB] movement on Intersection [4].	E	Turn bay length out of range
Number of lanes on [WB] movement is out of range (1-7) on intersection [4].	E	Total number of exclusive lanes out of range
PASSER II Data Checks		
"Dummy intersections will not be recognized by PASSER! Check Intersection [4]"	E	Dummy intersections exist
Adjusted Saturation Flow rate is needed! Check [WB] movement on Intersection [4]"	E	Missing Adjusted Sat. Flow rate

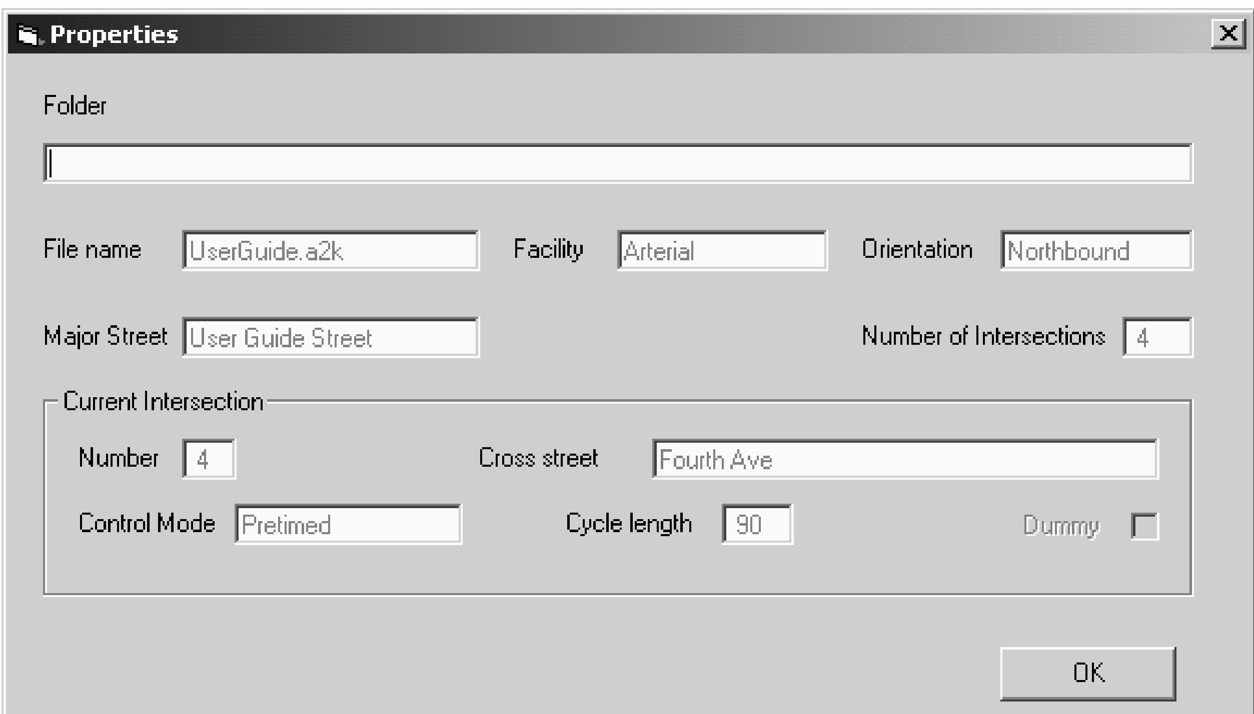
4.6 The View Menu

Using this menu you can view the results from the different component programs (HCS, TRANSYT, PASSER II, PASSER III, and CORSIM). You will be asked to select the file to be viewed using a standard dialog box. The selected file will then be opened in the application specified on the *Utility Programs* tab of the *File Locations* screen under the *Options* menu.



Other choices on this list include Project Properties and Run Log.

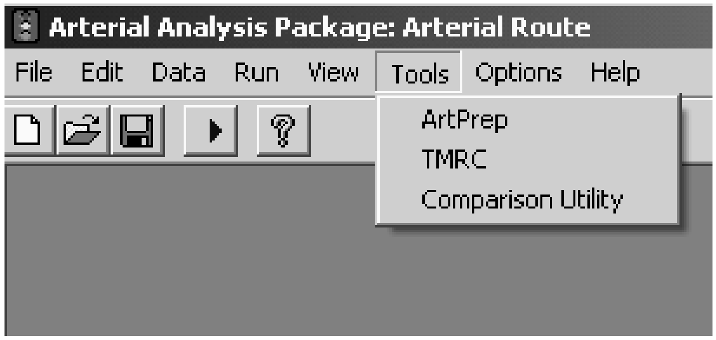
4.6.1 The Project Properties Screen



The Project Properties screen gives you a read-only overview of the most important attributes of the current data, such as file name, type of facility and orientation.

