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E-20-615
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Multimodal Transportation Planning Tool

MTPT Design and Source Code Documentation

April 2000

Multimodal Transportation Planning Tool

Design and Source Code Documentation

Prepared by

Georgia Transportation Institute

Georgia Institute of Technology

April 2000

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I. Installation Information

The Multimodal Transportation Planning Tool (MTPT) installation program was developed using the Visual Basic Package and Deployment Wizard. Several system files are necessary to run the software, and many of these must be self-registered upon installation. As a result, the format and order in which the files are installed is critical to successful tool deployment. The setup configuration and order are displayed, in their entirety, in Figure A-1 in the appendix of this report.

Due to the extensive use of ESRI's MapObjects for GIS result display, a minimum of 128MB of RAM is required for the program to run on a computer. The program also requires the following items:

- Display resolution: 1024 x 768 (required for map feature);
- Color Palette: 256 colors (required);
- Memory: 128 MB RAM (required -- as previously discussed);
- Hard Drive Space Required: 24 MB (program only), 340 MB (database files only), for a total requirement if the program user installs all of the database files on the hard drive of 364 MB [Note: the database file *rcfiles.mdb* **must** be installed on the local computer. Upon copying the file, the program user should use Windows Explorer and change the properties of the file so that it is **not** a read-only file.];
- At any time after initial program use, if the program user decides to relocate the location of the map files (currently on the CD in the databases/shp directory) or the file called *rcfiles.mdb*, he or she should erase the file *mtpt.ini* in the program directory. This file will be recreated the next time the program user opens MTPT. The *mtpt.ini* file tells MTPT the directory path to search for these files.

To install the Multimodal Transportation Planning Tool (MTPT) in a Windows NT environment, run the setup.exe file located in the mtpt_nt directory on the CD. Similarly, to install the program in the Windows 95 or 98 environment, select setup.exe from the mtpt_9598 directory.

While installing the software you may receive a message that a file you are copying to your computer is older than the current file on the system. If you receive the message, you should keep the newer version already on your system by selecting "Yes" when the program asks you if you want to keep the current file.

II. Database Overview

The MTPT requires the use of several external databases and text files. The program uses seven different text files. They are:

1. *Aviation.key* -- provides output "key" information for the aviation module;
2. *Bike.key* – provides output "key" information for the bike module;
3. *Cost.key* – provides output "key" information for the cost estimate module;
4. *District.csv* – provides district terrain information for the program;
5. *Highway.key* – provides output "key" information for the highway module;
6. *Rail.key* – provides output "key" information for the rail module;
7. *Terrain.csv* – provides regional terrain information for the program.

In addition, the program also uses seven MicroSoft Access databases. These databases include:

1. *AVI.mdb* – aviation database that summarizes general aviation airports and programs;
2. *Bike.mdb* – bike database that identifies the location and name of future GDOT bike routes;
3. *County.mdb* – county database that includes information about county FIPS codes, districts, RDCs, etc.;
4. *Crash.mdb* – a reformatted 1997 crash database used by the programs crash analysis routine;
5. *Mapresults.mdb* – a database the GIS component of the program uses to reformat results before displaying them in map displays;
6. *Transit.mdb* – database that includes census information, transit carrier information, etc. for use by the Transit module;

Rcfiles.mdb – the GDOT road characteristic file includes road information as well as critical data for the MTPT to successfully execute. Within the database there are several tables. The road characteristic information is located in tables named for the three digit FIPS county code (from 001 to 321). Within each of these county tables should be, at a minimum, the RC Fields and data formats shown in the following table.

Road Characteristic Fields for the County Tables (*rcfiles.mdb*)

Required RC Fields	Values
ID	Assigned by Access (Numbers)
RCLINK	Alphanumeric GDOT Route Identification Numbers defined as follows: Positions 1-3 = County FIPS Code Position 4 = GDOT Route Type Identified as: ➢ 0 = Unknown Road ➢ 1 = State Route ➢ 2 = County Route ➢ 3 = City Route ➢ 4 = Col Route ➢ 5 = Unofficial Route ➢ 6 = Ramp/Interchange ➢ 7 = Private Road ➢ 8 = Public Roads ➢ 9 = Collector-Distributor Roads Positions 5-10 = GDOT Route Number where positions 5-8 are the actual number of the road and positions 9-10 have the following codes: ➢ 00 = State Route or County Route or none of the following: ➢ NO = North ➢ SO = South ➢ EA = East ➢ WE = West ➢ AL = Alternate ➢ BY = Bypass ➢ SP = Spur ➢ CO = Connector ➢ LO = Loop ➢ TO = Toll ➢ DU = Dual Mileage ➢ AD = Alternate Dual ➢ BD = Business Dual ➢ BC = Bypass Connector ➢ CD = Connector Dual ➢ SD = Spur Dual ➢ NN = City Suffix Number
MILEPOINT	Point Milepoint
CITY	Associate City (if appropriate)
DESCRIPTION	Location identifier
DISTRICT	GDOT District Number
POPULATION	Population Size (if appropriate)
DESIG_TRUCK	Truck Descriptor Designated as follows:

	➢ A = Single and twin trailers and singles ➢ B = Single trailers only ➢ C = Twins only ➢ D = Original interstate routes ➢ L = Access limits from interstate routes ➢ N = Access limits from other than interstate routes ➢ T = Other than original interstate
RURAL_URBAN	Integer value identifying regional condition
SPEED_LIMIT	Posted speed limit integer value from 5 to 70 (increments of 5)
CONGRESS	
INV_YEAR	Last two digits of the year of actual inventory (00 – 99)
ACCESS	Control of traffic access to route as follows: ➢ U = Free access to the road at grade ➢ P = Access at grade are intersecting roads ➢ F = Access is gained only at interchanges or rest areas
OPERATION	Direction of traffic flow identified as: ➢ 0 = Can never be used ➢ 1 = One-way (non-restricted) ➢ 2 = Two-way (non-restricted) ➢ 3 = Reverseable ➢ 4 = One-way during school hours ➢ 5 = One-way (with truck restrictions) ➢ 6 = Two-way (with truck restrictions) ➢ 7 = Through trucks restricted
TRAVEL_LANES	Two digit number with one numeric character on the left and one numeric character on the right. For example, a 11 designation means one lane on the left and one lane on the right.
L_SHOULDER_D	Three character code for the shoulder on the left of a divided highway where the first two characters represent shoulder width in feet and the third character code represents shoulder composition as follows: ➢ G = Grass or sod ➢ S = Gravel or stone ➢ F = Bituminous surface treatment (low) ➢ I = Bituminous concrete (high) ➢ J = Portland cement (high) ➢ C = Curb and gutter (always coded '00C') ➢ N = No shoulder or curb ➢ D = Gutter only ➢ O = Bituminous concrete (high) with curb and gutter ➢ P = Bituminous surface treatment (low) with curb and gutter
SURFACE_D	Three character code for the pavement on a divided route where the first two characters represent the pavement width in feet and the third character code represents the surface type as follows: ➢ A = Primitive road ➢ B = Unimproved road

	➢ C = Graded and drained (natural earthen materials) ➢ D = Soil-surfaced road (mixed or stabilized soil) ➢ E = Gravel or stone road ➢ F = Bituminous surface treated (road of any type to which a bituminous surface layer which is < 1" thick) ➢ G = Mixed bituminous (< 7" combined thickness of surface and base materials, surface alone is > 1" thick) ➢ I = High flexible (> 7" combined thickness) ➢ J = High rigid (Portland cement concrete pavements with or without bituminous surface if less than 1") ➢ K = Brick ➢ L = Block (consisting of stone, asphalt, wood and other block, steel, or wood with < 1" surface thickness)
R_SHOULDER_D	Shoulder on right of a divided highway (See L_Shoulder_D for detailed description)
MEDIAN	Describes the width and type of median and barrier where the first two characters code barrier and median combined width in feet and a third character codes median type as follows: ➢ 0 = Undivided Road ➢ 1 = Grass ➢ 2 = Soil, Stone ➢ 3 = Park, Business ➢ 4 = Couplet (2 parallel solid painted lines 4, 8, or 10 ft wide center area) ➢ 5 = Concrete ➢ 6 = Other ➢ 7 = Roadway separated by barrier only (use 4' median width) A fourth character code represents barrier type as follows: ➢ 0 = No barrier ➢ 1 = Curb ➢ 2 = Guardrail ➢ 3 = Curb and guardrail ➢ 4 = Fence ➢ 5 = New Jersey concrete barrier ➢ 6 = Cable ➢ 7 = Other
L_SHOULDER_U	Describes width and type of shoulder on the left side of an undivided highway (see L_SHOULDER_D)
SURFACE_U	Described the width and type of pavement surface of the undivided route (see SURFACE_D)
R_SHOULDER_U	Describes the width and type of pavement surface of the undivided route (see L_SHOULDER_D)
AUX_LANES_L	Auxiliary lanes of different types on the left side of the route. The first two characters code the width of the auxiliary lane,

	while the third character code represents type of lane as follows: ➢ A = Left turn ➢ B = Right turn ➢ C = Left and right turn ➢ D = Left-Left lane in center of road (TWLTL) ➢ E = Passing or climbing lane ➢ F = Parking lane (must be striped or posted) ➢ G = Angle parking ➢ H = Left turn and parking ➢ I = Left-Left lane in center of road and parking ➢ J = Left-Left lane in center of road and right turn ➢ K = Marked or striped median in center of road, undivided roads only ➢ L = Left turn and other ➢ M = Striped median in center and other ➢ N = Right turn and other, must be marked with an arrow ➢ O = All additional non-through roadway width not listed ➢ P = Parking and other ➢ Q = Left-Left turn and other ➢ R = Left turn, right turn and other ➢ T = Transition lane
AUX_LANES_R	Auxiliary lanes of different types located on the right side of the route (See AUX_LANES_L)
FUNC_CLASS	Code for functional classification as follows: ➢ 1 = Rural Interstate principal arterial ➢ 2 = Rural Principal arterial ➢ 6 = Rural Minor arterial ➢ 7 = Rural Major collector ➢ 8 = Rural NFA Minor Collector ➢ 9 = Rural Local ➢ 11 = Urban Interstate Principal arterial ➢ 12 = Urban freeway and expressway ➢ 14 = Urban principal arterial ➢ 16 = Urban Minor arterial street ➢ 17 = Urban Collector street ➢ 19 = Urban Local
TRUCK_PERCENT	The first three digits represent the truck percentage. For example, a truck percentage shown as 085 represents 8.5% trucks.
SIGNALS	Code defining the type of traffic signal along route represented as follows: ➢ S = Traffic control device (red, amber, green) ➢ P = Traffic control with pedestrian signalization ➢ A = Stop sign ➢ F = Flasher, other than overhead beacon ➢ L = Traffic control device with left turn arrow

	➢ B = Beacon, overhead flashing amber ➢ R = Beacon, overhead flashing red ➢ C = Stop, all directions
AADT_PREV	Average Annual Daily Traffic from previous evaluation
PACES	Paces rating for the road surface
AADT_CUR	Average Annual Daily Traffic for the current database evaluation

In addition to the FIPS tables, four additional tables must be imported into any new rcfile database. These four tables are:

1. CurvePercent – developed as a result of data collection. This table includes actual observed rclink and curve percentage for corridors evaluated during the two-lane analysis.
2. RCYear – this table only has one value in it. This is the year the rcfile represents. For future year rcfiles, this number should be updated to reflect that year (currently shows 1997).
3. SelectFromMap – this table is used by the GIS select area from map feature. The MTPT identifies the selected region and then transfers the data from the FIPS files into this table for future analysis. For this reason, rcfiles.mdb should never be in a read-only format or the map options will not function.
4. SelectRoadSeg – this table is used by the MTPT to transfer data about a specific road corridor selected for analysis (Road Corridor Analysis). For this reason, rcfiles.mdb should never be in a read-only format or the specific road corridor analysis option will not function.

III. Source Code Summary

The MTPT was developed using MicroSoft Visual Basic. Numerous visual basic forms and thousand of lines of source code make up the program structure. Specific methods applied to develop the algorithms included in the program are described in the MTPT technical document. The actual program functionality and program structure can best be defined by following the program menu (and tool bars) to see what happens when a user initiates a menu or toolbar event.

A. Program Initiation

When a program user first activates the MTPT, a visual basic form known as frmStart is activated. This form displays a welcome window while the program begins to initialize the executable requirements. Following frmStart activation, the program searches for a file called mtpt.ini. This file identifies the path for the map files as well as the road characteristic file. The following summary briefly describes the frmStart and frmShpDir visual basic forms required to perform this successful program initiation.

1. **Name:** frmStart.FRM
   Caption: <none>
   General Information: Form displays each time the MTPT is executed.
   Form Appearance:

Content Summary:

Timer:
➢ Timer1: [Interval 2000]
Image:
➢ Image1: <Graphic Image as Shown>
Subroutines (Private):
Name: Timer1_Timer *Declaration:* Private Sub Timer1_Timer() *Purpose:* To display the "Start" screen for approximately 2 seconds.
Name: Form_Load *Declaration:* Private Sub Form_Load() *Purpose:* To initialize the Start form.

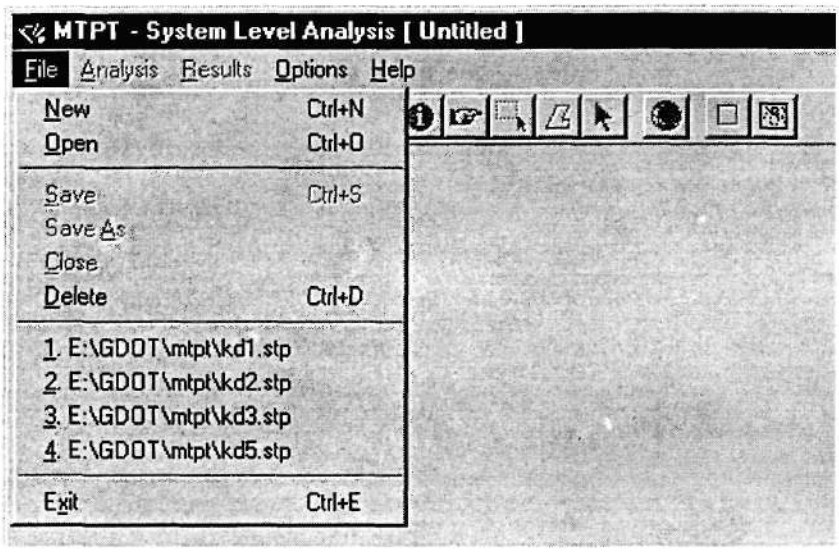
2. **Name:** frmShpDir.FRM
Caption: MTPT
General Information: This form is executed if a file named *mtpt.ini* is not present upon initial program execution.
Form Appearance:

Content Summary:

Label:
➢ Label1: Choose the directory with the map files
TextBox:
➢ TxtFileName: Hidden textbox where the selected directory name will be stored
CommandButton:
➢ Command1: OK ➢ Command2: No maps
DriveListBox:
➢ Drive1: <Located below Label1>
DirListBox:
➢ Dir1: <Located below the DriveListBox>
Subroutines (Private):
Name: Command1_Click *Declaration:* Private Sub Command1_Click() *Purpose:* Activated upon user selection of the "OK" button. It assigns the name the user selected for the map directory and then closes the form.
Name: Command2_Click *Declaration:* Private Sub Command2_Click *Purpose:* Activated upon user selection of the "No maps" button. It resets the directory path to " " and then closes the form.
Name: Drive1_Change *Declaration:* Private Sub Drive1_Change *Purpose:* Activated upon user selection of the DriveListBox. It executes the windows directory change command.
Name: Form_Load *Declaration:* Private Sub Form_Load() *Purpose:* Activated when the user selects the shape directory path. It sets both the drive and directory to the default MTPT directory path.

B. Program File Manipulation Items

Upon program execution, the program user may elect to create a new file or use an existing file. The MTPT "File" option in the menu displays the choices available to the program user. This menu section item is depicted in the following graphic.

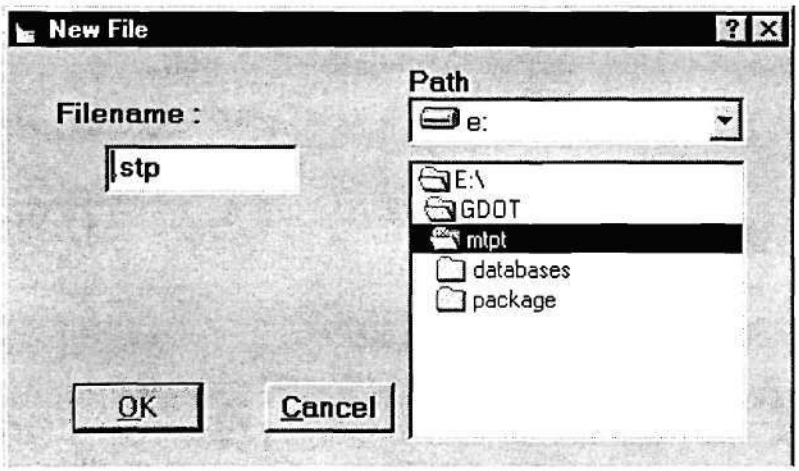


The main form for the MTPT includes all of the command prompts shown in the menu. These items are discussed in the following section.

1. New

The "New" menu item activates a program subroutine called mnuNew. This subroutine calls a form named frmNewFile that is formatted as follows:

Name: frmNewFile.FRM
Caption: New File
General Information: Form activated when the program user selects File - New from the MTPT menu.
Form Appearance:



Content Summary:

Label:
➢ Label1: Filename: ➢ Label2: Path
TextBox:
➢ Text1: .stp
CommandButton:
➢ Command1: OK ➢ Command2: Cancel
CommonDialog:
➢ CommonDialog1: <Positioned toward top> ➢ CommonDialog2: <Positioned below CommonDialog1>
DriveListBox
➢ Drive1: <Located below the Path Label>
DirListBox
➢ Dir1: <Located below the DriveListBox>
Subroutines (Private):
Name: Drive1_Change *Declaration:* Private Sub Drive1_Change() *Purpose:* Activated when the user selects the "down arrow" in the "Path" ListBox. It then displays the available drives on the computer.
Name: Form_Load *Declaration:* Private Sub Form_Load() *Purpose:* Activated when the user selects "New File" from the analysis area menu. Upon form activation, the Form_Load subroutine assigns the default drive and directory as the application path for MTPT.
Name: Form_QueryUnload *Declaration:* Private Sub Form_QueryUnload(Cancel As Integer, UnloadMode As Integer) *Purpose:* Occurs before the NewFile form can be closed. If the Cancel Integer is not equal to zero, this event will terminate. The routine also calls the Command2_Click subroutine that is executed when a user selects the "Cancel" button.
Name: Text1_Change *Declaration:* Private Sub Text1_Change() *Purpose:* Activated when the user selects the "down arrow" in the "Path" ListBox. It then displays the available drives on the computer.
Name: Text1_KeyPress *Declaration:* Private Sub Text1_KeyPress(KeyAscii As Integer) *Purpose:* Called before the NewFile form is closed if the "OK" Key is pressed. It first checks the assignment of KeyAscii and then calls Command1_Click.
Subroutines (Public):
Name: Command1_Click *Declaration:* Public Sub Command1_Click()

Purpose: Activated upon user selection of the "OK" button. It assigns the name the user selected to SystemFileName_G, checks to see if a file already exists with the same path name and prompts an overwrite message if one already exists. The program then executes the error checking routine called validate_filename. Finally, if the value assigned by validate_filename for ValidFileName_G is 1 the routine successfully names the selected file name and the program continues. If the value assigned is 0, then a name is not assigned.
Name: Command2_Click *Declaration:* Public Sub Command2_Click() *Purpose:* Activated upon user selection of the "Cancel" button. It hides the NewFile window.
Name: validate_filename *Declaration:* Public Sub validate_filename() *Purpose:* Activated by the Command1_Click subroutine. It checks to be sure it can open the file name and assigns a value of 1 to ValidFileName_G if the name the user identified is acceptable, it not it assigns a value of 0 to ValidFileName_G.

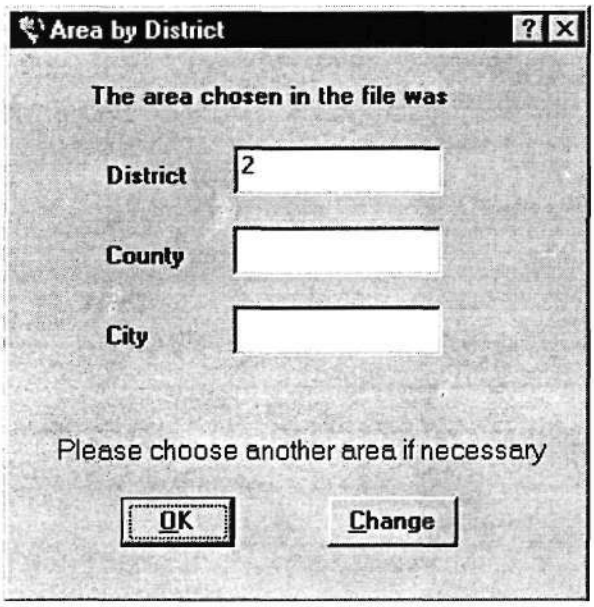
2. Open

The program user can open an existing *.stp file by selecting the File-Open command. This menu item activates a subroutine called mnuOpen (from frmMain form) which uses an ActiveX Windows dialog box to help the user locate the appropriate file. Section G of this report discusses the "Main Form" commands. Upon file initiation, the MTPT will determine what method was previously used to identify the analysis area. When the program user attempts to perform the analysis evaluation, the MTPT will remind the program user about the area selected and request revisions to that selection. This task is accomplished using five forms as described in the following section.

a.) Previous Area Selection -- District

Name: frmAreaDist2.FRM
Caption: Area by District
General Information: Activated when the program user opens an existing *.stp file where District area selection occurred. The District, County, or City previously selected is shown and the program user can accept that area or choose a different area.

Form Appearance:

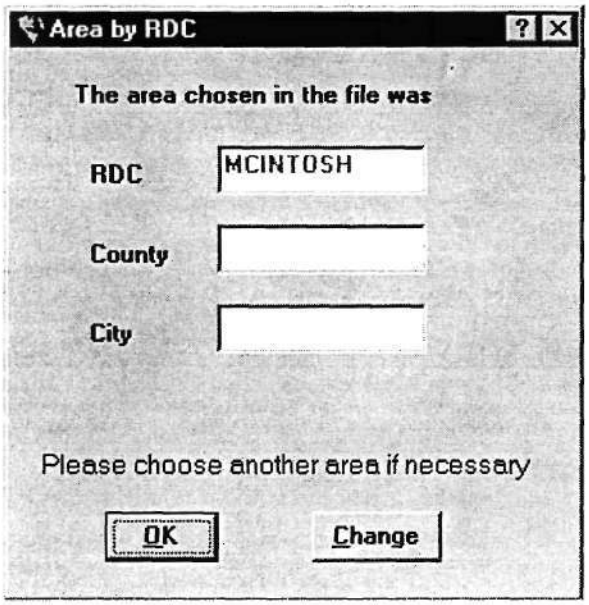


Content Summary:

TextBox:
➢ Text1: <Displays District as shown in *.stp file opened> ➢ Text2: <Displays County as shown in *.stp file opened> ➢ Text3: <Displays City as shown in *.stp file opened>
Labels:
➢ Label1: The area chosen in the file was ➢ Label2: District ➢ Label3: County ➢ Label4: City ➢ Label5: Please choose another area if necessary
CommandButtons:
➢ Command1: Change ➢ Command2: OK
Subroutines (Private):
Name: Command1_Click() *Declaration:* Private Sub Command1_Click() *Purpose:* Activated upon user selection of the "Change" button. It hides the current AreaDist2 form and displays the AreaDist form.
Name: Command2_Click() *Declaration:* Private Sub Command2_Click() *Purpose:* Activated upon user selection of the "OK" button. It accepts the area selection as displayed.

b.) Previous Area Selection -- RDC

Name: frmAreaRDC2.FRM
Caption: Area by RDC
General Information: Activated when the program user opens an existing *.stp file where RDC area selection occurred. The RDC, County, or City previously selected is shown and the program user can accept that area of choose a different area.
Form Appearance:



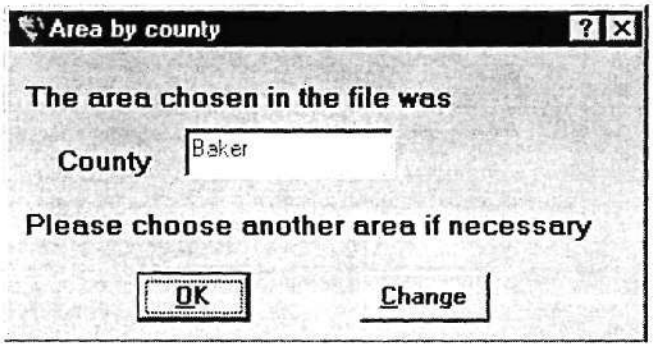
Content Summary:

TextBox:
➢ Text1: <Displays RDC name as shown in *.stp file opened> ➢ Text2: <Displays county name as shown in *.stp file opened> ➢ Text3: <Displays city name as shown in *.stp file opened>
Labels:
➢ Label1: The area chosen in the file was ➢ Label2: RDC ➢ Label3: County ➢ Label4: City ➢ Label5: Please choose another area if necessary
CommandButtons:
➢ Command1: Change ➢ Command2: OK
Subroutines (Private):
Name: Command1_Click()

Declaration: Private Sub Command1_Click() *Purpose:* Activated upon user selection of the "Change" button. It hides the current AreaRDC2 form and displays the AreaRDC form.
Name: Command2_Click() *Declaration:* Private Sub Command2_Click() *Purpose:* Activated upon user selection of the "OK" button. It accepts the area selection as displayed.

c.) Previous Area Selection -- County

Name: frmAreaCounty2.FRM
Caption: Area by county
General Information: Activated when the program user opens an existing *.stp file where county selection occurred. The county previously selected is shown and the program user can accept that county or choose a different area.
Form Appearance:



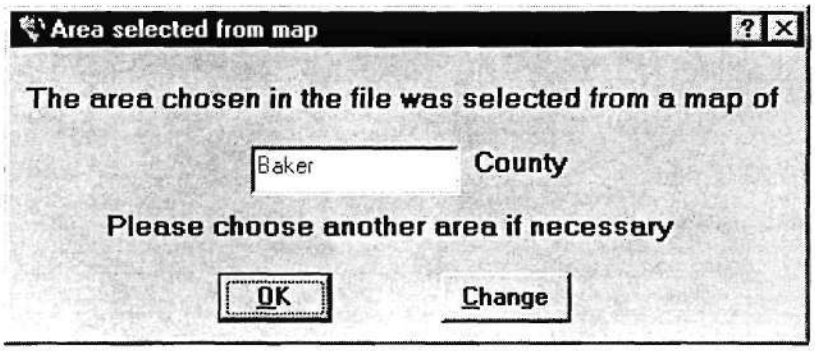
Content Summary:

TextBox:
➢ Text2: <Displays county name as shown in *.stp file opened>
Labels:
➢ Label1: The area chosen in the file was ➢ Label3: County ➢ Label5: Please choose another area if necessary
CommandButtons:
➢ Command1: Change ➢ Command2: OK
Subroutines (Private):
Name: Command1_Click() *Declaration:* Private Sub Command1_Click() *Purpose:* Activated upon user selection of the "Change" button. It hides the current AreaCounty2 form and displays the AreaCounty form.
Name: Command2_Click()

Declaration: Private Sub Command2_Click() *Purpose:* Activated upon user selection of the "OK" button. It accepts the area selection as displayed.

d.) Previous Area Selection -- Area from Map

Name: frmMapArea2.FRM
Caption: Area selected from map
General Information: Activated when the program user opens an existing *.stp file where selection from map area occurred. The county previously selected as the base map is shown and the program user can accept that area or choose a different area.
Form Appearance:



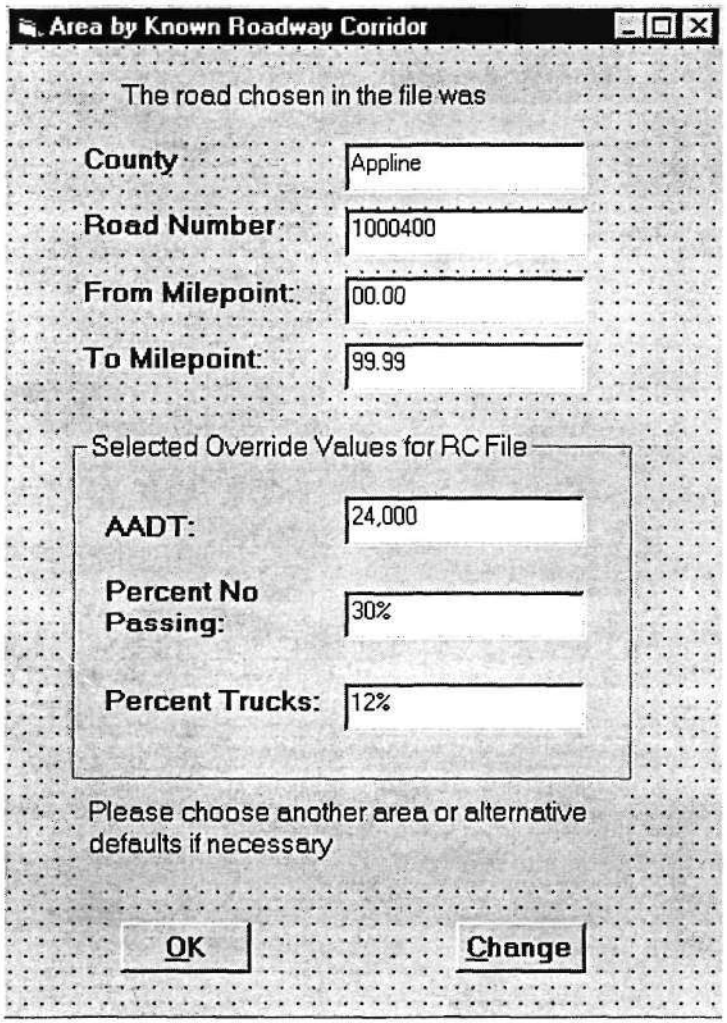
Content Summary:

TextBox:
➢ Text2: <Displays county name as shown in *.stp file opened>
Labels:
➢ Label1: The area chosen in the file was selected from a map of ➢ Label3: County ➢ Label5: Please choose another area if necessary
CommandButtons:
➢ Command1: Change ➢ Command2: OK
Subroutines (Private):
Name: Command1_Click() *Declaration:* Private Sub Command1_Click() *Purpose:* Activated upon user selection of the "Change" button. It hides the current MapArea2 form and displays the AreaMap form.
Name: Command1_Click() *Declaration:* Private Sub Command1_Click()

Purpose: Activated upon user selection of the "OK" button. It accepts the area selection as displayed and initiates evaluation.

e.) Previous Area Selection -- Area by Known Roadway Corridor

Name: frmAreaRoad2.FRM
Caption: Area by Known Roadway Corridor
General Information: Activated when the program user opens an existing *.stp file where "By Known Road Corridor" area selection occurred. The values previously selected are shown and the program user can accept them or choose the "change" option.
Form Appearance:



Content Summary:

TextBox:
➢ Text1: <Displays county name as shown in *.stp file opened> ➢ Text2: <Displays the Road number as shown in *.stp file opened> ➢ Text3: <Displays the "From Milepoint" designation as shown in *.stp file opened> ➢ Text4: <Displays the "To Milepoint" designation as shown in *.stp file opened> ➢ TextAADT: <Displays the user modified AADT value> ➢ TextNoPass: <Displays the user modified percent no passing value> ➢ TextTrucks: <Displays the user modified percent trucks>
Labels:
➢ Label1: The road chosen in the file was ➢ Label2: County ➢ Label3: Road Number ➢ Label4: Please choose . . . if necessary ➢ Label5: From Milepoint ➢ Label6: To Milepoint ➢ Label7: AADT ➢ Label8: Percent No Passing ➢ Label9: Percent Trucks
CommandButtons:
➢ Command1: OK ➢ Command2: Change
Subroutines (Private):
Name: Command1_Click() *Declaration:* Private Sub Command1_Click() *Purpose:* Activated upon user selection of the "OK" button. It accepts the area selection as displayed.
Name: Command2_Click() *Declaration:* Private Sub Command2_Click() *Purpose:* Activated upon user selection of the "Change" button. It hides the current AreaRoad2 form and displays the AreaRoad form.

3. Save

The program user can save an existing *.stp file by selecting the File-Save command. This menu item activates a subroutine called mnuSave (from frmMain form) which uses an ActiveX Windows dialog box to help the user save the previously named file. Section G of this report discusses the "Main Form" commands.

4. Save As

The program user can save an existing *.stp file under a new name by selecting the File-SaveAs command. This menu item activates a subroutine called mnuSaveAs (from frmMain form) which uses an ActiveX Windows dialog box to help the user save the previously named file. Section G of this report discusses the "Main Form" commands.

5. Close

The program user can close an existing *.stp file by selecting the File-Close command. This menu item activates a subroutine called mnuClose (from frmMain form) which uses an ActiveX Windows dialog box to ask the user if the file should be saved and then closes the file. Section G of this report discusses the "Main Form" commands.

6. Delete

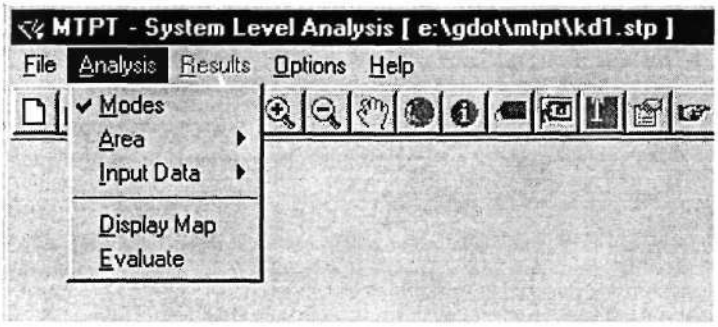
The program user can delete existing *.stp files by selecting the File-Delete command. This menu item activates a subroutine called mnuDel (from frmMain form) which then removes the selected file from the computer hard drive. Section G of this report discusses the "Main Form" commands.

7. Exit

The program user can exit the MTPT by selecting the exit command from the menu. This menu item activates a subroutine called mnuExit (from frmMain form) which then prompts the program user to save the exiting file before closing the program. Section G of this report discusses the "Main Form" commands.

C. Analysis Menu Items

Upon completion of the file manipulation stage where the program user either opens an existing file or creates a new file, the program user can next begin "Analysis". The MTPT "Analysis" option in the menu displays several choices available to the program user. This menu section item is depicted by the following graphic image. For optimal program functionality, a program user should select items from the top to the bottom of the menu beginning with Modes and ending with Evaluate.

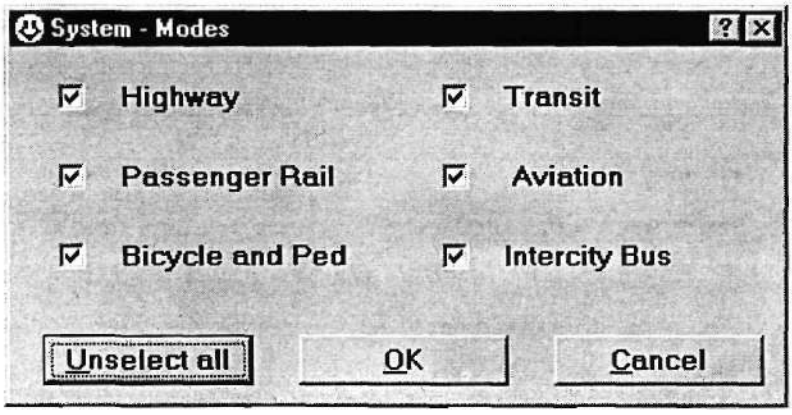


The individual analysis menu options (and sub-menu options where appropriate) require additional description.

1. Modes

a.) Select the Six General Transportation Modes

Name: frmModes.FRM
Caption: System – Modes
General Information: Form activated when program user selects "Analysis -- Modes"
Form Appearance:



Content Summary:

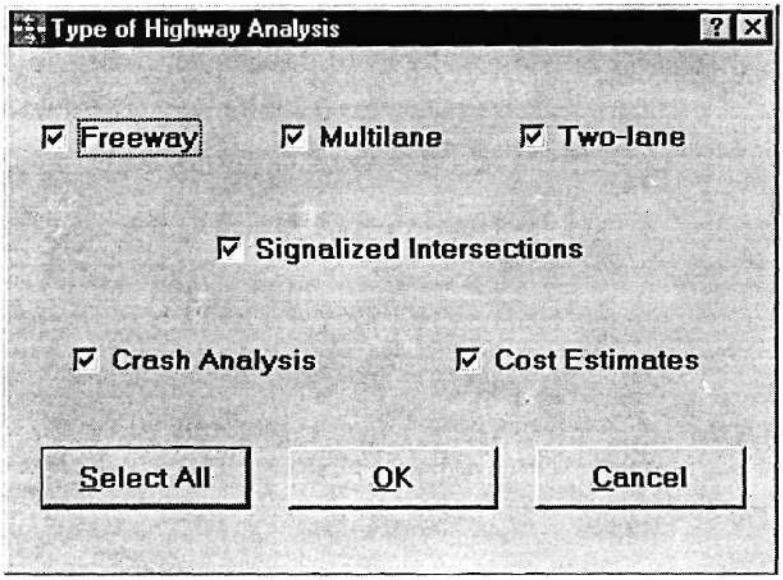
CheckBoxes:
➢ Check1: Transit ➢ Check2: Intercity Bus ➢ Check3: Passenger Rail ➢ Check4: Aviation ➢ Check5: Bicycle and Ped ➢ Check6: Highway
CommandButtons:
➢ Command1: OK ➢ Command2: Cancel ➢ Command3: Select all
Subroutines (Private):
Name: Check1_Click *Declaration:* Private Sub Check1_Click() *Purpose:* Checks to see if the program user selected at least one of the six mode options (Highway, Passenger Rail, Bicycle and Ped, Transit, Aviation, & Intercity Bus). If any of the modes were selected, Command1.Enabled is assigned a value of one (true).
Name: Check2_Click *Declaration:* Private Sub Check2_Click() *Purpose:* Checks to see if the program user selected at least one of the six mode options (Highway, Passenger Rail, Bicycle and Ped, Transit, Aviation, & Intercity Bus). If any of the modes were selected, Command1.Enabled is assigned a value of one (true).
Name: Check3_Click *Declaration:* Private Sub Check3_Click() *Purpose:* Checks to see if the program user selected at least one of the six mode options (Highway, Passenger Rail, Bicycle and Ped, Transit, Aviation, & Intercity Bus). If any of the modes were selected, Command1.Enabled is assigned a value of one (true).
Name: Check4_Click *Declaration:* Private Sub Check4_Click() *Purpose:* Checks to see if the program user selected at least one of the six mode options (Highway, Passenger Rail, Bicycle and Ped, Transit, Aviation, & Intercity Bus). If any of the modes were selected, Command1.Enabled is assigned a value of one (true).
Name: Check5_Click *Declaration:* Private Sub Check5_Click() *Purpose:* Checks to see if the program user selected at least one of the six mode options (Highway, Passenger Rail, Bicycle and Ped, Transit, Aviation, & Intercity Bus). If any of the modes were selected, Command1.Enabled is assigned a value of one (true).

Name: Check6_Click *Declaration:* Private Sub Check6_Click() *Purpose:* Checks to see if the program user selected at least one of the six mode options (Highway, Passenger Rail, Bicycle and Ped, Transit, Aviation, & Intercity Bus). If any of the modes were selected, Command1.Enabled is assigned a value of one (true).
Name: Command2_Click *Declaration:* Private Sub Command2_Click() *Purpose:* Activated upon user selection of the "Cancel" button. It hides the Modes form.
Name: Command3_Click *Declaration:* Private Sub Command3_Click() *Purpose:* Activated upon the user selecting the "Select all" button. The button works as a toggle to select and deselect the six mode options in their entirety.
Subroutines (Public):
Name: Command1_Click *Declaration:* Public Sub Command1_Click() *Purpose:* Activated upon user selection of the "OK" button. It then assigns values selected in the form to analysis values. It also error checks to be sure that if Bicycle and Ped analysis is selected that Highway analysis must also be selected. Upon completion of the subroutine, a value of True is assigned to ModeDone_G. If check6 was selected, the program next activates the frmHwyModes form.
Name: result_modes *Declaration:* Public Sub result_modes() *Purpose:* To determine if any of the six mode options were selected by the user. If a value was not selected for analysis, a value of zero (false) is assigned while a value of one (true) is assigned for selected values. For items that are not selected for analysis, the output options on ResultFormat are "gray-scaled."

b.) Select the Six Highway Modes

Name: frmHwyModes.FRM
Caption: Type of Highway
General Information: Form activated when the "Highway" checkbox on frmModes was selected and then the program user exited that form using the "OK" command button.

Form Appearance:



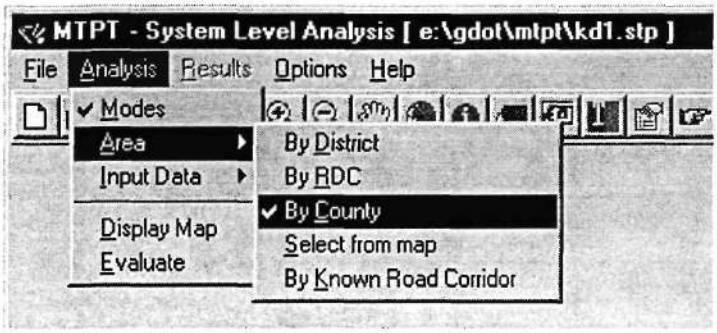
Content Summary:

CheckBoxes:
➢ Check1: Freeway ➢ Check2: Two-lane ➢ Check3: Multilane ➢ Check4: Signalized Intersections ➢ Check5: Crash Analysis ➢ Check6: Cost Estimates
CommandButtons:
➢ Command1: OK ➢ Command2: Cancel ➢ Command3: Select All / Unselect All
Subroutines (Private):
Name: Check1_Click *Declaration:* Private Sub Check1_Click() *Purpose:* To determine any of the six highway analysis options are selected and assign a value of zero to Command1.Enabled if they are not yet selected. If any of the six options are selected, the subroutine will assign a value of one. The default value of Check1 (freeway) is one.
Name: Check2_Click *Declaration:* Private Sub Check2_Click() *Purpose:* To determine any of the six highway analysis options are selected and assign a value of zero to Command1.Enabled if they are not yet selected. If any of the six options are selected, the subroutine will assign a value of one. The default value of Check2 (two-lane) is one.
Name: Check3_Click *Declaration:* Private Sub Check3_Click()

Purpose: To determine any of the six highway analysis options are selected and assign a value of zero to Command1.Enabled if they are not yet selected. If any of the six options are selected, the subroutine will assign a value of one. The default value of Check3 (multi-lane) is one.
Name: Check4_Click *Declaration:* Private Sub Check4_Click() *Purpose:* To determine any of the six highway analysis options are selected and assign a value of zero to Command1.Enabled if they are not yet selected. If any of the six options are selected, the subroutine will assign a value of one. The default value of Check4 (signalized intersections) is one.
Name: Check5_Click *Declaration:* Private Sub Check5_Click() *Purpose:* To determine any of the six highway analysis options are selected and assign a value of zero to Command1.Enabled if they are not yet selected. If any of the six options are selected, the subroutine will assign a value of one. The default value of Check5 (crash analysis) is one.
Name: Check6_Click *Declaration:* Private Sub Check6_Click() *Purpose:* To determine any of the six highway analysis options are selected and assign a value of zero to Command1.Enabled if they are not yet selected. If any of the six options are selected, the subroutine will assign a value of one. The default value of Check6(cost estimates) is one.
Name: Command1_Click *Declaration:* Private Sub Command1_Click() *Purpose:* Activated upon user selection of the "OK" button. It assigns a value of zero (not to be analyzed) or one (to be analyzed) for the six highway analysis options. This subroutine then activates the Main form function ReadyToEvaluate to prompt the program user for the next input data.
Name: Command2_Click *Declaration:* Private Sub Command2_Click() *Purpose:* Activated upon user selection of the "Cancel" button. It hides the Highway Modes form.
Name: Command3_Click *Declaration:* Private Sub Command3_Click() *Purpose:* Activated upon user selection of the "Select All" button. The button works as a toggle to select and deselect the six highway mode options in their entirety.

2. Analysis Area Selection

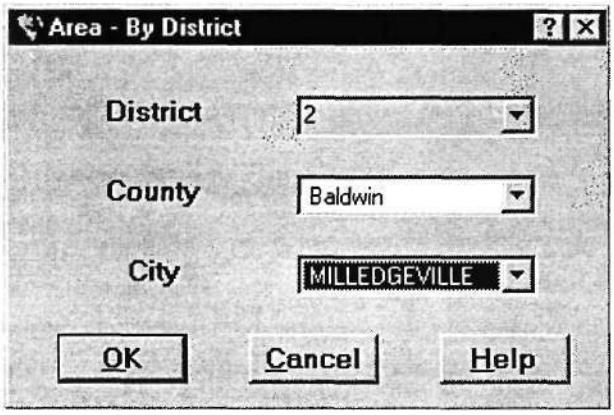
Upon completion of the mode selection stage where the program user selects any of the six analysis modes and, if applicable, any of the six highway modes, the program user can next begin "Area Selection." The MTPT "Analysis -- Area" option in the menu displays several choices available to the program user. This menu section item is depicted by the following graphic image. A program user should select only one of the five available area options shown.