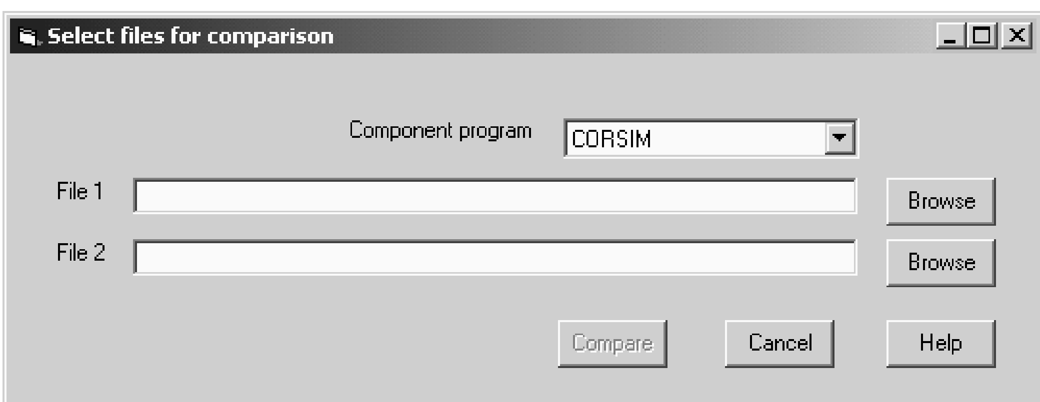
4.7 The Tools Menu

The tools menu provides access to three tools that support the AAP



- ArtPrep, a quick entry editor that uses planning level data to synthesize an AAP file for an arterial facility
- The Traffic Model Results Comparison (TMRC) program, that provides an intelligent comparison of two arterial data files in XML format.
- A general comparison utility that quickly spots small differences between two text files. Several choices are available on the market. One such choice is Microsoft WinDiff. You must procure and install your own comparison utility, and establish the location of the file on the Utility Programs tab in the File Locations screen on the Options Menu

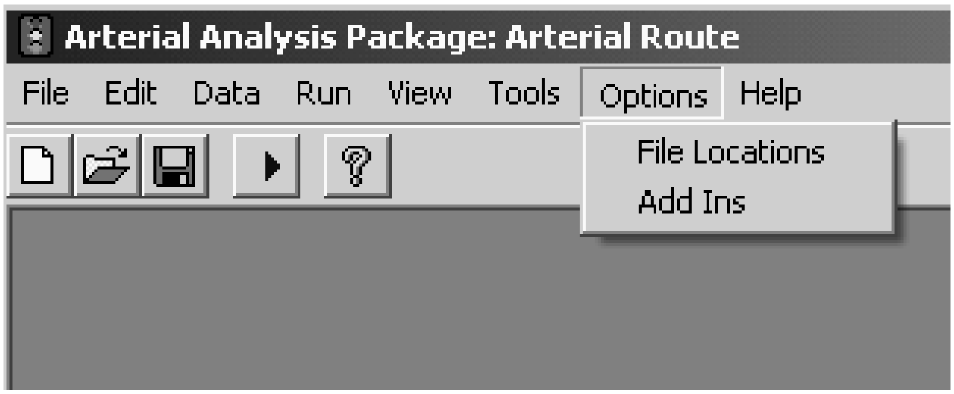
When you choose the Comparison Utility tool, you will see the following screen, assuming that you have installed a comparison utility program:



The two files for comparison may be identified using the Browse buttons. The browser will start looking in the data file folder for whatever component program you have selected from the pull-down list. When both files have been selected, the Compare command button will be enabled and you will be able to launch the comparison utility at that point.

4.8 The Options Menu

The following screen is the Options Pull-down menu. From here you can modify the locations of your files and component programs. For future expansion of the AAP, an Add Ins button has been placed on the pull-down menu. The Add Ins button is a future provision. It is not yet active because no add ins have been created for the AAP



The File Locations option is very important to the operation of the AAP. This option tells the AAP where all of your component programs, utility programs and data files are located. The File Locations screen is explained in detail in the "AAP Configuration" section of this document.