Each of the five analysis area options are described in detail in the following sections.

a.) Select the Analysis Area "By District"

Name: frmAreaDist.FRM
Caption: Area – By District
General Information: Form activated when program user selects Analysis - Area - By District
Form Appearance:



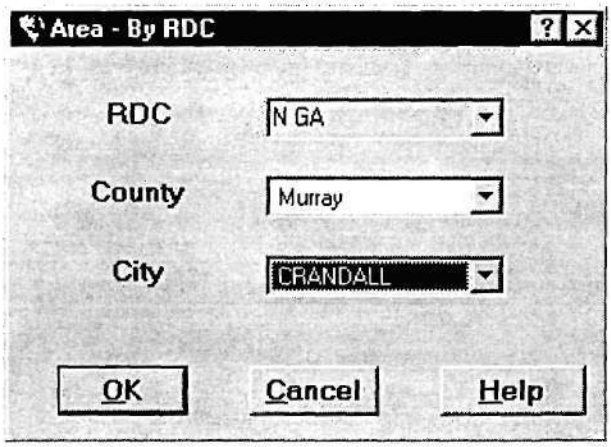
Content Summary:

Data:
➢ Data1: Connect to Access, City Reference ➢ Data2: Connect to Access, County Reference
Labels:
➢ Label1: District ➢ Label2: County ➢ Label3: City
ComboBox:
➢ Combo1: <empty> [Adjacent to Label1 (District)]
DBCombo:
➢ DBCombo1: County, Row Source: Data2 ➢ DBCombo2: City, Row Source: Data1
CommandButtons:
➢ Command1: OK ➢ Command2: Cancel ➢ Command3: Help
Subroutines (Private):
Name: Combo1_gotfocus() *Declaration:* Private Sub Combo1_gotfocus() *Purpose:* Activated upon user selection of the district ComboBox in the form. The content of the County and City boxes are cleared and values assigned in the FormLoad can be displayed upon user selection of the district "arrow" key in the box.
Name: Command1_Click() *Declaration:* Private Sub Command1_Click() *Purpose:* Activated upon user selection of the "OK" button. It clears the values for all previous records, assigns a value of 2 for AreaType_G (indicating district analysis) or a value of 1 for AreaType_G (indicating city analysis), and then assigns a value of True to mnuDist.checked and a value of false to the other available area options (Select From Map, County, and RDC).
Name: Command2_Click() *Declaration:* Private Sub Command2_Click() *Purpose:* Activated upon user selection of the "Cancel" button. It hides the AreaDist window.
Name: Command3_Click() *Declaration:* Private Sub Command3_Click() *Purpose:* Activated upon user selection of the "Help" button. It initiaties the HelpContext item 122 for information regarding the AreaDist form.
Name: dbCombo2_GotFocus *Declaration:* Private Sub dbCombo2_GotFocus() *Purpose:* Activated upon user selection of the "City" ComboBox. It will check to see what the program user selected in the district box and display the appropriate city list. For example, if the user selected ALL in the district box this routine will provide a list of all of the Georgia cities. If the user selected,

say, District 5 in the district box then selected a specific District 5 county, only the cities located in that county in District 5 will be displayed.
Name: Form_Load *Declaration:* Private Sub Form_Load() *Purpose:* Activated when the user selects District from the analysis area menu. Upon form activation, the Form_Load subroutine defines the data1 and the data2 database as "\county.mdb" in the source directory. This subroutine further defines the selection options in the District ComboBox to be "All, 1, 2, 3, 4, 5, 6, 7" with the "All" option as the default prompt.
Subroutines (Public):
Name: DBCombo1_GotFocus() *Declaration:* Public Sub DBCombo1_GotFocus() *Purpose:* Activated upon user selection of the "County" ComboBox. It will either display all possible counties for selection (if District -- All option was selected), or it will display only the counties in a specific district (if District -- Specific county (choice 1 thru 7)) was selected.

b.) Select the Analysis Area "By RDC"

Name: frmAreaRDC.FRM
Caption: Area – By RDC
General Information: Form activated when program user selects Analysis - Area - By RDC
Form Appearance:



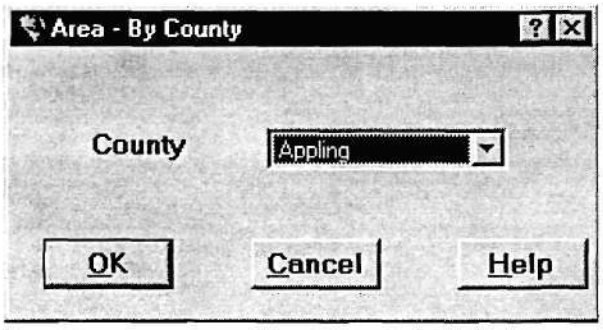
Content Summary:

Data:
➢ Data1: Connect to Access, City Reference ➢ Data2: Connect to Access, County Reference
Labels:
➢ Label1: RDC ➢ Label2: County ➢ Label3: City
ComboBox:
➢ Combo1: [Adjacent to Label1 (RDC)]
DBCombo:
➢ DBCombo1: County, Row Source: Data2 ➢ DBCombo2: City, Row Source: Data1
CommandButtons:
➢ Command1: OK ➢ Command2: Cancel ➢ Command3: Help
Subroutines (Private):
Name: Combo1_gotFocus *Declaration:* Private Sub Combo1_gotFocus() *Purpose:* Activated upon user selection of the "RDC" ComboBox in the form. The content of the county and city boxes are cleared and values assigned in the Form Load can be displayed upon user selection of the RDC "arow" key in the box.
Name: Command1_Click *Declaration:* Private Sub Command1_Click() *Purpose:* This form subroutine [Command1_Click()] is activated upon user selection of the "OK" button. It clears the values for all previous records, assigns a value of 3 for AreaType_G (indicating RDC analysis), or a value of 1 for AreaType_G (indicating city analysis), or a value of 0 for AreaType_G (indicating county analysis) and then assigns a value of True to mnuRDC.checked and a value of false to the other available area options (Select From Map, County, and District).
Name: Command2_Click *Declaration:* Private Sub Command2_Click() *Purpose:* This form subroutine [Command2_Click()] is activated upon user selection of the "Cancel" button. It hides the AreaRDC window.
Name: Command3_Click *Declaration:* Private Sub Command3_Click() *Purpose:* This form subroutine [Command3_Click()] is activated upon user selection of the "Help" button. It initiaties the HelpContext item 123 for information regarding the AreaRDC form.
Name: dbcombo2_GotFocus *Declaration:* Private Sub dbcombo2_GotFocus()

Purpose: The form subroutine [dbcombo2_GotFocus() is activated upon user selection of the "City" ComboBox. It will check to see what the program user selected in the RDC box and display the appropriate city list. For example, if the user selected ALL in the RDC box this routine will provide a list of all of the Georgia cities. If the user selected, say, "COAST GA" in the RDC box then selected a specific "COAST GA" county, only the cities located in that county in the "COAST GA" RDC will be displayed.
Name: Form_Load *Declaration:* Private Sub Form_Load() *Purpose:* The form subroutine [Form_Load()] is activated when the user selects RDC from the analysis area menu. Upon form activation, the Form_Load subroutine defines the data1 and the data2 database as "\county.mdb" in the source directory. This subroutine further defines the selection options in the RDC ComboBox to be "All" or the various RDC names with the "All" option as the default prompt.
Subroutines (Public):
Name: DBCombo1_GotFocus *Declaration:* Public Sub DBCombo1_GotFocus() *Purpose:* The form subroutine [DBCombo1_GotFocus] is activated upon user selection of the "County" ComboBox. It will either display all possible counties for selection (if RDC -- All option was selected), or it will display only the counties in a specific RDC (if RDC -- Specific RDC) was selected.

c.) Select the Analysis Area "By County"

Name: frmAreaCounty.FRM
Caption: Area – By County
General Information: Form activated when program user selects Analysis - Area - By County
Form Appearance:

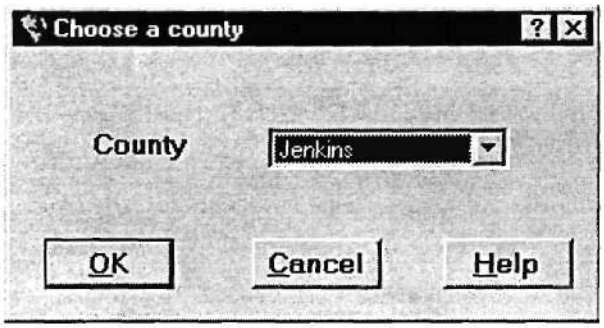


Content Summary:

Data:
➢ Data2: Connect to Access, County Reference
Labels:
➢ Label2: County
DBCombo:
➢ DBCombo1: County, Row Source: Data2
CommandButtons:
➢ Command1: OK ➢ Command2: Cancel ➢ Command3: Help
Subroutines (Private):
Name: Command1_Click() *Declaration:* Private Sub Command1_Click() *Purpose:* Activated upon user selection of the "OK" button. It clears the values for all previous records, assigns a value of 3 for AreaInputType_G (indicating county analysis), and then assigns a value of True to mnuCounty.checked and a value of false to the other available area options. This will cause a check to appear on the main menu area selection pulldown.
Name: Command2_Click() *Declaration:* Private Sub Command2_Click() *Purpose:* Activated upon user selection of the "Cancel" button. It hides the AreaCounty window.
Name: Command3_Click() *Declaration:* Private Sub Command3_Click() *Purpose:* Activated upon user selection of the "Help" button. It initiates the HelpContext item 124 for information regarding the AreaCounty form.
Name: DBCombo1_GotFocus *Declaration:* Private Sub DBCombo1_GotFocus() *Purpose:* Activated when the user selects the combo box arrow key for identifying the analysis county. The "COUNTY" recordsource is identified and referred to the "\county.mdb" file as identified upon form initialization in the Form_Load subroutine.
Name: Form_Load *Declaration:* Private Sub Form_Load() *Purpose:* Activated when the user selects county from the analysis area menu. Upon form activation, the Form_Load subroutine defines the data2 county database as "\county.mdb" in the source directory.

d.) Select the Analysis Area "Select from map"

Name: frmMapArea.FRM
Caption: Choose a county
General Information: Form activated when program user selects Analysis - Area - Select from Map
Form Appearance:



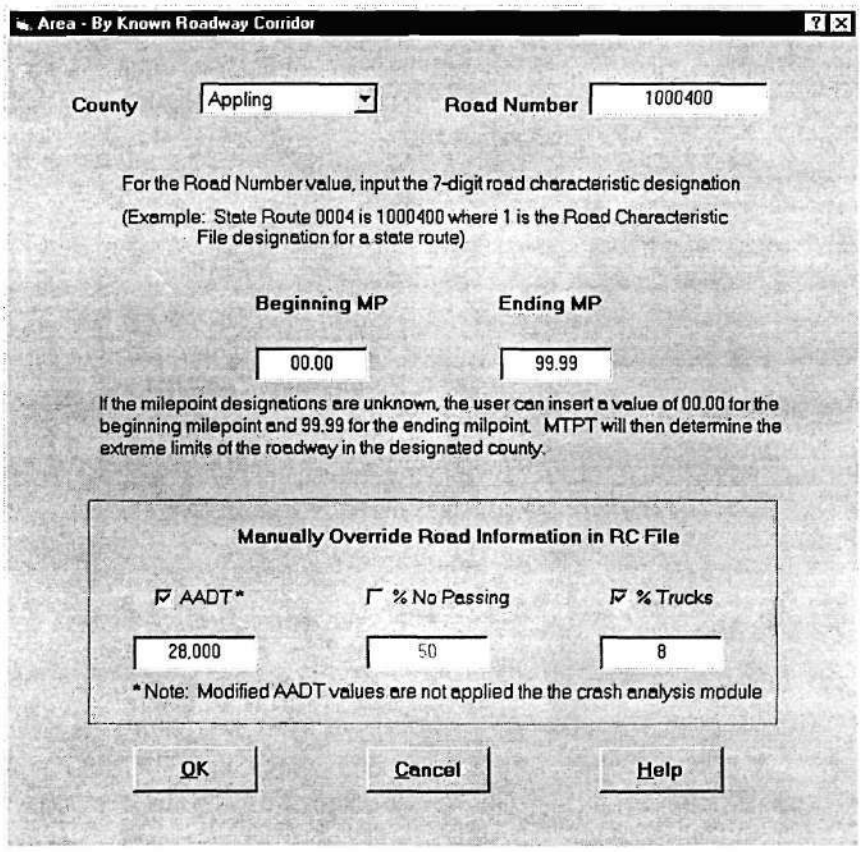
Content Summary:

Data:
➢ Data2: Connect to Access, County Reference
Labels:
➢ Label2: County
DBCombo:
➢ DBCombo1: County, Row Source: Data2
CommandButtons:
➢ Command1: OK ➢ Command2: Cancel ➢ Command3: Help
Subroutines (Private):
Name: Command1_Click *Declaration:* Private Sub Command1_Click() *Purpose:* This form subroutine [Command1_Click()] is activated upon user selection of the "OK" button. It clears the values for all previous records, identifies the database file to evaluate as "\\county.mdb", and assigns a value of 4 for AreaType_G (indicating Map Area analysis) and then assigns a value of True to mnuSelectFromMap.checked and a value of false to the other available area options (Select From RDC, County, and District).
Name: Command2_Click *Declaration:* Private Sub Command2_Click() *Purpose:* This form subroutine [Command2_Click()] is activated upon user selection of the "Cancel" button. It hides the MapArea window.
Name: Command3_Click

Declaration: Private Sub Command3_Click() *Purpose:* This form subroutine [Command3_Click()] is activated upon user selection of the "Help" button. It initiaties the HelpContext item 147 for information regarding the MapArea form.
Name: DBCombo1_GotFocus *Declaration:* Private Sub DBCombo1_GotFocus() *Purpose:* The form subroutine [DBCombo1_GotFocus] is activated upon user selection of the "County" ComboBox. It will display all possible counties for selection.
Name: Form_Load *Declaration:* Private Sub Form_Load() *Purpose:* The form subroutine [Form_Load()] is activated when the user selects "Select from map" from the analysis area menu. Upon form activation, the Form_Load subroutine defines the data2 database as "\county.mdb" in the source directory.

e.) Select the Analysis Area "By Known Road Corridor"

Name: frmAreaRoad.FRM
Caption: Area – By Known Roadway Corridor
General Information: Form activated when program user selects Analysis - Area - By Known Road Corridor
Form Appearance:



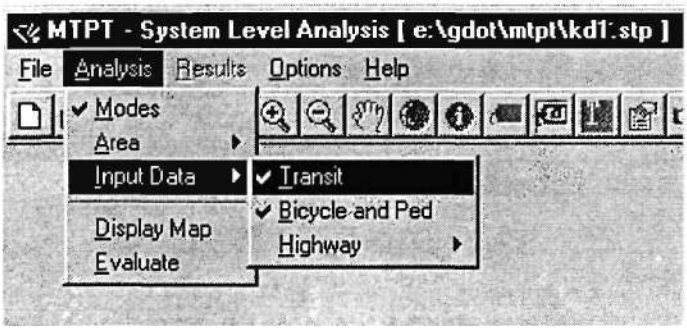
Content Summary:

Labels:
➢ Label1: County ➢ Label2: Road Number ➢ Label3: for the Road Number value, input the 7-digit road characteristic designation ➢ Label4: (Example: State ... route) ➢ Label5: Beginning MP ➢ Label6: Ending MP ➢ Label7: If the milepoint ... designated county ➢ Label8: Manually Override Road Information in RC file ➢ Label9: *Note: Modified . . . module
DBCombo:
➢ DBCombo1: County, Row Source: Data1
TextBox:
➢ Text1: <associated with Label2 (Road Number)> ➢ Text2: <associated with Label5 (Beginning MP)> ➢ Text3: <associated with Label6 (Ending MP)> ➢ TextAADT: <associated with Check1 (AADT*)> ➢ TextNoPass: <associated with Check2 (% No Passing)> ➢ TextTruck: <associated with Check3 (% Trucks)>
CommandButtons:
➢ Command1: OK ➢ Command2: Cancel ➢ Command3: Help
CheckBox:
➢ Check1: AADT* ➢ Check2: & No Passing ➢ Check3: & Trucks
Subroutines (Private):
Name: Check1_Click() *Declaration:* Private Sub Check1_Click() *Purpose:* If checked, this box will enable TextAADT textbox and permit the RC File AADT to be changed for specific road segment analysis.
Name: Check2_Click() *Declaration:* Private Sub Check2_Click() *Purpose:* If checked, this box will enable TextNoPass textbox and permit the program user to identify a specific percent no passing rather than using the program default value.
Name: Check3_Click() *Declaration:* Private Sub Check3_Click() *Purpose:* If checked, this box will enable TextTrucks textbox and permit the RC File percent trucks to be changed for specific road segment analysis.

Name: Command1_Click() *Declaration:* Private Sub Command1_Click() *Purpose:* Activated upon user selection of the "OK" button. It clears the values for all previous records, assigns the new user selected records, associates a value of 5 for AreaInputType_G (indicating road corridor), and then assigns a value of True to mnuRdCorridor.checked and a value of false to the other available area options. This will cause a check to appear on the main menu area selection pulldown.
Name: Command2_Click() *Declaration:* Private Sub Command2_Click() *Purpose:* Activated upon user selection of the "Cancel" button. It hides the AreaRoad window.
Name: Command3_Click() *Declaration:* Private Sub Command3_Click() *Purpose:* Activated upon user selection of the "Help" button. It initiates the HelpContext item 1138 for information regarding the AreaRoad form.
Name: DBCombo1_GotFocus *Declaration:* Private Sub DBCombo1_GotFocus() *Purpose:* Activated when the user selects the combo box arrow key for identifying the analysis county. The "COUNTY" recordsource is identified and referred to the "\county.mdb" file as identified upon form initialization in the Form_Load subroutine.
Name: Form_Load *Declaration:* Private Sub Form_Load() *Purpose:* Activated when the user selects county from the analysis area menu. Upon form activation, the Form_Load subroutine defines the data1 county database as "\county.mdb" in the source directory.

3. Analysis Input Data Identification

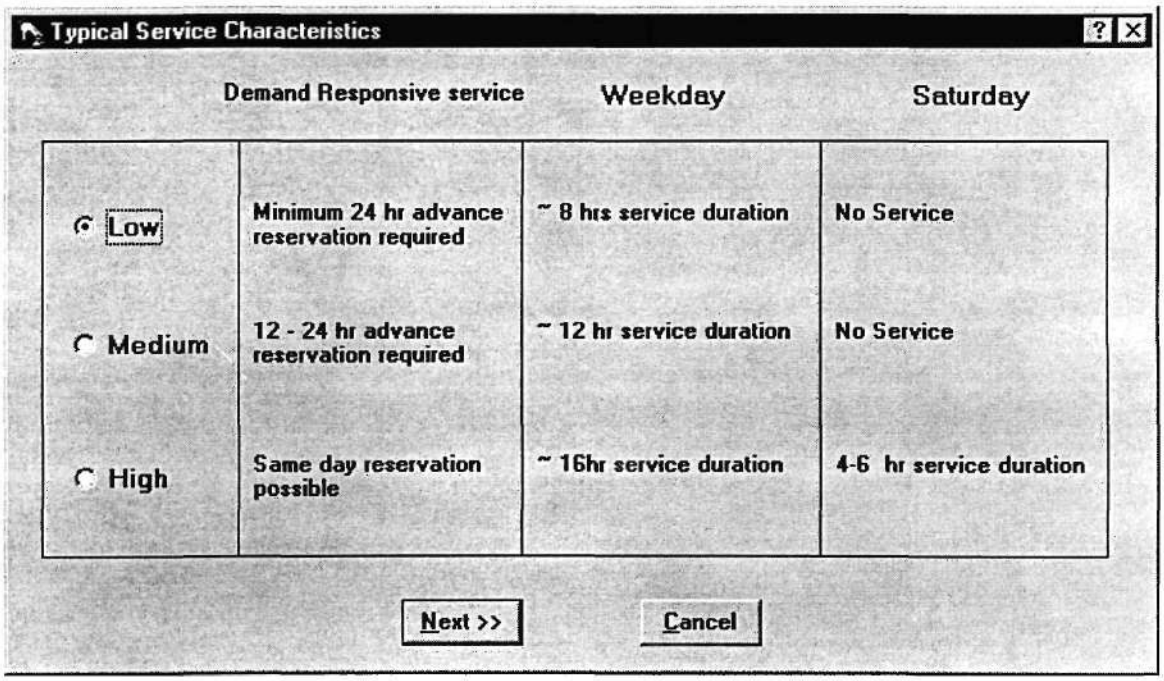
Upon completion of the analysis area selection stage where the program user selects one of five area options, the program user can next begin "Input Data Identification." The MTPT "Analysis -- Input Data" option in the menu displays three choices available to the program user. Only mode information that is required from the program user is required. If a program user selects a mode that does not display under the Input Data option, this does not mean the mode will not be evaluated but rather that no additional user input is required before analysis. This menu section item is depicted by the following graphic image.



Each of the input data item forms activated are described in detail in the following sections.

a.) Select the "Transit" Input Data

Name: frmTransitInput1.FRM
Caption: Typical Service Characteristics
General Information: Form activated when program user selects Analysis - Input Data - Transit
Form Appearance:



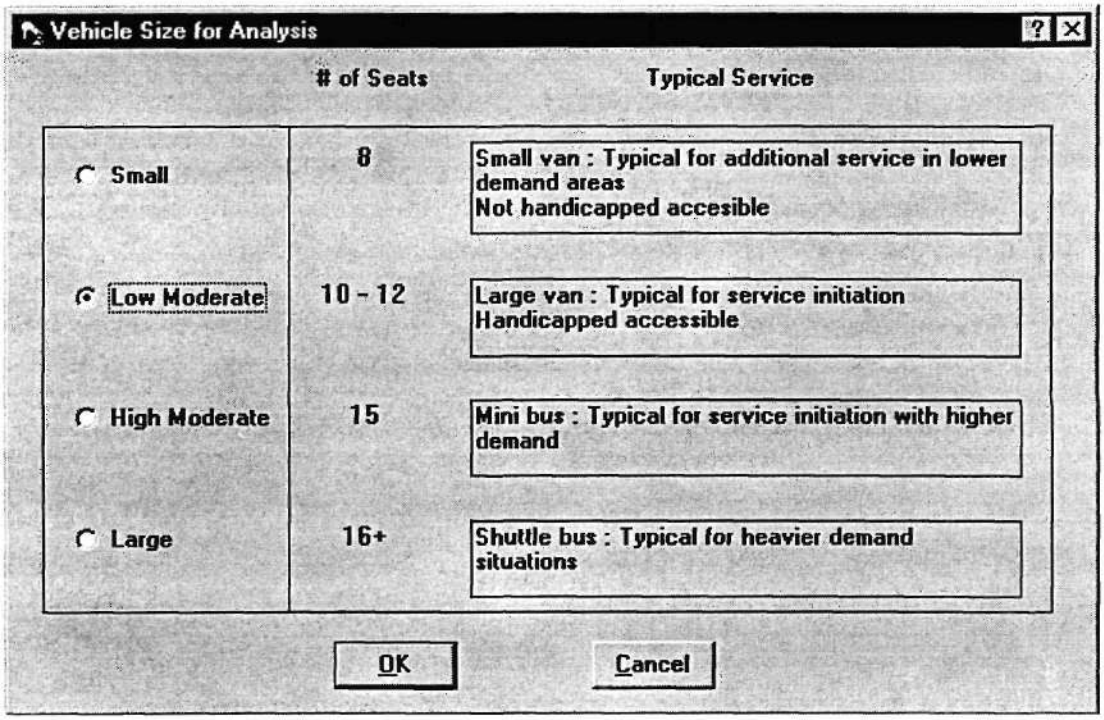
Content Summary:

Labels:
➢ Label1: Weekday ➢ Label2: Saturday
TextBox:
➢ Text1(0): ~8 hrs service duration ➢ Text1(1): Minimum 24 hr advance reservation required ➢ Text1(2): No Service [Saturday, Low] ➢ Text1(3): 12 – 24 hr advance reservation required ➢ Text1(4): Same day reservation possible ➢ Text1(5): Demand Responsive service ➢ Text1(6): 4-6 hr service duration ➢ Text1(7): ~16hr service duration ➢ Text1(9): No Service [Saturday, Medium] ➢ Text1(10): ~12 hr service duration
OptionButton:
➢ Option1: Low (Frame1) ➢ Option2: Medium (Frame1) ➢ Option3: High (Frame1)
CommandButton:
➢ Command1: Next>> ➢ Command2: Cancel
Subroutines (Private):
Name: Command1_Click *Declaration:* Private Sub Command1_Click() *Purpose:* Activated upon user selection of the "Next>>" button. Assigns a value of "L, M, or H" for either Low, Medium, or High service characteristics to the transit service and then activates fromTransitInput2.
Name: Command2_Click *Declaration:* Private Sub Command2_Click() *Purpose:* Activated upon user selection of the "Cancel" button. When selected, the form is then closed.
Name: Form_Load *Declaration:* Private Sub Form_Load() *Purpose:* Activated upon user selection of the Transit analysis mode in the main MTPT form. It resets the values for the Option1 and Command1.
Name: Form_QueryUnload *Declaration:* Private Sub Form_QueryUnload(Cancel As Integer, UnloadMode As Integer) *Purpose:* Occurs before the TransitInput1 form can be closed. If the Cancel Integer is not equal to zero, this event will terminate. The routine also calls the Command2_Click subroutine that is executed when a user selects the "Cancel" button.
Name: Option1_Click *Declaration:* Private Sub Option1_Click()

Purpose: Occurs upon user selection of the first available option buttons (low). A value of "True" is returned indicating selection is complete.
Name: Option2_Click *Declaration:* Private Sub Option2_Click() *Purpose:* Occurs upon user selection of the second available option buttons (medium). A value of "True" is returned indicating selection is complete.
Name: Option3_Click *Declaration:* Private Sub Option3_Click() *Purpose:* Occurs upon user selection of the third available option buttons (high). A value of "True" is returned indicating selection is complete.

b.) Select the "Transit Next>>" Button from the First Transit Form

Name: frmTransitInput2.FRM
Caption: Vehicle Size for Analysis
General Information: Form activated when program user selects the "Next>>" button on frmTransitInput1
Form Appearance:



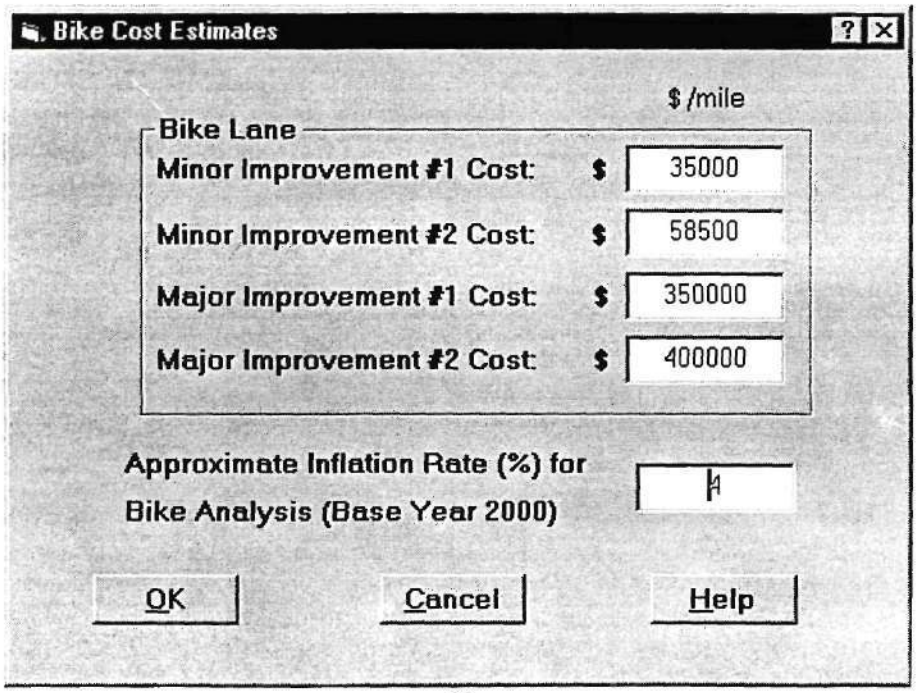
Content Summary:

Labels:
➢ Label1: # of Seats ➢ Label2: Typical Service ➢ Label3: 8 ➢ Label4: 10 – 12 ➢ Label5: 15 ➢ Label6: 16+
OptionButton:
➢ Option1: Small (Frame1) ➢ Option2: Low Moderate (Frame1) ➢ Option3: High Moderate (Frame1) ➢ Option4: Large (Frame1)
TextBox:
➢ Text1: Small van : Typical for additional service in lower demand areas. Not handicapped accessible ➢ Text2: Large van : Typical for service initiation. Handicapped accessible ➢ Text3: Mini bus : Typical for service initiation with higher demand ➢ Text4: Shuttle bus : Typical for heavier demand situations
CommandButton:
➢ Command1: OK ➢ Command2: Cancel
Subroutines (Private):
Name: Command1_Click *Declaration:* Private Sub Command1_Click() *Purpose:* Activated upon user selection of the "OK" button. The subroutine assigns a value of "S, M, H, or L" for either Small, Low Moderate, High Moderate, or Large Vehicle Size for transit analysis information. The subroutine next checks to see if any other transportation modes were selected by the user for analysis.
Name: Command2_Click *Declaration:* Private Sub Command2_Click() *Purpose:* Activated upon user selection of the "Cancel" button. When selected, the form is then closed.
Name: Form_Load *Declaration:* Private Sub Form_Load() *Purpose:* Activated upon user selection of the Next button on the first Transit analysis input form. It resets the values for the Option1 and Command1.
Name: Form_QueryUnload *Declaration:* Private Sub Form_QueryUnload(Cancel As Integer, UnloadMode As Integer) *Purpose:* Occurs before the TransitInput2 form can be closed. If the Cancel Integer is not equal to zero, this event will terminate. The routine also calls the Command2_Click subroutine that is executed when a user selects the "Cancel" button.

Name: Option1_Click *Declaration:* Private Sub Option1_Click() *Purpose:* Occurs upon user selection of the first available option button (Small vehicle size). A value of "True" is returned indicating selection is complete.
Name: Option2_Click *Declaration:* Private Sub Option2_Click() *Purpose:* Occurs upon user selection of the second available option button (Low Moderate vehicle size). A value of "True" is returned indicating selection is complete.
Name: Option3_Click *Declaration:* Private Sub Option3_Click() *Purpose:* Occurs upon user selection of the third available option button (High Moderate vehicle size). A value of "True" is returned indicating selection is complete.
Name: Option4_Click *Declaration:* Private Sub Option4_Click() *Purpose:* Occurs upon user selection of the fourth available option button (Large vehicle size). A value of "True" is returned indicating selection is complete.

c.) Select the "Bicycle and Ped" Input Data

Name: frmCostBike.FRM
Caption: Bike Cost Estimate Analysis Defaults
General Information: Form Activated when program user selects Analysis - Input Data - Bicycle and Ped
Form Appearance:

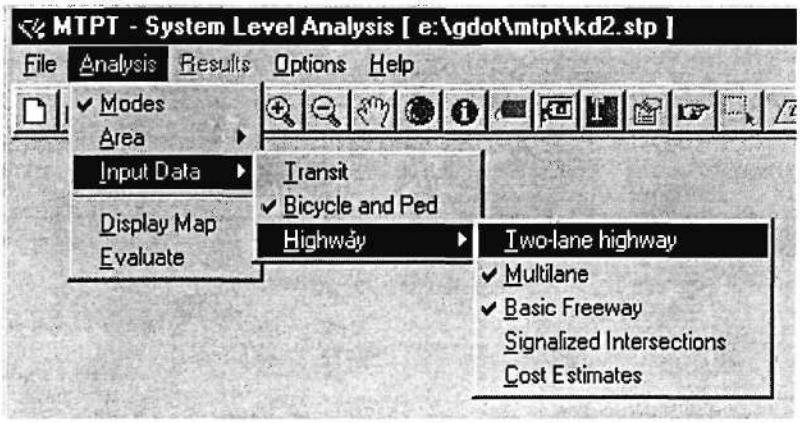


Content Summary:

Labels:
➢ Label1: Bike Analysis (Base Year 2000) ➢ Label7: Approximate Inflation Rate (%) for: ➢ Label8: Minor Improvement #1 Cost (bike lane) ➢ Label9: Minor Improvement #2 Cost (bike lane) ➢ Label10: Major Improvement #1 Cost (bike lane) ➢ Label11: Major Improvement #2 Cost (bike lane) ➢ Label12: $/mile
TextBox:
➢ bikeMinor1 <associated with Label8 (Minor #1)> ➢ bikeMinor2 <associated with Label9 (Minor #2)> ➢ bikeMajor1 <associated with Label10 (Major #1)> ➢ bikeMajor2 <associated with Label11 (Major #2)> ➢ GRateBike <associated with Label7 (Inflation Rate)>
CommandButtons:
➢ Command1: OK ➢ Command2: Cancel ➢ Command3: Help
Subroutines (Private):
Name: Command1_Click() *Declaration:* Private Sub Command1_Click() *Purpose:* Activated upon user selection of the "OK" button. It modifies the bike cost estimate unit costs per user selection, and then assigns a value of True to mnuBike.checked. This will cause a check to appear on the pull down menu for the main window.
Name: Command2_Click() *Declaration:* Private Sub Command2_Click() *Purpose:* Activated upon user selection of the "Cancel" button. It hides the CostBike window.
Name: Command3_Click() *Declaration:* Private Sub Command3_Click() *Purpose:* Activated upon user selection of the "Help" button. It initiates the HelpContext item 1139 for information regarding the CostBike form.
Name: Form_Load *Declaration:* Private Sub Form_Load() *Purpose:* Activated when the user selects Bicycle and Ped Input Data option. Upon form activation, the Form_Load subroutine populates the cost estimate form with default values for costs.

d.) Select the "Highway" Input Data Option

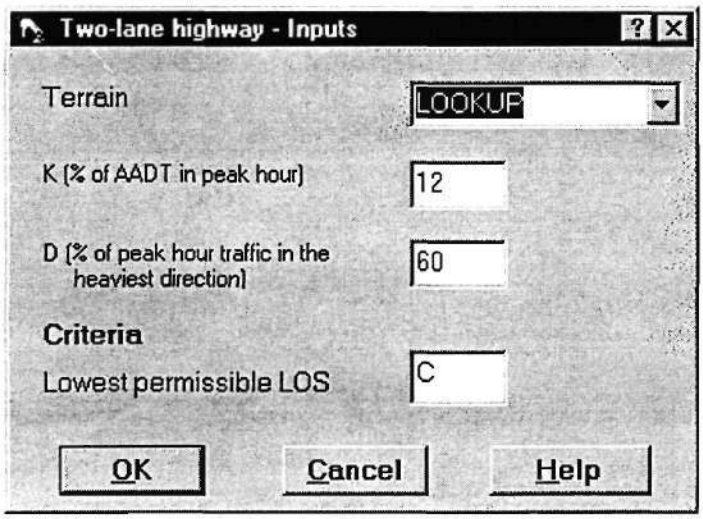
Upon selection of the "Highway" input data option, a sub-menu will appear that will have all selected highway modes that require additional input enabled. This menu item is depicted in the following graphic:



The five highway input options are described in further detail in the following descriptive section.

i.) Two-lane highway Input Option

Name: frmTwoInput.FRM
Caption: Two lane highways - Inputs
General Information: Form activated when program user selects Analysis - Input Data - Highway - Two-lane highway
Form Appearance:



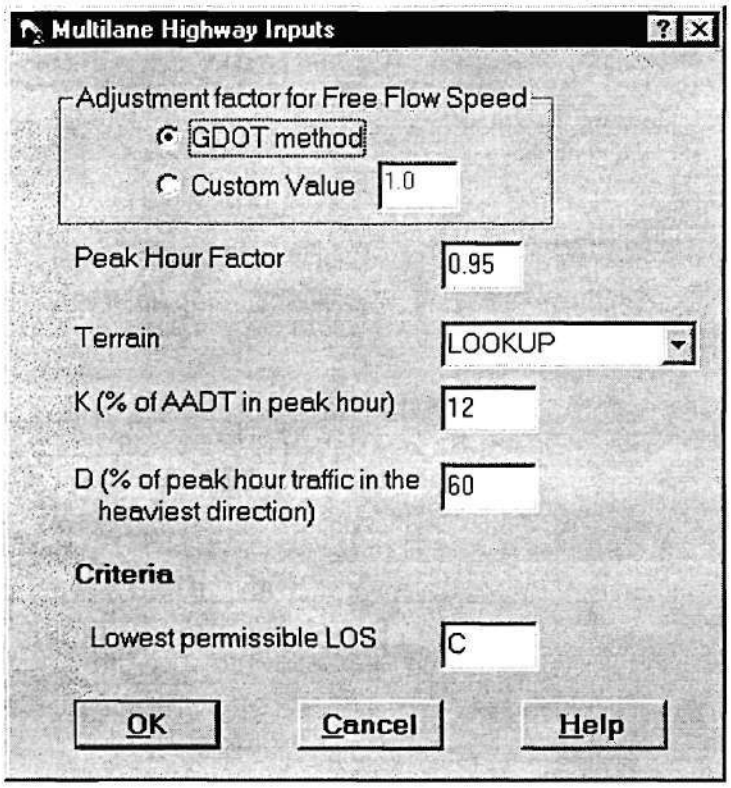
Content Summary:

Labels:
➢ Label2: Terrain ➢ Label3: K (% of AADT in peak hour) ➢ Label4: D(% of peak hour traffic in the heaviest direction) ➢ Label5: Lowest permissible LOS ➢ Label6: Criteria
ComboBox:
➢ Combo1: LOOKUP
TextBox:
➢ Text2: 12 ➢ Text3: L (Not Visible -- Hidden) ➢ Text4: 60 ➢ Text5: C
CommandButtons:
➢ Command1: OK ➢ Command2: Cancel ➢ Command3: Help
Subroutines (Private):
Name: Command1_Click *Declaration:* Private Sub Command1_Click() *Purpose:* Activated upon user selection of the "OK" button. If terrain type selected by the user is "Lookup", then Text3.Text is assigned to be frm.terrain_lookup. It then checks to verify if the value assigned to Text3.Text is "X". The routine then checks to see if any other transportation modes require input information.
Name: Command2_Click *Declaration:* Private Sub Command2_Click() *Purpose:* Activated upon user selection of the "Cancel" button. It resets the default values for the TwoInput form and then exits the form.
Name: Command3_Click *Declaration:* Private Sub Command3_Click() *Purpose:* Activated upon user selection of the "Help" button. It initiaties the HelpContext item 127 for information regarding the TwoInput form.
Name: Form_Load *Declaration:* Private Form_Load() *Purpose:* This form subroutine [Form_Load()] is activated upon user selection of the Two Lane Highway analysis mode in the main MTPT form. It fills the selection options in the Terrain ComboBox table and also identifies the default value of "C" in the "Lowest permissible LOS" TextBox.
Name: Text1_Change *Declaration:* Private Sub Text1_Change()

Purpose: This form subroutine [Text1_Change()] assigns a value of 50 to Text1.Text if it is greater than 100 or less than 0. This is a "hold-over" from MTPT Version 1.0 and is currently not used.
Subroutines (Public):
Name: Combo1_LostFocus *Declaration:* Public Sub Combo1_LostFocus() *Purpose:* This form subroutine [Combo1_LostFocus()] assigns the available selection options for the "Terrain" ComboBox to Text3.Text. The default value assigned to "Terrain" is "LOOKUP" with a value of "X" for Text3.Text.

ii.) Multilane highway Input Option

Name: frmMultiInput.FRM
Caption: Multilane Highway Inputs
General Information: Form activated when program user selects Analysis - Input Data - Highway - Multilane
Form Appearance:



Content Summary:

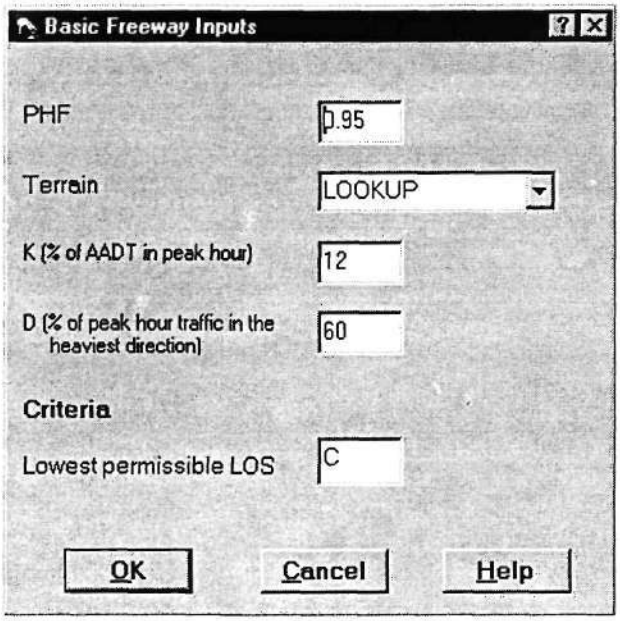
Frame:
➢ Frame1: Adjustment factor for Free Flow Speed
OptionButton:
➢ Option1: GDOT method ➢ Option2: Custom Value
TextBox:
➢ Text1: 1.0 ➢ Text2: 0.95 ➢ Text3: L [associated with Combo1 (Terrain) -- not visible] ➢ Text4: 60 ➢ Text5: C ➢ Text6: 12
Labels:
➢ Label2: Peak Hour Factor ➢ Label3: Terrain ➢ Label4: D (% of peak hour traffic in the heaviest direction) ➢ Label5: Lowest permissible LOS ➢ Label6: Criteria: ➢ Label7: K (% of AADT in peak hour)
CommandButtons:
➢ Command1: OK ➢ Command2: Cancel ➢ Command3: Help
ComboBox:
➢ Combo1: LOOKUP
Subroutines (Private):
Name: Command1_Click *Declaration:* Private Sub Command1_Click() *Purpose:* Activated upon user selection of the "OK" button. If terrain type selected by the user is "Lookup", then Text3.Text is assigned to be frmMain.terrain_lookup. It then checks to verify if the value assigned to Text3.Text is "X". The routine then checks to see if any other transportation modes require input information.
Name: Command2_Click *Declaration:* Private Sub Command2_Click() *Purpose:* Activated upon user selection of the "Cancel" button. It resets the default values for the MultiInput form and then exits the form.
Name: Command3_Click *Declaration:* Private Sub Command3_Click() *Purpose:* Activated upon user selection of the "Help" button. It initiates the HelpContext item 128 for information regarding the MultiInput form.
Name: Form_Load *Declaration:* Private Sub Form_Load()

Purpose: Activated upon user selection of the Multilane Highway analysis mode in the main MTPT form. It fills the selection options in the Terrain ComboBox table and also identifies the prompt custom value for the Adjustment factor for Free Flow Speed (1.0) and the prompt/default value for the Peak Hour Factor.
Name: Option1_Click *Declaration:* Private Sub Option1_Click() *Purpose:* Activated upon user selection of the Adjustment factor for Free Flow Speed GDOT method.
Name: Option2_Click *Declaration:* Private Sub Option2_Click() *Purpose:* Activated upon user selection of the Adjustment factor for Free Flow Speed Custom value option.
Name: Text2_Change *Declaration:* Private Sub Text2_Change() *Purpose:* Activated when the user attempts to modify the Peak Hour Factor. This routine checks to be sure the identified Peak Hour Factor is less than one and greater than zero. If it falls outside of these ranges, then the program defaults to a value of 0.95.
Subroutines (Public):
Name: Combo1_LostFocus *Declaration:* Public Sub Combo1_LostFocus() *Purpose:* Assigns the available selection options for the "Terrain" ComboBox to Text3.Text. The default value assigned to "Terrain" is "LOOKUP" with a value of "X" for Text3.Text.

iii.) Basic Freeway Input Option

Name: frmFreeInput.FRM
Caption: Basic Freeway Inputs
General Information: Form activated when program user selects Analysis - Input Data - Highway - Basic Freeway

Form Appearance:



Content Summary:

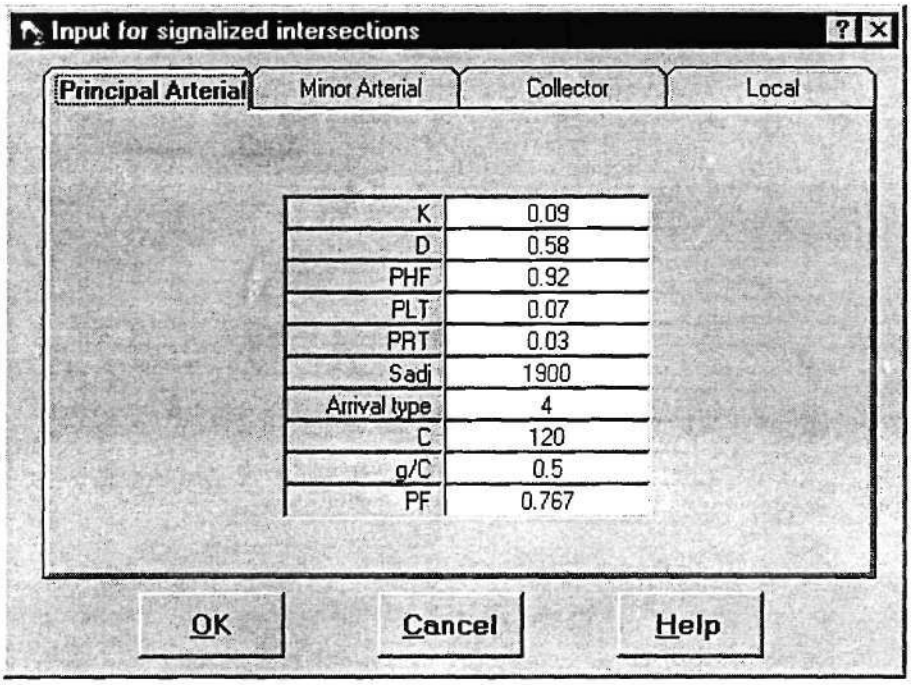
Labels:
➢ Label1: PHF ➢ Label2: Terrain ➢ Label3: Dir1 ➢ Label4: Dir2 (not visible) ➢ Label5: Lowest permissible LOS ➢ Label6: Criteria ➢ Label7: D (% of peak hour traffic in the heaviest direction) ➢ Label8: K (% of AADT in peak hour)
TextBox:
➢ Text1: 0.95 (associated with Label 3) ➢ Text2: 0.95 (associated with Label 4 -- not currently visible) ➢ Text3: L (associated with the terrain ComboBox -- not visible) ➢ Text4: 60 ➢ Text5: C ➢ Text6: 12
ComboBox:
➢ Combo1: LOOKUP
CommandButtons:
➢ Command1: OK ➢ Command2: Cancel ➢ Command3: Help
Subroutines (Private):
Name: Command1_Click

Declaration: Private Sub Command1_Click() *Purpose:* Activated upon user selection of the "OK" button. If terrain type selected by the user is "Lookup", then Text3.Text is assigned to be frmMain.terrain_lookup. It then checks to verify if the value assigned to Text3.Text is "X". The routine then checks to see if any other transportation modes require input information.
Name: Command2_Click *Declaration:* Private Sub Command2_Click() *Purpose:* Activated upon user selection of the "Cancel" button. It resets the default values for the FreeInput form and then exits the form.
Name: Command3_Click *Declaration:* Private Sub Command3_Click() *Purpose:* Activated upon user selection of the "Help" button. It initiates the HelpContext item 129 for information regarding the FreeInput form.
Name: Form_Load *Declaration:* Private Sub Form_Load() *Purpose:* Activated upon user selection of the Freeway Highway analysis mode in the main MTPT form. It fills the selection options in the Terrain ComboBox table and also identifies the prompt custom value for the Peak Hour Factor (0.95) for each direction.
Name: Form_Paint *Declaration:* Private Sub Form_Paint() *Purpose:* This form subroutine [Form_Paint()] is activated upon user whenever the FreeInput form is refreshed or resized.
Name: Text1_Change *Declaration:* Private Sub Text1_Change() *Purpose:* Activated when the user attempts to modify the Peak Hour Factor. This routine checks to be sure the identified Peak Hour Factor is less than one and greater than zero. If it falls outside of these ranges, then the program defaults to a value of 0.95.
Subroutines (Public):
Name: Combo1_LostFocus *Declaration:* Public Sub Combo1_LostFocus() *Purpose:* Assigns the available selection options for the "Terrain" ComboBox to Text3.Text. The default value assigned to "Terrain" is "LOOKUP" with a value of "X" for Text3.Text.

iv.) Signalized Intersections Input Option

Name: frmInterInput.FRM
Caption: Input for signalized intersections
General Information: Form activated when program user selects analysis - Input Data - Highway - Signalized Intersections

Form Appearance:



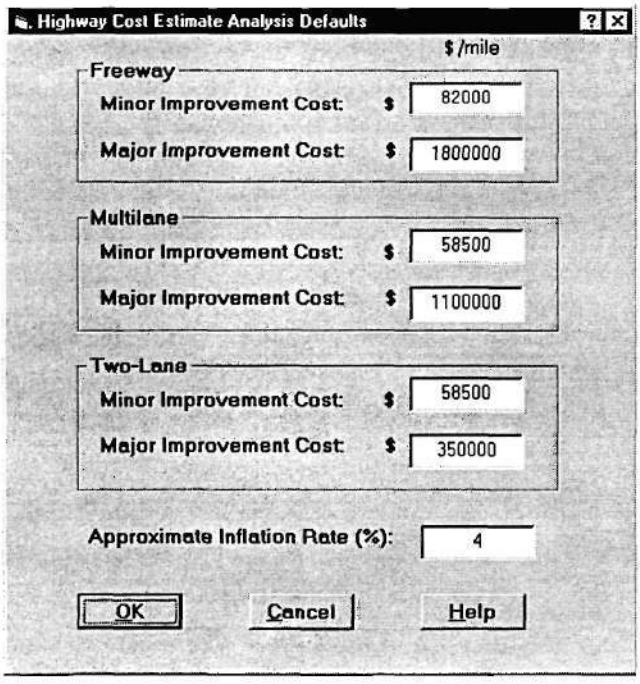
Content Summary:

CommandButton:
➢ Command1: OK ➢ Command2: Cancel ➢ Command3: Help
TabCaptions:
➢ TabCaption(0): Principal Arterial ➢ TabCaption(1): Minor Arterial ➢ TabCaption(2): Collector ➢ TabCaption(3): Local
TextBox:
➢ Text1(0) thru Text1(39): Matrix Grid with Index 0 in upper left corner and Index 39 in lower right ➢ Text2(0): K [Also Index 11, 22, 33] ➢ Text2(1): D [Also Index 12, 23, 34] ➢ Text2(2): PHF [Also Index 13, 24, 35] ➢ Text2(3): PLT [Also Index 14, 25, 36] ➢ Text2(4): PRT [Also Index 15, 26, 37] ➢ Text2(5): Sadj [Also Index 16, 27, 38] ➢ Text2(7): Arrival type [Also Index 18, 29, 40] ➢ Text2(8): C [Also Index 19, 30, 41] ➢ Text2(9): g/C [Also Index 20, 31, 42] ➢ Text2(10): PF [Also Index 21, 32, 43]

Subroutines (Private):
Name: Command1_Click *Declaration:* Private Sub Command1_Click() *Purpose:* Activated upon user selection of the "OK" button. The subroutine checks to see if any other transportation modes were selected by the user for analysis and assigns the defaults selected in the intersection form.
Name: Command2_Click *Declaration:* Private Sub Command2_Click() *Purpose:* Activated upon user selection of the "Cancel" button. When selected, the form closes.
Name: Command3_Click *Declaration:* Private Sub Command3_Click() *Purpose:* Activated upon user selection of the "Help" button. It initiates the HelpContext item 130 for information regarding the InterInput form.
Name: Form_Load *Declaration:* Private Sub Form_Load() *Purpose:* Activated upon user selection of the Intersection Highway analysis mode in the main MTPT form. Previously, this code read inter.dat (an external file) and then filled the table. Currently, this feature has been inactivated and the form has values assigned and modified directly.

v.) Highway Cost Estimate Analysis Defaults

Name: frmCostInput.FRM
Caption: Highway Cost Estimate Analysis Defaults
General Information: Form activated when program user selects Analysis - Input Data - Highway - Cost Estimates
Form Appearance:



Content Summary:

Labels:
➢ Label1: Minor Improvement Cost (freeway) ➢ Label2: Major Improvement Cost (freeway) ➢ Label3: Minor Improvement Cost (multilane) ➢ Label4: Major Improvement Cost (multilane) ➢ Label5: Minor Improvement Cost (two-lane) ➢ Label6: Major Improvement Cost (two-lane) ➢ Label7: Approximate Inflation Rate (%): ➢ Label12: $/mile
TextBox:
➢ fwyMinor <associated with Label1> ➢ fwyMajor <associated with Label2> ➢ multiMinor <associated with Label3> ➢ multiMajor <associated with Label4> ➢ twoMinor <associated with Label5> ➢ twoMajor <associated with Label6> ➢ Grate <associated with Label7>
CommandButtons:
➢ Command1: OK ➢ Command2: Cancel ➢ Command3: Help
Subroutines (Private):
Name: Command1_Click() *Declaration:* Private Sub Command1_Click() *Purpose:* Activated upon user selection of the "OK" button. It modifies the cost estimate unit costs per user selection, and then assigns a value of True to mnuCost.checked. This will cause a check to appear on the pull down menu for the main window.
Name: Command2_Click() *Declaration:* Private Sub Command2_Click() *Purpose:* Activated upon user selection of the "Cancel" button. It hides the CostInput window.
Name: Command3_Click() *Declaration:* Private Sub Command3_Click() *Purpose:* Activated upon user selection of the "Help" button. It initiates the HelpContext item 1139 for information regarding the AreaCounty form.
Name: Form_Load *Declaration:* Private Sub Form_Load() *Purpose:* Activated when the user selects cost estimate analysis from the highway mode menu. Upon form activation, the Form_Load subroutine populates the cost estimate form with default values for costs.

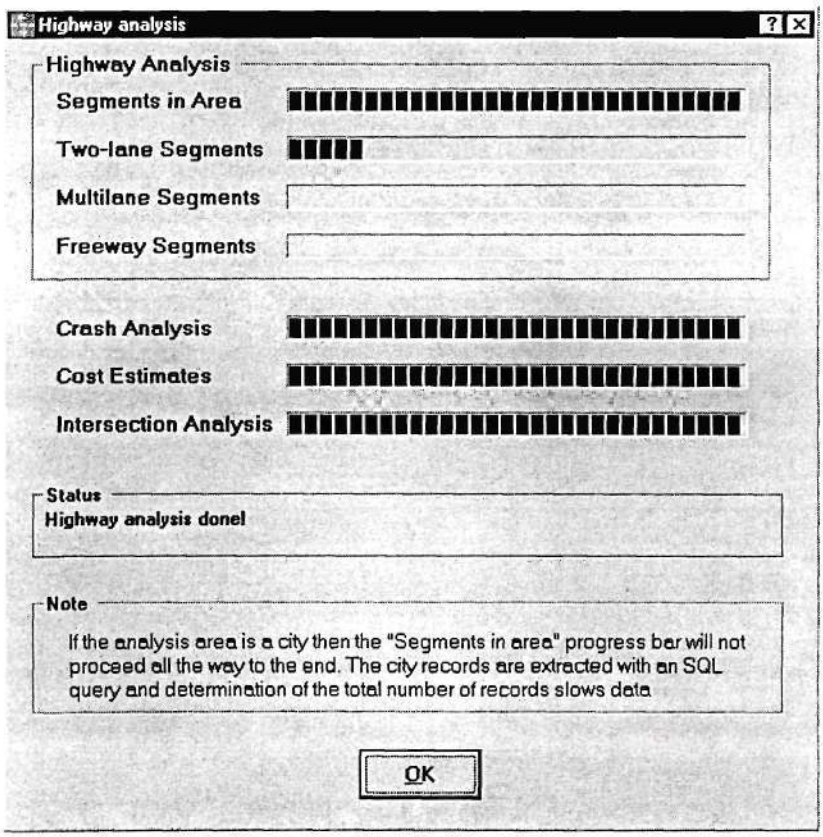
4. Display Map

The program user may elect to display the road map associated with the selected area. The Display Map option will permit the program user to turn on and off the map. If the analysis elects to change the area selected, they must turn off the old map before the new map can be displayed. This menu item activates a subroutine called mnuMap (from frmMain form). Section G of this report discusses the "Main Form" commands.

5. Evaluate

To perform the analysis evaluation, the program executes mnuEval (from frmMain form). If any highway options were selected for analysis, the Highway form is then initiated to display progress.

Name: frmHighway.FRM
Caption: Highway analysis
General Information: Form activated when the program user selects Analysis – Evaluate from the MTPT menu
Form Appearance:



Content Summary:

CommandButton:
➢ Command1: OK
Labels:
➢ LblIntersection: Intersection analysis ➢ LblSegments: Segments in area ➢ LblTwoFound: Two-lane segments ➢ LblMultiFound: Multilane segments ➢ LblFreeFound: Freeway segments ➢ Label1: If the analysis … total number. ➢ Label2: [area located below the Status label – empty]
ProgressBar:
➢ PgbIntersection: [associated with lblIntersection] ➢ PgbSegments: [associated with lblSegments] ➢ PgbTwoFound: [associated with lblTwoFound] ➢ PgbMultiFound: [associated with lblMultiFound] ➢ PgbFreeFound: [associated with lblFreeFound]
Functions (Private):
Name: AnalyzeSegment *Declaration:* Private Function AnalyzeSegment(RC1 As RCdata) *Purpose:* Activated by the Form_Activate subroutine. This function counts the number of lanes to the left and right, adds them, and then determines if they are two lane, multi lane, or freeway sections.
Name: BikeTest *Declaration:* Private Function BikeTest(ByRef cond() As Integer, ByVal RC1 As RCdata, ByVal RC2 As RCdata, ByRef BikeRes, ByRef BikeTable As Recordset) *Purpose:* Activated by the TwoLaneAnalysis subroutine. It checks to see if any rural designation 2-lane roads are on the state bike plan, and if so, executes the BikePed function to evaluate suitability.
Name: BikePed *Declaration:* Private Function BikePed(ByRef cond() As Integer, ByVal RC1 As Rcdata, ByRef BikeRes, ByRef BikeTable As Recordset) *Purpose:* Activated by the TwoLane & MultiLane Analysis subroutines as well as the single lane filter analysis. It checks to see if any rural designation roads are on the state bike plan, and if so, whether the roads meet bike standards and what improvements are required to achieve these standards.
Name: CalculateFFS *Declaration:* Private Function CalculateFFS(ByVal SpeedLimit As Integer, ByVal MultiTerrain As Integer, ByVal Population As Long, City As Integer) *Purpose:* Applies the multi-lane highway algorithm to estimate the free flow speed based on site conditions.
Name: CostTest *Declaration:* Private Function CostTest()

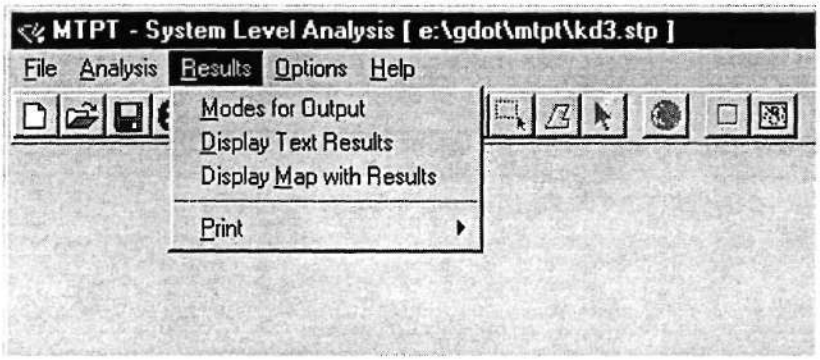
Purpose: Activated in the analysis section to evaluate the CostRes file created during TwoLane, Multilane, & Freeway Analysis subroutines. The function generates an interim files (costtwo.res, costmulti.res, and costfwy.res) that collapses similar records for a specific highway analysis mode and assigns costs to the improvements.
Name: CrashTest *Declaration:* Private Function CrashTest() *Purpose:* Activated in the analysis section to evaluate the CrashRes file created during TwoLane, Multilane, & Freeway Analysis subroutines. It checks to see what the 1997 crash rate was for a given road section (2 miles long approx.) and then compares the crash rate for all crashes as well as for fatal crashes to the Georgia statewide average for that specific functional classification. The function then generates an interim file (crash1.res) that summarizes observed road sections that exceed statewide crash averages.
Name: FreeGetFLC *Declaration:* Private Function FreeGetFLC(ByVal RShldWidth As Integer, ByVal NumLanes As Integer) *Purpose:* Determines the reduction of the free flow speed for freeways as a result of constrained right shoulder widths. This function is called from the FreewayAnalysis subroutine.
Name: FreeGetFLW *Declaration:* Private Function FreeGetFLW(ByVal LaneWidth As Integer) *Purpose:* Determines the reduction of the free flow speed for freeways as a result of constrained lane widths. This function is called from the FreewayAnalysis subroutine.
Name: FreeGetFN *Declaration:* Private Function FreeGetFN(ByVal NumLanes As Integer, ByVal FunctionalClass As Integer) *Purpose:* Determines the reduction of the free flow speed for freeways as a result of constrained lane widths. This function is called from the FreewayAnalysis subroutine.
Name: FreeGetLOS *Declaration:* Private Function FreeGetLOS(ByVal DesignVol As Integer, ByVal FreeSpeed As Integer) *Purpose:* Evaluates a freeway section based on the identified freeflow speed and traffic volume and assigns a level of service to that roadway segment. This function is then activated within the FreewayAnalysis subroutine.
Name: GrowthFactor *Declaration:* Private Function GrowthFactor(ByVal i As Integer, ByVal FuncClass As Integer, ByVal District As Integer) *Purpose:* Determines 10 and 20 year projected growth factors based on functional classification, GDOT District, and historic trends. This function is activated by the FreewayAnalysis, MultiAnalysis, TwolaneAnalysis subroutines and the TmpInterAnalysis function.
Name: MultiGetLOS *Declaration:* Private Function MultiGetLOS(ByVal DesignVol As Integer,

ByVal FreeSpeed As Integer) *Purpose:* Assigns a LOS to a multilane highway section based on estimated free flow speed and traffic volume. This function is then called by the MultiLaneAnalysis subroutine.
Name: Priority *Declaration:* Private Function Priority(ByVal bpr As String, ByVal FuncClass As Integer, ByVal eou As String, ByRef Points As Integer) *Purpose:* Ranks improvement needs. This function is called by the TwolaneAnalysis, FreewayAnalysis, and MultilaneAnalysis subroutines.
Name: TmpInterAnalysis *Declaration:* Private Function TmpInterAnalysis(ByRef asumtable() As Double) *Purpose:* Computes numerous signalized intersection defaults and characteristics. Upon determining approximate traffic volumes, turning volumes, peak hour factors, and delay the function estimates the intersection level of service. This function is then called by Form_Activate.
Name: TwoFhv *Declaration:* Private Function TwoFhv(ByVal i As Integer, ByVal TwoTerrain As Integer, ByVal Pt As Double, EtArray() As Double) *Purpose:* Estimates the heavy vehicle factor for use in the HCM two-lane highway LOS analysis. This function is the called by the TwoLaneAnalysis subroutine.
Name: TwoFw *Declaration:* Private Function TwoFw(ByVal i As Integer, ByVal LaneWidth As Integer, ByVal ShldWidth As Integer, FwArray() As Double) *Purpose:* Uses the FwArray created from the text file Twolane2.dat to simulate Table 8-5 of the HCM for lane and shoulder width adjustment factors. This function is called by TwoLaneAnalysis.
Name: TwoSaturate *Declaration:* Private Function TwoSaturate(ByVal I As Integer, ByVal TwoTerrain As Integer, ByVal NoPass As Double, vbycArray() As Double) *Purpose:* Uses the estimated percent no-passing and terrain type in an effort to estimate reasonable values for a two-lane highway volume to capacity ratio. This lookup table is the vbycArray initiated by Twolane3.dat and is based on Table 8-1 of the HCM. This function is called by TwolaneAnalysis for establishing acceptable v/c for a given LOS.
Name: WithBP *Declaration:* Private Function WithBP(RC1 As Rcdata) *Purpose:* Evaluates bike and pedestrian conditions for the MultiAnalysis and TwoLaneAnalysis modules for highway analysis only. (Note: The BikePed function is used exclusively for the bike/ped analysis option.)
Subroutines (Private):
Name: Command1_Click *Declaration:* Private Sub Command1_Click() *Purpose:* Activated when the user selects the "OK" button. Upon button selection, the form closes.

Name: Form_Activate *Declaration:* Private Sub Form_Activate() *Purpose:* Activates the highway analysis form. First, the subroutine identifies several variables for highway analysis. Next, the subroutine checks to see which modes were selected for analysis. Finally, the program will analyze the highway modes as well as bicycle and ped.
Name: Form_KeyPress *Declaration:* Private Sub Form_KeyPress(KeyAscii As Integer) *Purpose:* Unloads the Highway form if the user selects the Escape key (Key 27).
Name: FreewayAnalysis *Declaration:* Private Sub FreewayAnalysis(ByRef RC1 As RCdata, ByRef RC2 As Rcdata, ByVal k As Double, ByVal d As Double, ByVal phf As Double, ByVal FreeTerrain As Integer, ByVal LOSTresh As String, ByRef FreeRes, ByRef GISRes, ByRef BikeRes, ByRef cond() As Integer, ByRef BikeTable As Recordset, ByVal BikeCty As Boolean) *Purpose:* Uses the HCM technique for freeway analysis method to determine MOE's for the freeway segments identified in the analysis area selected by the user.
Name: IntersectionAnalysis *Declaration:* Private Sub IntersectionAnalysis() *Purpose:* Currently not used by MTPT but rather the TmpInterAnalysis function processes the signalized intersection data.
Name: MultilaneAnalysis *Declaration:* Private Sub MultilaneAnalysis(ByRef RC1 As Rcdata, ByRef RC2 As Rcdata, ByVal k As Double, ByVal d As Double, ByVal phf As Double, ByVal MultiTerrain As Integer, ByVal LOSTresh As String, ByVal FreeFlowFactor, ByVal CityPopulation, ByRef alcs() As Double, ByRef alcf() As Double, ByRef MultiRes, ByRef GISRes, ByRef BikeRes, ByRef cond() As Integer, ByRef BikeTable As Recordset, ByVal BikeCty As Boolean) *Purpose:* Uses the HCM technique to approximate Multilane Highway MOE's based on the areas selected for analysis by the program user. This subroutine is then called by Form_Activate.
Name: TwolaneAnalysis *Declaration:* Private Sub TwolaneAnalysis(ByRef RC1 As Rcdata, ByRef RC2 as Rcdata, ByVal k As Double, ByVal d As Double, ByVal phf As Double, ByVal TwoTerrain As Integer, ByVal LOSTresh As String, ByRef pass() As Double, ByRef vbycArray() As Double, ByRef FwArray() As Double, ByRef EtArray() As Double, ByRef phfArray() As Double, ByRef SF() As Double, ByRef fd() As Double, ByVal PercentNoPass As Double, ByRef TwoRes, ByRef GISRes, ByRef BikeRes, ByRef cond() As Integer, ByRef BikeTable As Recordset, ByVal BikeCty As Boolean) *Purpose:* Uses the HCM technique to approximate two lane Highway MOE's based on the areas selected for analysis by the program user. This subroutine is then called by Form_Activate.

D. Results Menu Items

Upon completion of the analysis stage where the program user identifies the study area and executes the analysis, the program user can next begin the "Results" stage. The MTPT "Results" option in the menu displays several choices available to the program user. This menu section item is depicted by the following graphic image. For optimal program functionality, a program user should first select "Modes for Output" before selecting any of the display options.

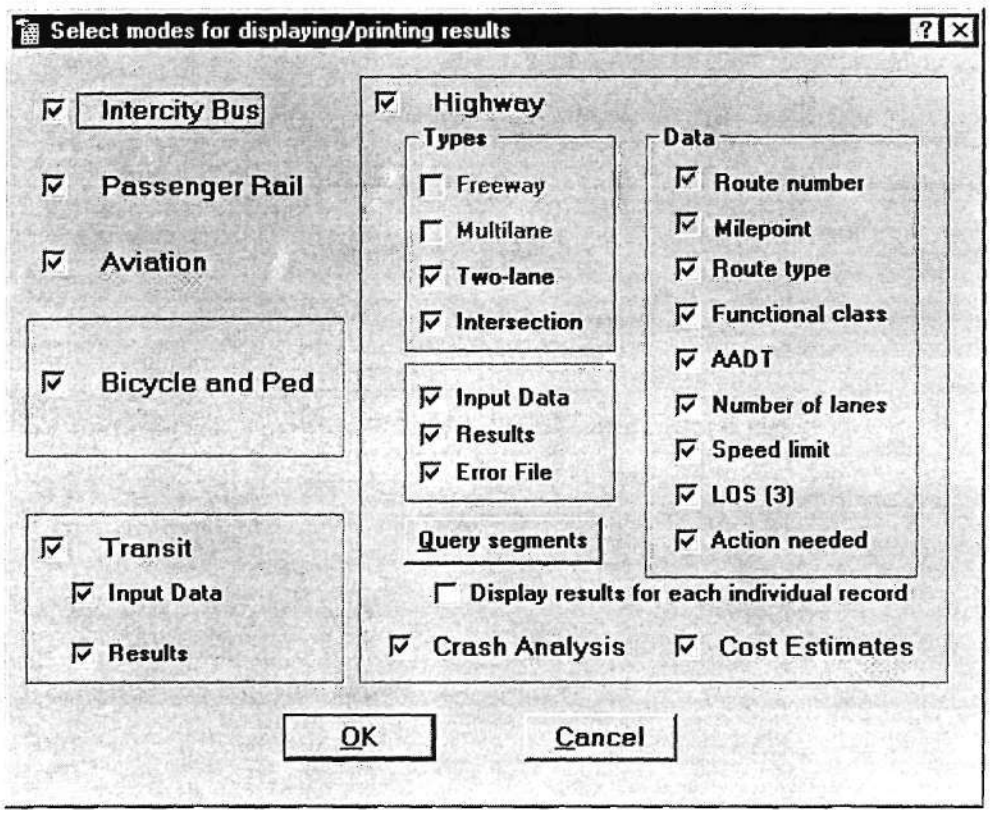


The individual analysis menu options (and sub-menu options where appropriate) require additional description.

1. Modes for Output

Name: frmResultFormat.FRM
Caption: Select modes for displaying/printing results
General Information: Form activated when program user selects Results - Modes for Output

Form Appearance:



Content Summary:

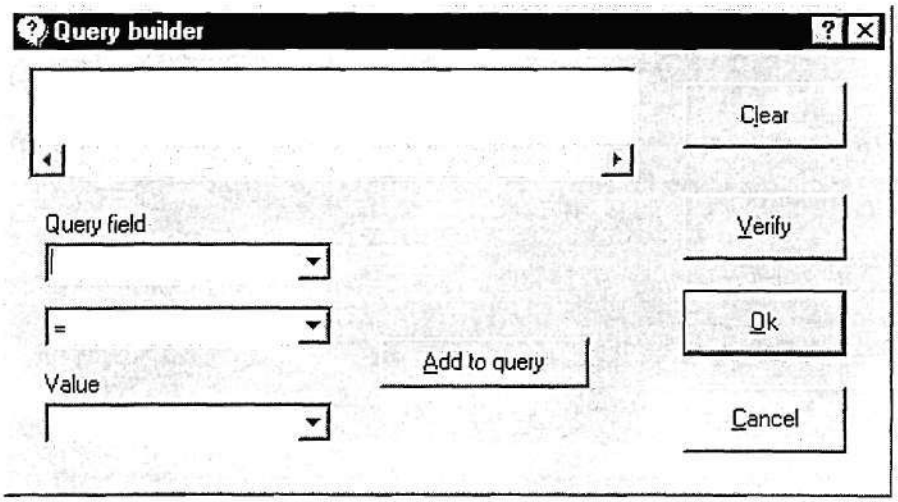
Labels:
➢ Label1: Route number ➢ Label2: Milepoint
CheckBox:
➢ Check1: Transit (Frame2) ➢ Check2: Intercity Bus ➢ Check3: Passenger Rail ➢ Check4: Aviation ➢ Check5: Bicycle and Ped (Frame 1) ➢ Check6: Highway (Frame3) ➢ Check7: Crash Analysis ➢ Check8: Cost Estimates ➢ Check9: Results (for Check1 [Transit], Frame2) ➢ Check10: Input Data (for Check1 [Transit], Frame2) ➢ Check11: Results (for Check6 [Highway], Frame3) ➢ Check12: Input Data (for Check6 [Highway], Frame3) ➢ Check13: Freeway (Frame3 (Frame5 – Types))

➢ Check14: Two-lane (Frame3 (Frame5 – Types)) ➢ Check15: Multilane (Frame3 (Frame5 – Types)) ➢ Check16(0): [Associated with Label1 -- Route Number] (Frame3 (Frame6 – Data)) ➢ Check16(1): [Associated with Label2 -- Milepoint] (Frame3 (Frame6 – Data)) ➢ Check16(2): Route type (Frame3 (Frame6 – Data) ➢ Check16(3): Functional class (Frame3 (Frame6 – Data) ➢ Check16(4): AADT (Frame3 (Frame6 – Data) ➢ Check16(5): Number of lanes (Frame3 (Frame6 – Data) ➢ Check16(6): Speed limit (Frame3 (Frame6 – Data) ➢ Check16(7): LOS (3) (Frame3 (Frame6 – Data) ➢ Check16(8): Action needed (Frame3 (Frame6 – Data) ➢ Check17: Intersection (Frame3 (Frame5 – Types)) ➢ Check18: Error File (for Check6 [Highway], Frame 3) ➢ ChkDisplayAll: Display results for each individual record
CommandButton:
➢ Command1: OK ➢ Command2: Cancel ➢ Command3: Query segments
Subroutines (Private):
Name: Check1_Click *Declaration:* Private Sub Check1_Click() *Purpose:* To determine if the user has selected the Transit option. A value of one for check1.Value indicated the program user wishes the review transit conditions and the input data and results check boxes are enabled with a default value of one. For a Check1.Value of zero, none of the transit boxes are activated for selection.
Name: Command1_Click *Declaration:* Private Sub Command1_Click() *Purpose:* Activated when user selects the "OK" button. It assigns a value of one to ResultReady so the user can next display a map or text output.
Name: Command2_Click *Declaration:* Private Sub Command2_Click() *Purpose:* Activated when user selects the "Cancel" button. It then hides the ResultFormat window.
Name: Command3_Click *Declaration:* Private Sub Command3_Click() *Purpose:* Activated when user selects the "Query segments" button. It then activates the Query form window (frmQuery).
Name: Form_Load *Declaration:* Private Sub Form_Load() *Purpose:* Checks to see which of the six transportation modes were analyzed and then loads the ResultFormat form with any analyzed modes darkened with a default value of one (display results). For Check6.Value of zero (box not selected) none of the highway boxes are enabled for user selection.

Subroutines (Public):
Name: Check6_Click *Declaration:* Public Sub Check6_Click() *Purpose:* To determine first if any highway options were selected, then to determine which of the four were selected and make results selection available for the specific options evaluated.

2. Output Query Form

Name: frmQuery.FRM
Caption: Query builder
General Information: Form activated when program user selects "Query segments" in frmResultFormat
Form Appearance:



Content Summary:

Labels:
➢ Label1: Query field ➢ Label3: Value
TextBox:
➢ Text1: <user to input search query in this box>
ComboBox:
➢ Combo1: <associated with Label1 (Query Field)> ➢ Operator: <choice of = , >, <, >=, or <=> ➢ Combo3: <associated with Label3 (Value)>

CommandButtons:
➢ Command2: Clear ➢ Command3: Add to query ➢ Command4: OK ➢ Command5: Cancel ➢ Command6: Verify
Subroutines (Private):
Name: Combo1_gotfocus *Declaration:* Private Sub Combo1_gotfocus() *Purpose:* Assigns the initial value of Combo3.Text to "" until the program user completes query selection.
Name: Combo3_gotfocus *Declaration:* Private Sub Combo1_gotfocus() *Purpose:* Populates the combo3 box based on the combo1 selection
Name: Command2_Click *Declaration:* Private Sub Command2_Click() *Purpose:* Activated upon user selection of the "Clear" button. Assigns a string value of "" to Text1.Text (i.e. clears the text box).
Name: Command3_Click *Declaration:* Private Sub Command3_Click() *Purpose:* Activated upon user selection of the "Add to query" button. Permits the program user to extend the string value information shown in Text1.
Name: Command4_Click *Declaration:* Private Sub Command3_Click() *Purpose:* Activated upon user selection of the "OK" button. It initiates the decode_query public function.
Name: Command5_Click *Declaration:* Private Sub Command5_Click() *Purpose:* Activated upon user selection of the "Cancel" button. It resets all default values for text to empty fields.
Name: Command6_Click *Declaration:* Private Sub Command6_Click() *Purpose:* Activated upon user selection of the "Verify" button. It checks format of query and sends error messages if the query cannot be completed as requested.
Name: decode_query *Declaration:* Private Sub decode_query() *Purpose:* Evaluates the form input (when called from the Command4_Click subroutine) and then executes the query selection.
Name: Form_Load *Declaration:* Private Sub Form_Load() *Purpose:* Activated when the user selects "Query segments" from the ResultFormat form. This subroutine firs populates Combo1 and operator combination boxes and then loads the Query form for user input.

Functions (Public):
Name: check_paren *Declaration:* Public Function check_paren(condition As String) *Purpose:* Verifies the input format has appropriate use of parentheses.
Name: get_char *Declaration:* Public Function get_char(str As String, Index As Integer) *Purpose:* Captures character information for use in decode_query.
Name: sub_str *Declaration:* Public Function sub_str(str As String, i As Integer, j As Integer) *Purpose:* Defines string for query sort and is executed from within.

3. Display Text Results

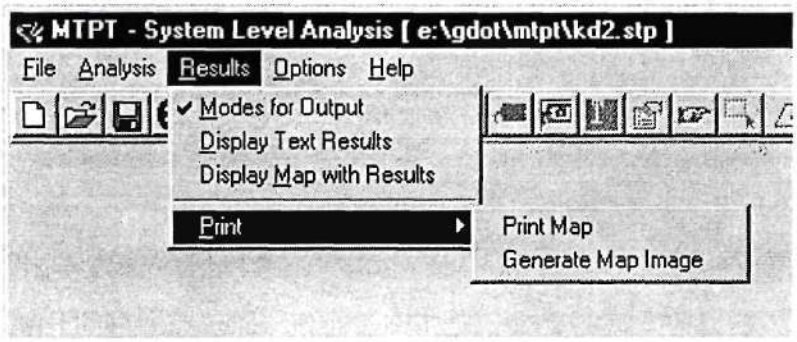
The MTPT creates a text output file called *mtpt.out*. This file is then displayed using wordpad.exe. A program user can directly print the file from wordpad. For this reason, there is no unique form associated with the "Display Text Results" menu option.

4. Display Map with Results

The MTPT executes the program subroutine called mnuDisplayMap located in frmMain (summarized in Section G of this report). This routine creates the required external database tables and then displays the map with user display options.

5. Print

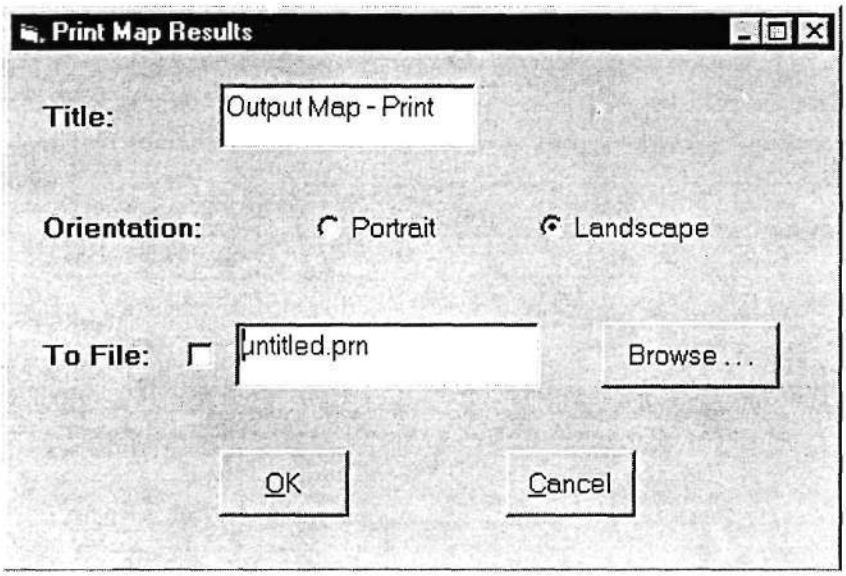
Upon completion of the display map with results option, the program user may elect to print the map results or save them to an image file. The MTPT "Print" option in the Results menu is depicted by the following graphic image. A program user should select one of the two available print options.



The two print options are described in detail in the following section:

a.) Print Map

Name: frmMapPrint.FRM
Caption: Print Map Results
General Information: Form activated when program user selects Results - Print - Print Map
Form Appearance:



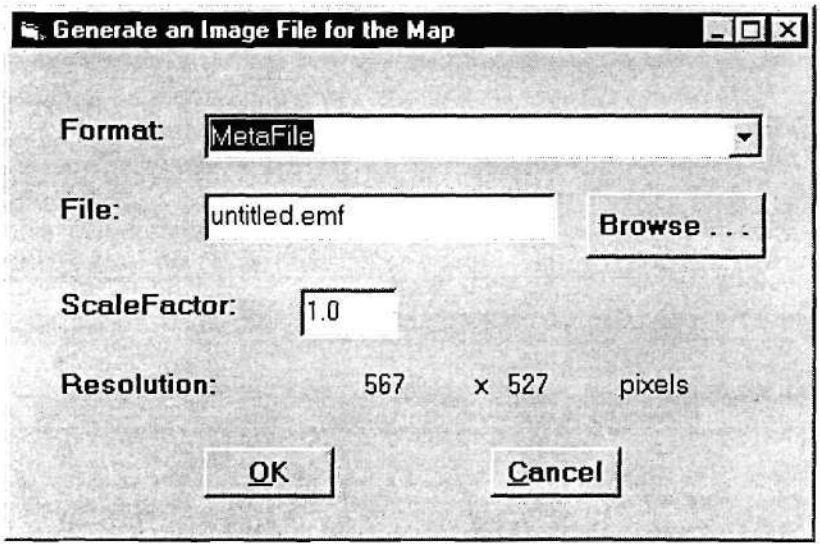
Content Summary:

Labels:
➢ Label1: Title ➢ Label2: Orientation ➢ Label3: To File
OptionButton:
➢ Option1: Portrait page orientation ➢ Option2: Landscape page orientation
CommonDialog:
➢ CommonDialog1: provides file name assignment information
CheckBox:
➢ Check1: <associated with Label3 (To File)>
TextBox:
➢ Text1: "untitled.prn" <associated with Label3 (To File) and Check1> ➢ Text2: "Output Map - Print" <associated with Label1 (Title)>

CommandButtons:
➢ Command1: OK ➢ Command2: Cancel ➢ Command3: Browse
Subroutines (Private):
Name: Check1_Click() *Declaration:* Private Sub Check1_Click() *Purpose:* Activated upon user selection of the Check1 checkbox. If selected, the program user is allowed to assign a file name to the print file.
Name: Command1_Click() *Declaration:* Private Sub Command1_Click() *Purpose:* Activated upon user selection of the "OK" button. It initiates the print map feature with the user assigned name (if applicable).
Name: Command2_Click() *Declaration:* Private Sub Command2_Click() *Purpose:* Activated upon user selection of the "Cancel" button. It hides the MapPrint form.
Name: Command3_Click() *Declaration:* Private Sub Command3_Click() *Purpose:* Activated upon user selection of the "Browse" button. This subroutine activates the CommonDialog1 and allows file name assignment of the *.prn file.

b.) Generate Map Image

Name: frmMapImage.FRM
Caption: Generate an Image File for the Map
General Information: Form activated when program user selects Results - Print - Generate Map Image
Form Appearance:



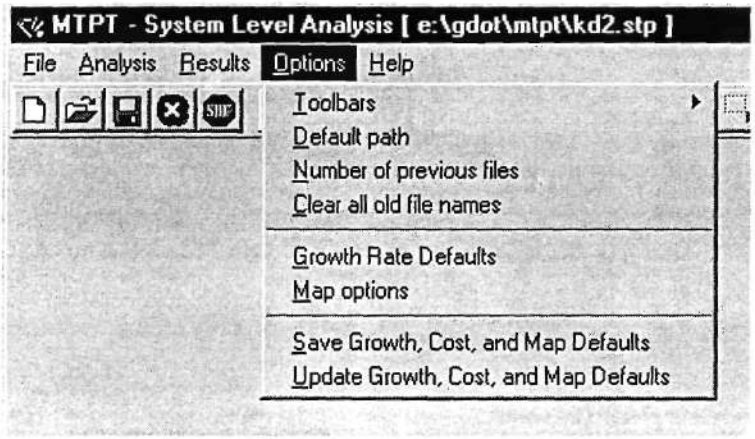
Content Summary:

Labels:
➢ Label1: Format ➢ Label2: File ➢ Label3: ScaleFactor ➢ Label4: Resolution ➢ Label5: x (multiplication symbol) ➢ Label6: pixels ➢ lblHRes: Horizontal resolution of image (first value displayed with Label4) ➢ lblVRes: Vertical resolution of image (second value displayed with Label4)
CommonDialog:
➢ CommonDialog1: provides "Browse" file name options
TextBox:
➢ Text1: "untitled.emf" <associated with Label2> ➢ Text2: "1.0" <associated with Label3>
CombinationBox:
➢ Combo1: "MetaFile" <associated with Label1>
CommandButtons:
➢ Command1: OK ➢ Command2: Cancel ➢ Command3: Browse . . .
Subroutines (Private):
Name: Combo1_Click() *Declaration:* Private Sub Combo1_Click() *Purpose:* Activated upon user selection of the Combo1 option associated with the "Format" label. This box currently provides the program user two options of an image. The program user can select MetaFile or BitMap.
Name: Command1_Click() *Declaration:* Private Sub Command1_Click() *Purpose:* Activated upon user selection of the "OK" button. It submits the image creation features and then closes the MapImage form.
Name: Command2_Click() *Declaration:* Private Sub Command2_Click() *Purpose:* Activated upon user selection of the "Cancel" button. It hides the MapImage window.
Name: Command3_Click() *Declaration:* Private Sub Command3_Click() *Purpose:* Activated upon user selection of the "Browse" button. It searches the CommonDialog1 options (currently the metafile and bitmap file name features) and then assigns names and locations for map image storage.
Name: Form_Load *Declaration:* Private Sub Form_Load() *Purpose:* Activated when the user selects Map Image from the result

options. Upon form activation, the Form_Load subroutine populates the text boxes and combo box.
Name: Text2_Change *Declaration:* Private Sub Text2_Change() *Purpose:* This controls the text box associated with Label3 (ScaleFactor). The subroutine first makes sure the value entered is greater than zero and then assigns the scale factor to the horizontal and vertical resolutions. Modified resolution settings will be displayed in the lblHRes and lblVRes labels.

E. Options Menu Items

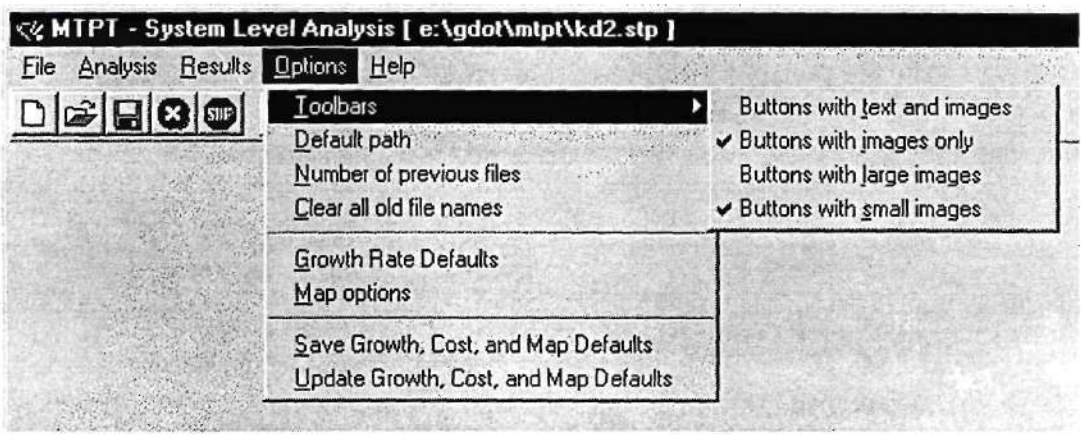
At any time during program execution, the program user may elect to modify several available program options. The MTPT "Options" item in the menu displays several choices available to the program user. This menu section item is depicted by the following graphic image.



The individual analysis menu options (and sub-menu options where appropriate) require additional description.

1. Toolbars

   The program user may select one of four toolbar options. These choices are depicted in the following graphic:



   Each of the Toolbar viewing options executes a routine located in frmMain (see Section G for a full description of this form). The item and associated subroutine are as follows:

Menu Item	frmMain Subroutine
Buttons with text and images	mnuTextImg
Buttons with images only	mnuImg
Buttons with large images	mnuLargeImg
Buttons with small images	mnuSmallImg

2. Default Path

To adjust the default path for *.stp files, a routine called mnuPath (located in frmMain) is executed. If the program user does not identify a default path, the program uses the program working directory as that path.

3. Number of Previous Files

To adjust the number of available previous files (located in the File pull-down menu), the program executes a routine called mnuNumOldFiles. This routine is in the frmMain form as described in Section G.

4. Clear All Old File Names

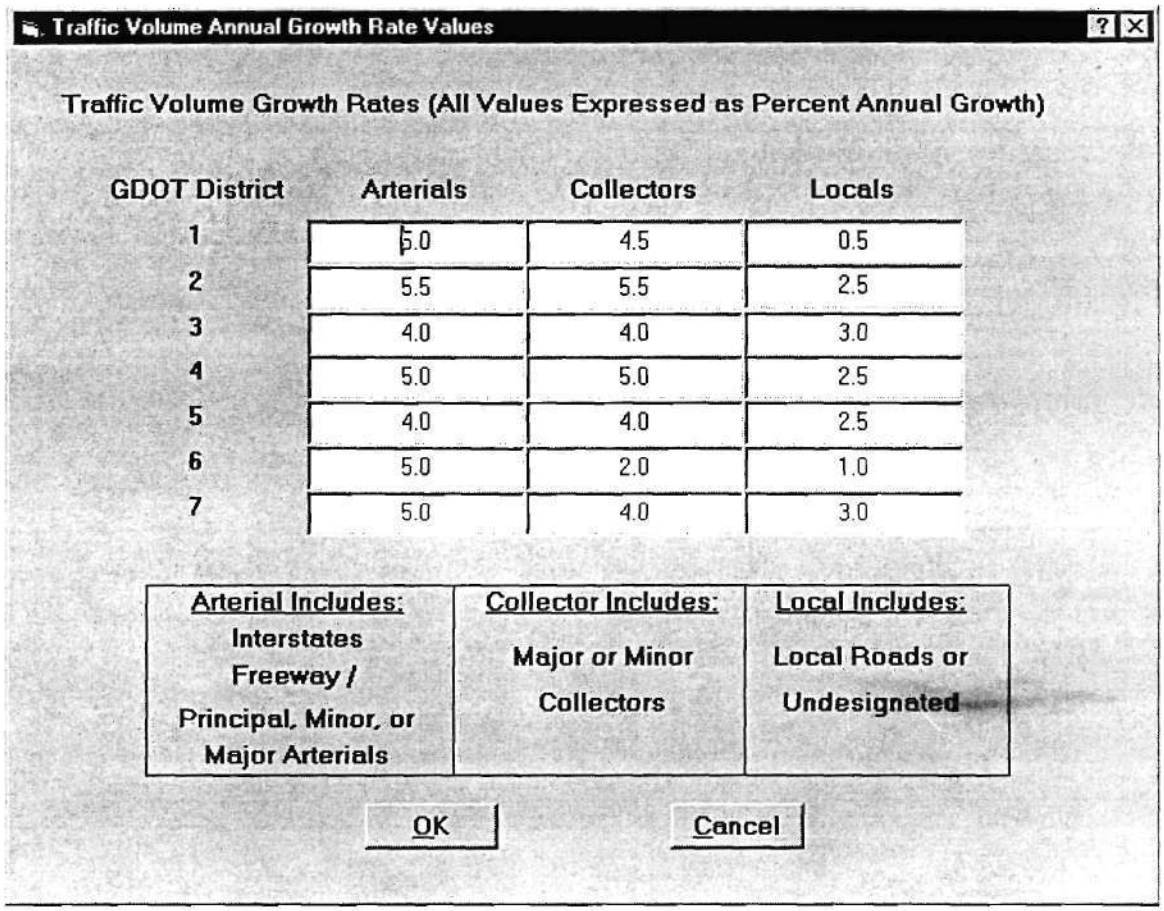
If the program user elects to clear the old file names displayed in the File pull-down menu, the program executes a routine called mnuClearNames. This routine is in the frmMain form as described in Section G.

5. Growth Rate Defaults

The traffic projection used for level of service analysis bases future traffic growth on road type and GDOT District. If a program user is familiar with a specific site and is aware of a specific growth rate, the user can modify that value in the growth rate form described in more detail below.

Name: frmGrowthRate.FRM
Caption: Traffic Volume Annual Growth Rate Values
General Information: Form activated when program user selects Options - Growth Rate Defaults.

Form Appearance:



Content Summary:

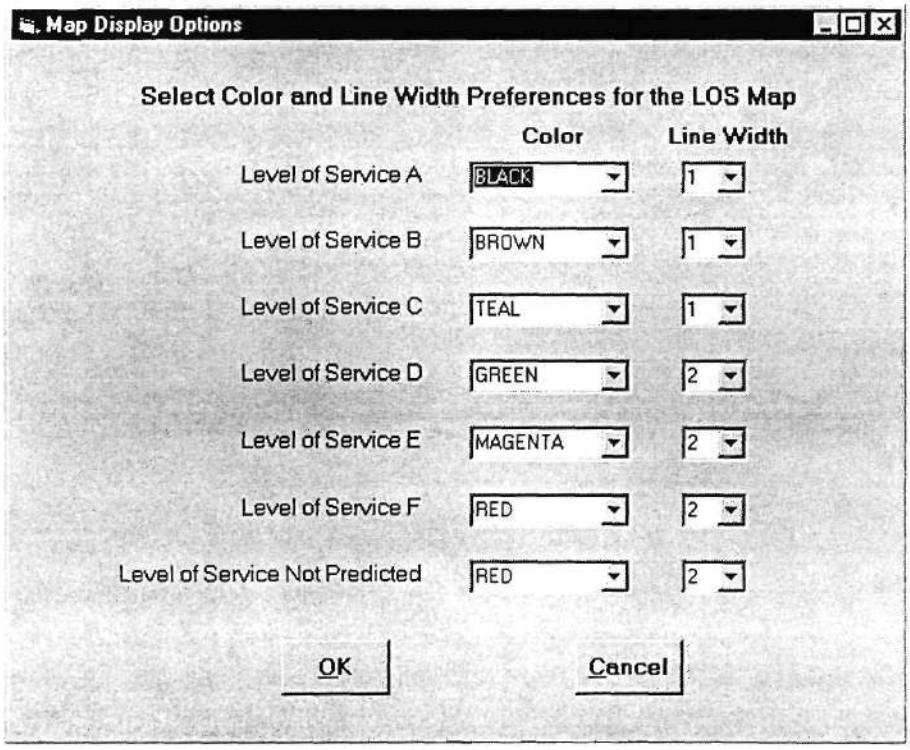
Labels:
➢ Label1(0) thru Label1(7): GDOT District 1 - 7 labels ➢ Label2: Arterials ➢ Label3: Collectors ➢ Label4: Locals ➢ Label5: Traffic Volume Growth Rates (All Values Expressed as Percent Annual Growth) ➢ Label 6 thru Label 16: Descriptions for arterial, collector, & local
TextBox:
➢ Text1(0) thru Text1(6): Arterial growth rates where 1(0) corresponds to GDOT District #1 and 1(6) corresponds to GDOT District 7 ➢ Text2(0) thru Text2(6): Collector growth rates where 2(0) corresponds to GDOT District #1 and 2(6) corresponds to GDOT District 7 ➢ Text3(0) thru Text3(6): Locals growth rates where 3(0) corresponds to GDOT District #1 and 3(6) corresponds to GDOT District 7

CommandButtons:
➢ Command1: OK ➢ Command2: Cancel
Subroutines (Private):
Name: Command1_Click() *Declaration:* Private Sub Command1_Click() *Purpose:* Activated upon user selection of the "OK" button. It assigns the user selected growth rates for analysis and then closes the GrowthRate form.
Name: Command2_Click() *Declaration:* Private Sub Command2_Click() *Purpose:* Activated upon user selection of the "Cancel" button. It hides the GrowthRate window.

6. Map Options

The program user may elect to modify the color or line weight for level of service result display. For this purpose, frmMapOptions may be executed. This form is described in detail in the following section.

Name: frmMapOptions.FRM
Caption: Map Display Options
General Information: Form activated when program user selects Options - Map options.
Form Appearance:



Content Summary:

Labels:
➢ Label1: Select Color ... LOS Map ➢ Label2 thru Label7: Level of Service A thru F ➢ Label8: Level of Service Not Predicted ➢ Label9: Select Line ... Road Map ➢ Label10: Base Map Display
ComboBox:
➢ Combo1(0) thru Combo1(6): Assigns color options for Level of Service A thru F ➢ Combo2: Assigns color to base map display <associated with Label10> ➢ Combo3(0) thru Combo3(6): Assigns line weights for Level of Service A thru F
CommandButtons:
Command1: OK Command2: Cancel
Subroutines (Private):
Name: Command1_Click() *Declaration:* Private Sub Command1_Click() *Purpose:* Activated upon user selection of the "OK" button. It assigns the color and line weight options selected by the program user and then closes the MapOptions form.
Name: Command2_Click() Declaration: Private Sub Command2_Click() Purpose: Activated upon user selection of the "Cancel" button. It hides the MapOptions form.
Name: Form_Load *Declaration:* Private Sub Form_Load() *Purpose:* Activated when the user selects map options from the map option menu. Upon form activation, the Form_Load populates the ComboBoxes associated with the form.

7. Save Growth, Cost, and Map Defaults

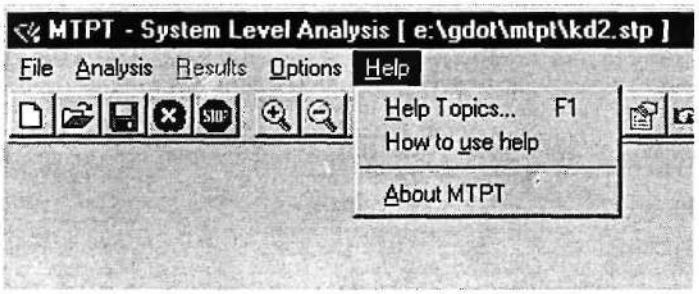
Frequently, a program user may use the same default options more than once. For this reason, a save default option is available to the program user. The user can save a file to any name with a .def extension (such as appling.def) and then reload the default file at any time. The routine that executes this feature is the mnuSaveDef in frmMain.

8. Update Growth, Cost, and Map Defaults

At any time, a program user may update previously saved growth, cost, and map display defaults saved in a *.def file. The routine that executes this feature is the mnuUpdateDef in frmMain.

F. Help Menu Items

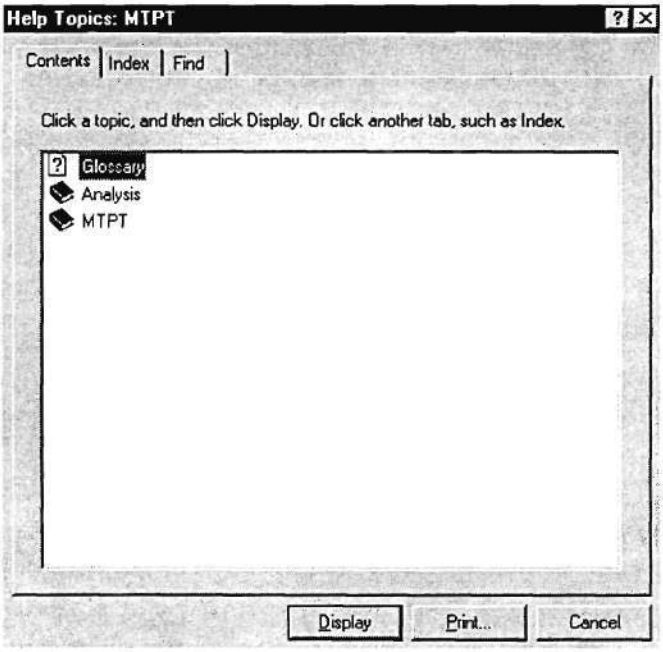
At any time during program execution, the program user may elect to request help about the program or information regarding the help tool. The MTPT "Help" item in the menu displays several choices available to the program user. This menu section item is depicted by the following graphic image.



The individual analysis menu options are further described in the following section.

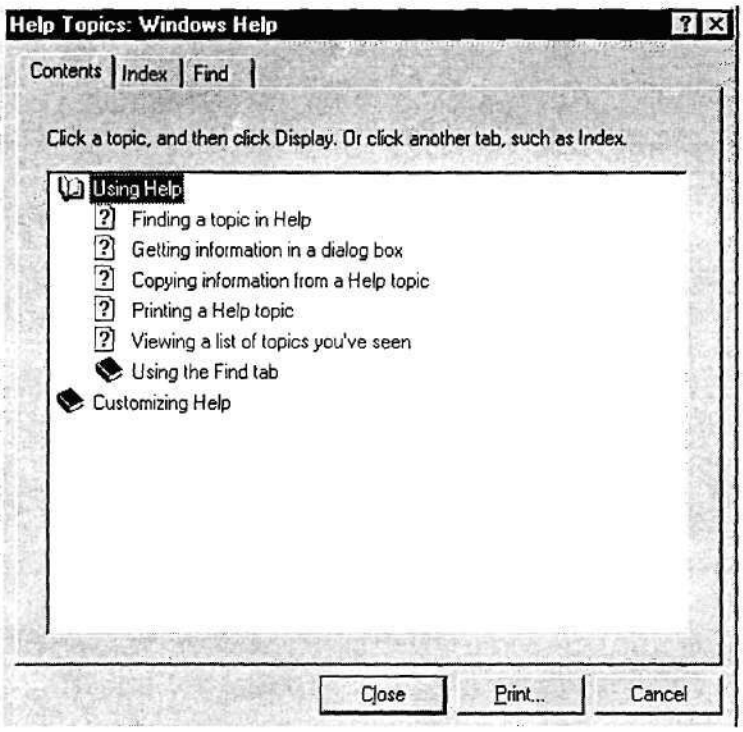
1. Help Topics...

   The program executes a subroutine called mnuContents (located in the frmMain form). This subroutine uses the MTPT.hlp file and displays the contents identified in that file so the program user can search for specific items. The following graphic displays the window that is displayed when the program user executes this menu item.



2. How to use help

The program executes a subroutine called mnuHelpUse (located in the frmMain form). This subroutine uses the MTPT.hlp file and displays the "how to use" options available in the help utility. The following graphic displays a sample window the user will see when navigating though this utility.

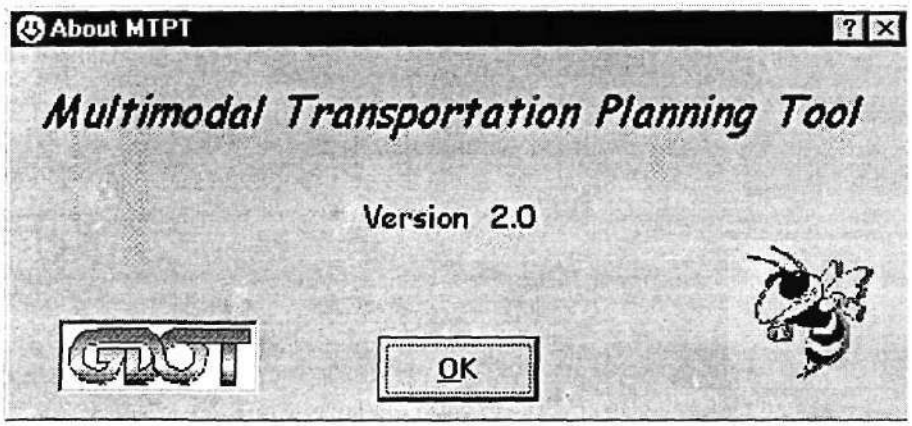


3. About MTPT

The program executes a subroutine called mnuHelpAbout (located in the frmMain form). This subroutine displays a form called frmHelpAbout that is identified in detail as follows:

Name: frmHelpAbout.FRM
Caption: About MTPT
General Information: Form activated when the program user selects Help - About MTPT from the main menu.

Form Appearance:



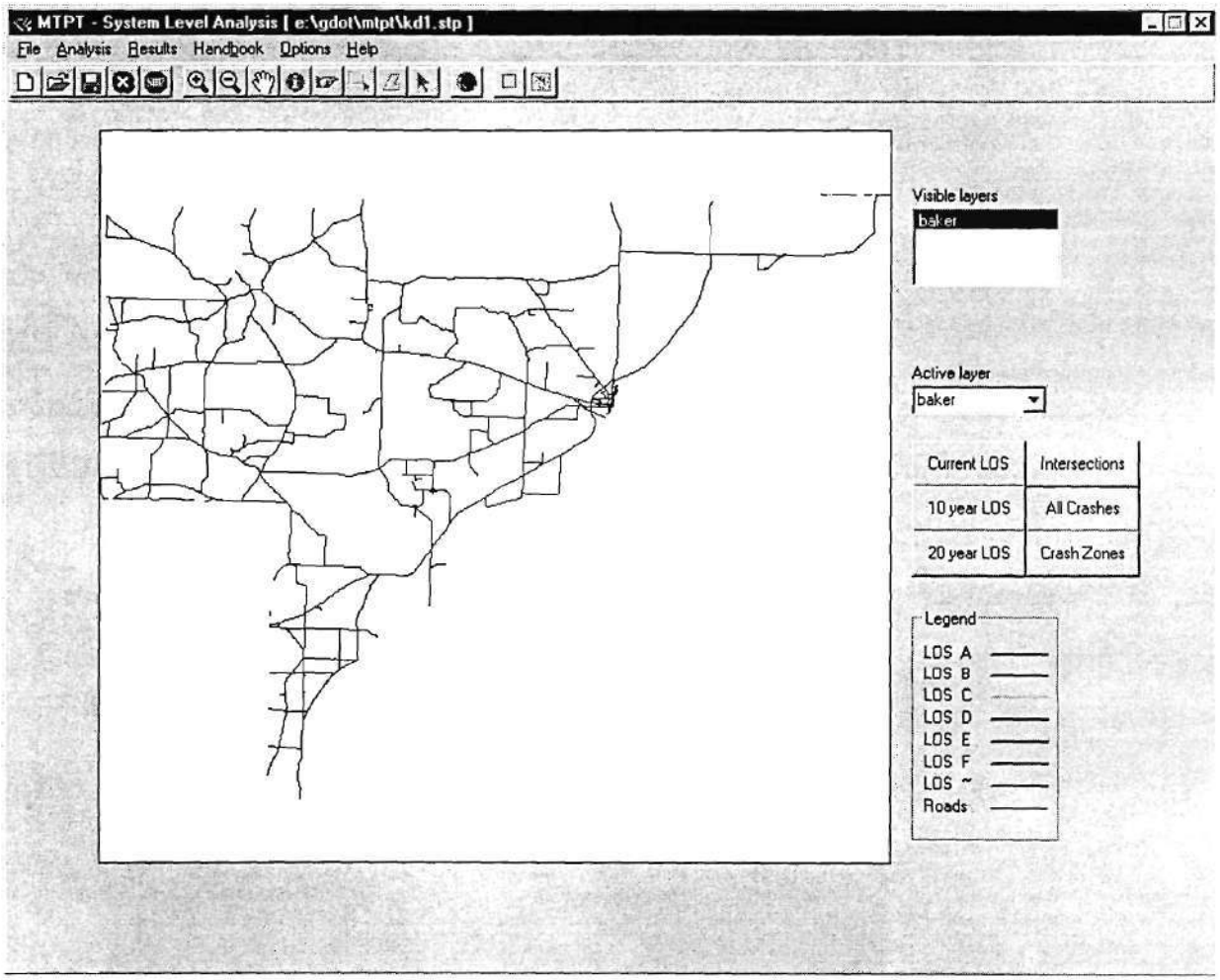
Content Summary:

Labels:
➢ Label1: Multimodal Transportation Planning Tool ➢ Label2: Version 2.0 for Windows NT
CommandButton:
➢ Command1: OK
Image:
➢ Image1: [Buzz Image]
PictureBox:
➢ Picture1: [GDOT Image]
Subroutines (Private):
Name: Command1_Click *Declaration:* Private Sub Command1_Click() *Purpose:* Activated upon user selection of the "OK" button. The form is hidden upon selection.

G. Main Program Overview

When the program is open, the primary screen the program user will view was created in a form named frmMain. The following section identifies all of the functions and subroutines associated with the main MTPT form.

Name: frmMain.FRM
Caption: MTPT – System Level Analysis
General Information: This form is primary MTPT form and is activated when a program user executes MTPT.
Form Appearance:



Content Summary:

Toolbars:
➢ Toolbar1: Positioned below menu at top of form ➢ Toolbar2: Positioned vertically along right edge of form
Map:
➢ Map1: Primary map drawing area
ComboBox:
➢ Combo1: Associated with Label2
ListBox:
➢ List1: Associated with Label1
CommandButtons:
➢ Command1: Current LOS ➢ Command2: 10 year LOS ➢ Command3: 20 year LOS ➢ Command4: All Crashes ➢ Command5: Crash Zones ➢ Command6: Intersections ➢ Command7: Show Bike Plan Routes ➢ Command8: Clear Roads ➢ Command9: Clear Title ➢ Command10: Clear County ➢ Command11: Clear Legend
CommonDialog:
➢ CommonDialog1: Upper Left Corner
Label:
➢ Label1: Visible layers ➢ Label2: Active layer ➢ Label3(0): LOS A ➢ Label3(1): LOS B ➢ Label3(2): LOS C ➢ Label3(3): LOS D ➢ Label3(4): LOS E ➢ Label3(5): LOS F ➢ Label3(6): ~ ➢ Label3(8): Roads ➢ Label4: Text for Map Title ➢ Label 5: Clear Text Placed on Map
Textbox:
➢ Text1: <associated with Label4 (Title Text)
ImageList:
➢ ImageList1: [lower ImageList positioned along left form edge] ➢ ImageList2: [ImageList positioned above ImageList1 and below CommonDialog1]
Menu:
➢ MnuFile: [Top menu border]

Functions (Public):
Name: AviHead *Declaration:* Private Function AviHead() *Purpose:* Activated by the display_result() subroutine. It will print the output header for the aviation summary information in the MTPT.OUT file.
Name: BikeHead *Declaration:* Private Function BikeHead() *Purpose:* Activated by the display_result() subroutine. It will print the output header for the bike and pedestrian summary information in the MTPT.OUT file.
Name: BikeNames *Declaration:* Private Function BikeNames() *Purpose:* Activated by the display_result() subroutine. It will print a list of all of the bike routes and their respective names encountered during BikePed analysis. This function uses the global variable array, BikeRt(19), to determine the appropriate routes.
Name: CipHead *Declaration:* Private Function CipHead() *Purpose:* Activated by the display_result() subroutine. It will print the output header for the aviation cost summary information in the MTPT.OUT file.
Name: ConvToSentenceCase *Declaration:* Public Function ConvToSentenceCase(ByVal SomeStr As String) As String *Purpose:* Converts the case of text strings passed to it in its declaration. Currently, this function does not appear to be used anywhere else in the program.
Name: CostHead *Declaration:* Private Function CostHead() *Purpose:* Activated by the display_result() subroutine. It will print the output header for the cost estimate summary in the MTPT.OUT file.
Name: CostPrint *Declaration:* Private Function CostPrint(ByVal analtype As String, ByVal Cost As String) *Purpose:* Activated by the display_result() subroutine. It will print the output header for the cost estimation module. Three separate calls to this function can occur (from fwy, two-lane, & multilane), so the "Cost String" indicates the input file name. This function then re-formats the summary information in the MTPT.OUT file.
Name: CrashHead *Declaration:* Private Function CrashHead() *Purpose:* Activated by the display_result() subroutine. It will print the output header for the crash summary information in the MTPT.OUT file.
Name: CrashRate *Declaration:* Private Function CrashRate(ByVal county As String, ByVal tp As String, ByVal rtnum As String, ByVal suff1 As String, ByVal cnum As Long) *Purpose:* Activated by the display_result() subroutine. It will check to see if the road segment crash rate exceeds the 1997 average functional classification value for that type of facility.

Name: ctpp *Declaration:* Private Function ctpp(ByRef cntynum As Integer, ByRef TransRes) *Purpose:* Activated by the transit module. It determines the various ctpp data for a given county and then prepares the data for output format.
Name: ErrorHead *Declaration:* Private Function ErrorHead() *Purpose:* Activated by the display_result() subroutine. It will print the output header for the error record summary in the MTPT.OUT file.
Name: ErrorPrint *Declaration:* Private Function ErrorPrint(ByVal analtype As String, ByVal ErrFile As String) *Purpose:* Activated by the display_result() subroutine. It will print the output header for the cost estimation module. Three separate calls to this function can occur (from fwy, two-lane, & multilane), so the "Cost String" indicates the input file name. This function then re-formats the summary information in the MTPT.OUT file.
Name: GetRecordsetBounds *Declaration:* Private Function GetRecordsetBounds(recs As MapObjects2.Recordset) As MapObjects2.Rectangle *Purpose:* Called when performing a map query using a rectangular search.
Name: HighwayHead *Declaration:* Private Function HighwayHead() *Purpose:* Activated by the display_result() subroutine. It will print the output header for highway information in the MTPT.OUT file.
Name: InterHead *Declaration:* Private Function InterHead() *Purpose:* Activated by the display_result() subroutine. It will print the output header for the isolated signalized intersection in the MTPT.OUT file.
Name: Inter2Head *Declaration:* Private Function Inter2Head() *Purpose:* Activated by the display_result() subroutine. It will print the output header for the signalized intersection corridor analysis in the MTPT.OUT file.
Name: NotSame *Declaration:* Private Function NotSame(ByRef ctr As Integer) *Purpose:* Activated by the display_result() subroutine. It will generate output information for compiled records that do not have similar characteristics when the "Display results for each individual record" box is not checked on the Result Format form.
Name: ReadyToEvaluate *Declaration:* Public Function ReadyToEvaluate() As Boolean *Purpose:* Checks to see if the user selected any of the six mode options (Highway, Passenger Rail, Bicycle and Ped, Transit, Aviation, & Intercity Bus). If any of the six were selected, then the value of frmModes.Check6.Value is one. Next the function checks to see what type of location selection method was indicated by the user and if all of the data selection is complete (using the "And" expression to determine if all of the expressions (ModeDone_G, AreaDone_G, InputDone_G, RCSetupDone_G, and

mnuMap.Checked)are true.
Name: Same *Declaration:* Private Function Same(ByRef ctr As Integer) *Purpose:* Activated by the display_result() subroutine. It will generate output information as compiled records with similar characteristics when the "Display results for each individual record" box is not checked on the Result Format form.
Name: socser *Declaration:* Private Function socser(ByRef cntynum As Integer, ByRef TransRes) *Purpose:* Activated by the transit module. It determines the different social service providers in the designated counties and writes the information to an output file named socser.res. This file can then be accessed by the output routines when the program is executed.
Name: terrain_lookup *Declaration:* Public Function terrain_lookup() *Purpose:* Determines how the user selected the analysis area (i.e. County, District, City, Map) and then assigns the appropriate terrain_lookup value for the region identified.
Name: TransitDemand *Declaration:* Private Function TransitDemand(ByRef cntynum As Integer, ByRef TransRes) *Purpose:* Activated by the transit module. It determines the demand for transit in select evaluation groups that include the elderly, those with mobility limitations, and those who live at an income below poverty level. This function creates a result file named "TransitDemand.res" that will later be called by the output routines. If a value of TransitDemand=0 is returned, this means that MTPT did not have any social data available for the selected county.
Name: TransitGrowth *Declaration:* Private Function TransitGrowth(ByRef cntynum As Integer) *Purpose:* Activated by the transit module. It computes an approximate population growth rate for rural counties. If a base year population is not available, then this function returns a value of zero (to prevent division by zero) and if the county is not valid (i.e. urban) this function also returns a value of zero.
Name: TransitPriority *Declaration:* Private Function TransitPriority(ByRef cntynum As Integer, ByRef TransRes) *Purpose:* Activated by the transit module. It determines the transit county priority and prints a Prioritization Class at the bottom of the output for each evaluated county. This function uses three global variables (StatewideCount, Count5311, and AnnualDemand) for this analysis. This function adds the priority class to the result file named "TransitDemand.res" that will later be called by the output routines.
Name: TransitScreen *Declaration:* Private Function TransitScreen(ByRef cntynum As Integer, ByRef TransRes) *Purpose:* Activated by the transit module. It checks to see if the county is urbanized or a current Section 5311 provider. In the event it sends a message to the output file indicating the current service and terminates transit analysis for that county. If not, it executes the other transit functions and continues the screening process.

Subroutines (Private):
Name: Combo1_Click *Declaration:* Private Sub Combo1_Click() *Purpose:* Checks to see if the active layer option for map viewing has text assigned. If so, then the text selected by the user is assigned as the CurrentLayer_G.
Name: Command1_Click *Declaration:* Private Sub Command1_Click() *Purpose:* Activated when the user selects the "Current LOS" button in the main MTPT map results display. The subroutine calls the LOS results theme map called "LOS1."
Name: Command2_Click *Declaration:* Private Sub Command2_Click() *Purpose:* Activated when the user selects the "10 year LOS" button in the main MTPT map results display. The subroutine calls the LOS results theme map called "LOS2."
Name: Command3_Click *Declaration:* Private Sub Command3_Click() *Purpose:* Activated when the user selects the "20 year LOS" button in the main MTPT map results display. The subroutine calls the LOS results theme map called "LOS3."
Name: Command4_Click *Declaration:* Private Sub Command4_Click() *Purpose:* Activated when the user selects the "Crashes" button in the main MTPT map results display. The subroutine calls the crash map routine that displays crashes in the selected region.
Name: Command5_Click *Declaration:* Private Sub Command5_Click() *Purpose:* Activated when the user selects the "Crash Zones" button in the main MTPT map results display.
Name: Command6_Click *Declaration:* Private Sub Command6_Click() *Purpose:* Activated when the user selects the "Intersection" button in the main MTPT map results display.
Name: Command7_Click *Declaration:* Private Sub Command7_Click() *Purpose:* Activated when the user selects the "Bikes" button in the main MTPT map results display.
Name: Command8_Click *Declaration:* Private Sub Command8_Click() *Purpose:* Activated when the user selects the "Remove Road Labels" button in the main MTPT map results display.
Name: Command9_Click *Declaration:* Private Sub Command9_Click() *Purpose:* Activated when the user selects the "Clear Map Title" button in the main MTPT map display.
Name: Command10_Click *Declaration:* Private Sub Command10_Click() *Purpose:* Activated when the user selects the "Remove County Labels" button in the

main MTPT map results display.
Name: Command11_Click *Declaration:* Private Sub Command11_Click() *Purpose:* Activated when the user selects the "Clear Legend" button in the main MTPT map results display.
Name: Form_Load *Declaration:* Private Sub Form_Load() *Purpose:* Activated when the MTPT program is opened. First, the program calls the initialize routine, then it defines all of the default variables, and finally the program sets up the map layer features.
Name: Form_MouseDown *Declaration:* Private Sub Form_MouseDown(Button As Integer, Shift As Integer, x As Single, y As Single) *Purpose:* Activates any selected item upon identification with the mouse button.
Name: Form_QueryUnload *Declaration:* Private Sub Form_QueryUnload(Cancel As Integer, UnloadMode As Integer) *Purpose:* Activated when a program user selects the quit MTPT option. The program first checks to see if any files are open and then asks the program user if he or she would like to save the file before closing.
Name: Make_IniFile *Declaration:* Private Sub Make_IniFile() *Purpose:* Generates a file called mtpt.ini that includes the application path, initiates the directory location for the GIS shape files by executing the ShpDir form and assigning the selected directory path to the variable GISShpDir_G, identifies the number of previous files that the user would like the program to retain, and the name of the previous file edited. This subroutine is called by the initialize subroutine in the main form if the program does not locate an existing mtpt.ini file.
Name: Map1_AfterLayerDraw *Declaration:* Private Sub Map1_AfterLayerDraw(ByVal index As Integer, ByVal canceled As Boolean, ByValhDC As Stdole.OLE_HANDLE) *Purpose:* Following map display, this function writes information on top of the map such as lines.
Name: Map1_AfterTrackingLayerDraw *Declaration:* Private Sub Map1_AfterTrackingLayerDraw(ByVal hDC As stdole.OLE_HANDLE) *Purpose:* Permits the program user to draw features on top of the active map (text & labels).
Name: Map1_MouseDown *Declaration:* Private Sub Map1_MouseDown(Button As Integer, Shift As Integer, x As Single, y As Single) *Purpose:* Activates the map features that can be selected by the user's mouse. These include query, zoom in, zoom out, pan, and search.
Name: mnuBike_Click *Declaration:* Private Sub mnuBike_Click() *Purpose:* Activated when the user selects "Analysis - Input Data - Bike and Ped" from

the main MTPT menu. The subroutine opens a message box that indicates all required data is acquired from the RC file and then puts a checkmark next to the menu item.
Name: mnuClearNames_Click *Declaration:* Private Sub mnuClearNames_Click() *Purpose:* Activated when the user selects "Options - Clear all old file names" from the main MTPT menu. The subroutine opens the "Previous Files" text file ini_file1. It also creates a new file (ini_file2), clears the first file, and then copies the 2nd (empty) file to the first file.
Name: mnuClose_Click *Declaration:* Private Sub mnuClose_Click() *Purpose:* Activated when the program user selects the "File - Close" option on the main MTPT menu. The subroutine displays a message box to have the user verify they do want to close the file and then if the user indicates "Yes" the program resets program variables and then unloads all of the forms. If the user indicates "No" then the program resets program variables but does not unload any of the forms.
Name: mnuContents_Click *Declaration:* Private Sub mnuContents_Click() *Purpose:* Activated when the user selects "Help - Help Topics" from the main MTPT menu. It opens the MicroSoft HelpContents dialog box.
Name: mnuCost_Click *Declaration:* Private Sub mnuCost_Click() *Purpose:* Activated when the program user selects "Analysis - Input Data - Highway - Cost Estimate" from the main MTPT menu. This menu item will activate the Cost Analysis for the identified highway modes selected by the program user (freeway, multilane, or two-lane). An input form that permits the program user to modify default cost values will be activated before execution of the cost estimate analysis module.
Name: mnuCounty_Click *Declaration:* Private Sub mnuCounty_Click() *Purpose:* Activated when the program user selects "Analysis - Area - By County" from the main MTPT menu. This subroutine activates the frmAreaCounty for specifric county selection. It also provides warning messages if the areas were selected using some selection method other than the county selection option.
Name: mnuDel_Click *Declaration:* Private Sub mnuDel_Click() *Purpose:* Activated when the user selects the "File - Delete" option from the MTPT main menu. This subroutine will delete a file selected by the program user in the CommonDialog2 box.
Name: mnuDisplay_Click *Declaration:* Private Sub mnuDisplay_Click() *Purpose:* Activated when the user selects the "Results - Display Results" option from the main MTPT menu. This subroutine calls the display_result subroutine.
Name: mnuDisplayMap_Click *Declaration:* Private Sub mnuDisplayMap_Click() *Purpose:* Activated when the program user selects the "Analysis - Display Map" option from the main MTPT menu. The subroutine calls the make_gisdata followed by the show_map subroutine.

Name: mnuDist_Click *Declaration:* Private Sub mnuDist_Click() *Purpose:* Activated when the program user selects "Analysis - Area - By District" from the main MTPT menu. This subroutine activates the AreaDist form and also includes error messages for alternative area selection options.
Name: mnuExit_Click *Declaration:* Private Sub mnuExit_Click() *Purpose:* Activated when the user selects the "File - Exit" option from the main MTPT menu. A warning message box is displayed and after the user confirms that they want to exit the program, all files are saved and closed and all forms are closed.
Name: mnuFree_Click *Declaration:* Private Sub mnuFree_Click() *Purpose:* Activated when the user selects "Analysis - Input Data - Highway - Basic Freeway" on the main MTPT menu. The subroutine opens the freeway input form.
Name: mnuGRate_Click *Declaration:* Private Sub mnuGRate_Click() *Purpose:* Activated when the user selects "Options - Growth Rate Defaults" from the main MTPT menu.
Name: mnuHelpAbout_Click *Declaration:* Private Sub mnuHelpAbout_Click() *Purpose:* Activated when the user selects "Help - About MTPT" from the main MTPT menu. The subroutine activates and displays the HelpAbout form.
Name: mnuHelpIndex_Click *Declaration:* Private Sub mnuHelpIndex_Click() *Purpose:* Activated when the program user first selects "Help - Help Contents." The windows help dialog box will display and the "Index" tab activates this subroutine that displays available help index options for the program user.
Name: mnuHelpUse_Click *Declaration:* Private Sub mnuHelpUse_Click() *Purpose:* Activated when the user selects "Help - How to use help" from the main MTPT menu. This will open the standard "Windows Help" screen.
Name: mnuImg_Click *Declaration:* Private Sub mnuImg_Click() *Purpose:* Activated when the user selects the "Options - Toolbars - Buttons with images only" option from the main MTPT menu. The subroutine then assigns an empty text string to each of the default image buttons.
Name: mnuInter_Click *Declaration:* Private Sub mnuInter_Click() *Purpose:* Activated when the user selects "Analysis - Input Data - Highway – Signalized Intersection" on the main MTPT menu. The subroutine prompts the user to identify the intersection database and then inputs the default values into the InterInput form.
Name: mnuLargeImg_Click *Declaration:* Private Sub mnuLargeImg_Click() *Purpose:* Activated when the user selects the "Options - Toolbars - Buttons with large images" option from the main MTPT menu. It assigns the alternative large images from ImageList1 and then indicates the button number associated with each button.

Name: mnuMapImage_Click *Declaration:* Private Sub mnuMapImage_Click() *Purpose:* Activated when the program user selects the "Generate Map Image" option.
Name: mnuMapOptions_Click *Declaration:* Private Sub mnuMapOptions_Click() *Purpose:* Activated when the user selects "Options - Map options" from the main MTPT menu.
Name: mnuMapPrint_Click *Declaration:* Private Sub mnuMapPrint_Click() *Purpose:* Activated when the program user selects the "Print Map" option.
Name: mnuModes_Click *Declaration:* Private Sub mnuModes_Click() *Purpose:* Activated when the program user selects "Results - Modes" from the main MTPT menu. This menu selection will activate the ResultFormat form for result data selection output.
Name: mnumodes2_Click *Declaration:* Private Sub mnumodes2_Click() *Purpose:* Activated when the program user selects "Analysis - Modes" from the main MTPT menu. This menu selection will verify that mode forms are not currently open and then will display the Modes form for mode analysis selection.
Name: mnuMulti_Click *Declaration:* Private Sub mnuMulti_Click() *Purpose:* Activated when the program user selects "Analysis - Input Data - Highway - Multilane" from the main MTPT menu. This menu item will activate the MultiInput form for multilane highway default selection.
Name: mnuNew_Click *Declaration:* Private Sub mnuNew_Click() *Purpose:* Activated when the user selects the "File - New" command from the main MTPT menu. This menu option first closes any open system files and then activates the NewFile form.
Name: mnuNumOldFiles_Click *Declaration:* Private Sub mnuNumOldFiles_Click() *Purpose:* Activated when the user selects the "Options - Number of Previous Files" from the main MTPT menu. This menu item permits the program user to change the number of previous file names displayed upon program initiation (this information is stored in mtpt.ini).
Name: mnuoldfile_Click *Declaration:* Private Sub mnuoldfile_Click(index As Integer) *Purpose:* Activated when the program user selects "File - <previous file names shown>" options from the main MTPT menu. [Note: the <previous file names shown> designation is any of the number of previous files edited by the user that will be displayed in the menu option.] Upon user file selection, the Open menu option is executed.
Name: mnuOpen_Click *Declaration:* Private Sub mnuOpen_Click() *Purpose:* Activated when the user selects the "File - Open" option from the main MTPT menu. The program opens an existing file, checks to see if it is in the proper MTPT

format, and then scans the information in the file into program memory.
Name: mnuPath_Click *Declaration:* Private Sub mnuPath_Click() *Purpose:* Activated when the user selects the "Options - Default Path" from the main MTPT menu. It displays an input box that prompts the user to idenify the path for the analysis files and then verifies the path exists.
Name: mnuRDC_Click *Declaration:* Private Sub mnuRDC_Click() *Purpose:* Activated when the program user selects "Analysis - Area - By RDC" from the main MTPT menu. The subroutine performs checks to see which modes were accepted and then opens the AreaRDC form for selection of RDC options such as county or city.
Name: mnuRdCorridor_Click *Declaration:* Private Sub mnuRdCorridor_Click() *Purpose:* Activated when the program user selects "Analysis - Area - By Known Road Corridor" from the main MTPT menu. This subroutine activates the frmAreaRoad for specific county selection. It also provides warning messages if the areas were selected using some selection method other than the known road corridor selection option.
Name: mnuSave_Click *Declaration:* Private Sub mnuSave_Click() *Purpose:* Activated with the program user selects "File - Save" from the main MTPT menu. The subroutine creates an MTPT input file with all of the default options previously selected that are necessary for program analysis. The file name will be that identified when the user initiated the analysis.
Name: mnuSaveas_Click *Declaration:* Private Sub mnuSaveas_Click() *Purpose:* Activated with the program user selects "File – Save As" from the main MTPT menu. The subroutine prompts the user for a file name and then creates an MTPT input file by prompting the mnuSave subroutine.
Name: mnuSaveDef_Click *Declaration:* Private Sub mnuSaveDef_Click() *Purpose:* Activated with the program user selects "Options -- File Cost & Growth Defaults" from the main MTPT menu. The subroutine creates an MTPT default file with all of the default options previously selected for the costs & growth forms and saves the file with a *.def exentsion.
Name: mnuSelectFromMap_Click *Declaration:* Private Sub mnuSelectFromMap_Click() *Purpose:* Activated when a user selects "Analysis - Area - Select from map" from the main MTPT menu. After performing a series of checks to see that prior required variables have been selected, this subroutine activates the MapArea form.
Name: mnuSmallImg_Click *Declaration:* Private Sub mnuSmallImg_Click() *Purpose:* Activated when the user selects the "Options - Toolbars - Buttons with small images" option from the main MTPT menu. It assigns the alternative small images from ImageList2 and then indicates the button number associated with each button.
Name: mnuTextImg_Click *Declaration:* Private Sub mnuTextImg_Click()

Purpose: Activated when the user selects the "Options - Toolbars - Buttons with text and images" option from the main MTPT menu. It assigns a caption to each button.
Name: mnuTransit_Click *Declaration:* Private Sub mnuTransit_Click() *Purpose:* Activated when the program user selects "Analysis - Input Data - Transit" from the main MTPT menu. The subroutine activates the TransitInput1 form for initial transit default data input.
Name: mnuTwo_Click *Declaration:* Private Sub mnuTwo_Click() *Purpose:* Activated when the user selects "Analysis - Input Data - Highway - Two Lane Highway" on the main MTPT menu. The subroutine opens the two lane highway input form.
Name: mnuUpdateDef_Click *Declaration:* Private Sub mnuUpdateDef_Click() *Purpose:* Activated when the user selects the "File - Open" option from the main MTPT menu. The program opens an existing file, checks to see if it is in the proper MTPT format, and then scans the information in the file into program memory.
Name: Toolbar1_ButtonClick *Declaration:* Private Sub Toolbar1_ButtonClick(ByVal Button As ComctlLib.Button) *Purpose:* This form subroutine [Toolbar1_ButtonClick(...) assigns subroutines to the buttons in the toolbar on the main MTPT menu.
Subroutines (Public):
Name: analysis_map *Declaration:* Public Sub analysis_map(ByVal flag As Integer) *Purpose:* Assigns map default values for the analysis area and shows a base map with line widths displayed as thick lines.
Name: bike_map *Declaration:* Public Sub bike_map(ByVal flag As Integer) *Purpose:* Assigns map default values for proposed bike lane locations and assigns a red color to the individual road segment that is affected.
Name: crash_map *Declaration:* Public Sub crash_map(ByVal flag As Integer) *Purpose:* Displays crashes and the evaluated roads as determined from a map selection analysis option.
Name: crash1_map *Declaration:* Public Sub crash1_map(ByVal flag As Integer) *Purpose:* Assigns map default values for crash "zones" that exceed statewide average values and assigns a red color to the individual road segment that is affected.
Name: display_result *Declaration:* Public Sub display_result() *Purpose:* Creates the output report as requested by the program user. All modes of transportation can be viewed if selected by the user and their associated MOEs will be displayed in the output file mtpt.out that can then be viewed using wordpad.
Name: hide_map *Declaration:* Public Sub hide_map() *Purpose:* Turns off the display of the results viewing tools in the main form. These

include all of the map associated features, the level of service index and legend, and the crash or road option in the lower right corner of the form.
Name: initialize *Declaration:* Public Sub initialize() *Purpose:* Activated when MTPT is initiated. First it runs through some initialization steps like locating or creating a ".ini" file, it then seeks out the required databases and associated files for successful program execution.
Name: List1_MouseUp *Declaration:* Public Sub List1_MouseUp(Button As Integer, Shift As Integer, x As Single, y As Single) *Purpose:* Activated when the user selects one of the layer options displayed in the "Visible layers" box on the main MTPT map display. The selected layer is assigned to the variable CurrentLayer_G.
Name: map_refresh *Declaration:* Public Sub map_refresh() *Purpose:* Activated by several of the map viewing subroutines. It simply regenerates the map image.
Name: map_select_bike *Declaration:* Public Sub map_select_bike() *Purpose:* Displays bike route and the evaluated roads as determined from a map selection analysis option.
Name: mnueval_Click *Declaration:* Public Sub mnueval_Click() *Purpose:* Activated when the program user selects the "Analysis - Evaluate" option from the main MTPT menu. This subroutine performs the program evaluation for the individual modes, areas, etc. selected by the user.
Name: mnuMap_Click *Declaration:* Public Sub mnuMap_Click() *Purpose:* Activated when the program user selects "Analysis - Display Map" from the main MTPT menu. The program determines which areas were selected for display, identifies the files and limits using MapObjects tools, and then calls the show_map subroutine.
Name: show_map *Declaration:* Public Sub show_map() *Purpose:* Activated by the mnuDisplayMap_Click or mnuMap_Click subroutines. It checks to see which items have been processed and makes them visible in the main form. This includes displaying the map features.
Name: signal_map *Declaration:* Public Sub signal_map(ByVal flag As Integer) *Purpose:* Assigns map default values for level of service and then assigns the color definitions to the individual items based on computed LOS letter values for regions selected from the map.
Name: sort_crashdata *Declaration:* Public Sub sort_crashdata() *Purpose:* Called when the display map item is selected from the menu and crash analysis was identified as one of the highway mode options. This subroutine reads the "crash.res"

file and compiles the records and places them into the Access database file mapresults.mdb (table CRASH). The mnuDisplayMap item calls this subroutine.
Name: sort_crash1data *Declaration:* Public Sub sort_crash1data() *Purpose:* Called when the display map item is selected from the menu. This subroutine first reads the "crash1.res" file and compiles crash corridor information and places it into the Access database file mapresults.mdb (table CRASH2). The mnuDisplayMap item calls this subroutine.
Name: sort_gisbike *Declaration:* Public Sub sort_gisbike() *Purpose:* Called when the display map item is selected from the menu. This subroutine first reads the "bikeped.res" file and compiles similar records with the same limits but different bike route numbers and places them into the Access database file mapresults.mdb (table BIKE). This subroutine is called from command7 in frmMain.
Name: sort_gisdata *Declaration:* Public Sub sort_gisdata() *Purpose:* Called when the display map item is selected from the menu. This subroutine first reads the "free.res", "multi.res", & "two.res" files and compiles similar records with the same level of service and places them into the Access database file mapresults.mdb (table LOS). The mnuDisplayMap item calls this subroutine.
Name: sort_interdata *Declaration:* Public Sub sort_interdata() *Purpose:* Called when the display map item is selected from the menu and intersection analysis was identified as one of the highway mode options. This subroutine reads the "inter1.res" file and compiles the records and places them into the Access database file mapresults.mdb (tables SIG_ISOL). The mnuDisplayMap item calls this subroutine.
Name: sort_interdata2 *Declaration:* Public Sub sort_interdata2() *Purpose:* Called when the display map item is selected from the menu and intersection analysis was identified as one of the highway mode options. This subroutine reads the "inter2.res" file and compiles the records and places them into the Access database file mapresults.mdb (table SIG_CORR). In the event the "inter2.res" file is empty, the subroutine will simply empty the current table in the database. The mnuDisplayMap item calls this subroutine.
Name: sort_mapdata *Declaration:* Public Function sort_mapdata(ByRef MapRes, ByVal fips As String, ByVal rcname As String) *Purpose:* Adds records to the MapRes file that will then be used to creating the RCfile associated with map selection. Note: records with rclinks outside of the county map analysis region are filtered by mnuEval before the sort_mapdata function is executed
Name: sort_segdata *Declaration:* Public Function sort_segdata(ByVal cty As String, ByVal roadname As String, ByVal rdbegin As Double, ByVal rdend As Double) *Purpose:* Adds records to the RoadRes file that will then be used to creating the RCfile associated with specific road corridor selection.
Name: theme_map

Declaration: Public Sub theme_map(arg As String) *Purpose:* Assigns map default values for level of service and then assigns the color definitions to the individual items based on computed LOS letter values.
Name: Update_OldFileNames *Declaration:* Public Sub Update_OldFileNames() *Purpose:* Refers to the list of previous file names, adds the most recent to the list, and copies the new file name list over the previous one. This subroutine is called by several of the menu command subroutines including Open, Save, etc.
Name: UpdateMap *Declaration:* Public Sub UpdateMap() *Purpose:* Refers activated when the program user updates the map options view. The program determines which areas were selected for display, identifies the files and limits using MapObjects tools, and then calls the show_map subroutine.

IV. APPENDIX

Installation Setup Requirements

```
[Bootstrap]
SetupTitle=Install
SetupText=Copying Files, please stand by.
CabFile=MTPT.CAB
Spawn=Setup1.exe
Uninstal=st6unst.exe
TmpDir=msftqws.pdw
Cabs=1

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PrivateGroup0=True
Parent0=$(Programs)

[Multimodal Transportation Planning Tool]
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Title1=MTPT
StartIn1=$(AppPath)
Icon2="MTPT.hlp"
Title2=MTPT Help Tool
StartIn2=$(AppPath)


[Setup]
Title=Multimodal Transportation Planning Tool
DefaultDir=c:\MTPT
AppExe=MTPT.exe
AppToUninstall=MTPT.exe
```

```
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```

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GEORGIA INSTITUTE OF TECHNOLOGY OFFICE OF CONTRACT ADMINISTRATION

RESEARCH REPORT APPROVAL SHEET

(Please see Instructions on Page 2)

Project No. E-20-615

Lab/School/Center CEE

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A. Report Title Monthly Progress

B. Author(s) and/or PD/PI Karen Dixon and Wayne Sarasua Phone: 894-5830

C. Period Covered Feb. 1, 2000 through March 31, 2000 Due Date: Mar. 31, 2000

II. **REPORT**

A. Deliverable Line No. 20 (from Deliverable Schedule)

B. Type Report:

☐ Monthly ☐ Contract Mgt. ☐ Progress ☐ Semi-Annual ☐ Cost & Performance

☐ Annual ☐ Quarterly ☒ Final Report ☐ Other _____ (Specify)

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A. PD/PI _____ Date: _____

B. Div. Chief/Branch Head _____ Date: _____

C. Lab/School Director (Required on Finals) _____ Date: _____

D. MAPS/RAN Coordinator Log Entry: _____ Date: _____

A copy has been sent to the Sponsor.

To: Ulysses Mitchell
Georgia Department of Transportation
#2 Capitol Square, S.W.
Atlanta, GA 30334
FAX : 404-657-5228

From: Karen K. Dixon K. Dixon
Georgia Institute of Technology
School of Civil and Environmental Engineering
Atlanta, GA 30332-0355

Date: April 11, 2000

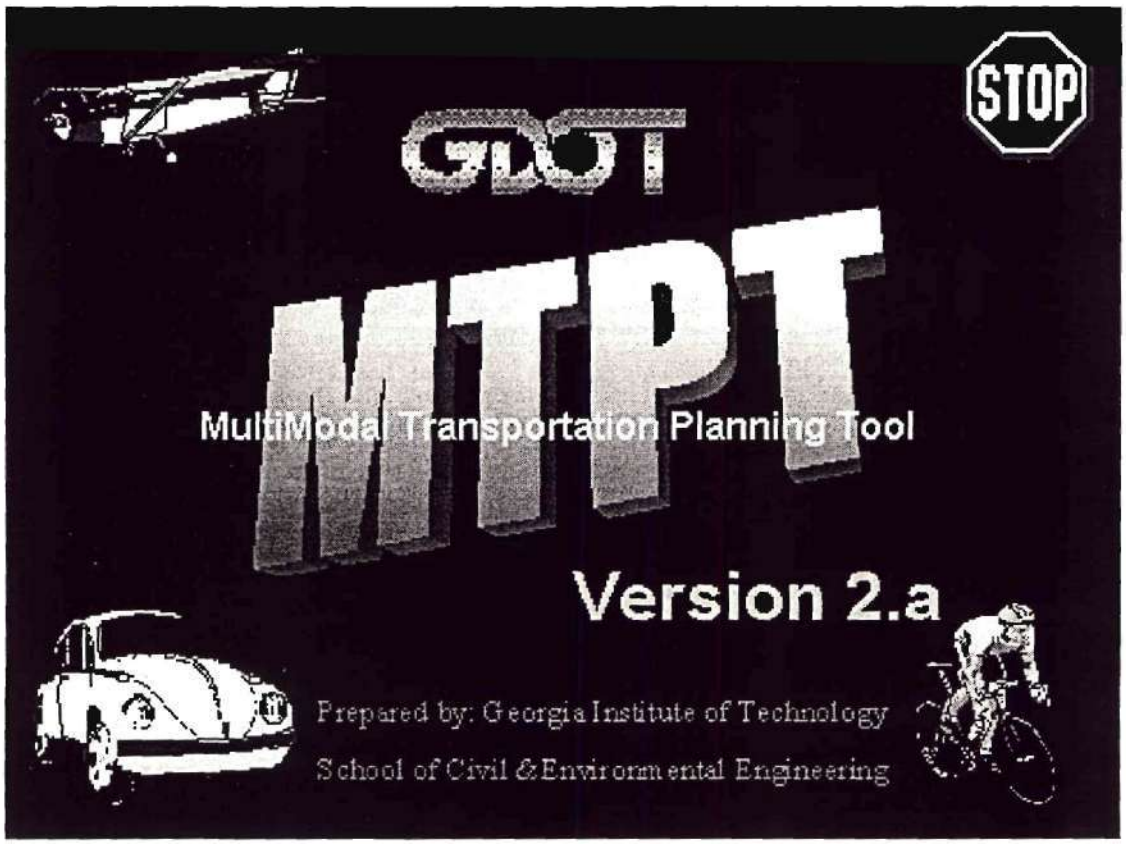
Re: Final Report for the Multimodal Transportation Planning Tool – Phase II

At this time we are pleased to submit the final reports for the Multimodal Transportation Planning Tool. The program CD that includes the program, a help utility, and user tutorial is being submitted under separate cover.

The technical document and the design document are enclosed. These two documents combined serve as the final project report. If we can answer any questions or be of any further assistance, please do not hesitate to call.

Multimodal Transportation Planning Tool

Phase 2 -- Technical Document



April 2000

Multimodal Transportation Planning Tool

Phase 2 Technical Document

Prepared by

Georgia Transportation Institute

Georgia Institute of Technology

April 2000

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CHAPTER 1. MTPT INTRODUCTION AND OVERVIEW

1.1. Introduction

The Multimodal Transportation Planning Tool (MTPT) is a computer program developed for the Georgia Department of Transportation (GDOT). The program provides a tool that allows a program user to access numerous existing GDOT databases, analyze existing facility conditions, and evaluate potential improvement for these facilities. This report summarizes the methodology used for analysis and is provided as a technical document that supplements the program.

1.2. Program Analysis Components

The MTPT provides six modes for transportation evaluation. Based on available database information, the level of analysis varies from a simple database query module up to a complex analysis tool. The six modes available include Aviation, Commuter Rail, Intercity Bus, Transit, Highway, and Bicycle and Pedestrian. Each mode component is discussed in detail in this report. Required user input information widely varies based upon the requested analysis; however, in all cases the MTPT provides default values for the program user.

In addition to the six available analysis modes, a program user has the ability to select an evaluation region based on GDOT district, Regional Development Center (RDC), County, Selection from Map, or By Known Road Corridor.

The program provides two result formats. A user can display all computed results as a text report using MicroSoft WordPad. In addition, highway analysis results can be displayed on a GIS map.

The program was developed using Visual Basic 6.0 and MapObjects.

1.3. Program Structure

Due to the complex nature of integrating the six analysis modes, the basic program structure is best represented by a series of logic flow charts (Figure 1-1 through Figure 1-11). Figure 1-1 represents the general structure of the MTPT. Figure 1-2 provides the general methodology used for Transit analysis. Similarly, Figures 1-3 through 1-10 address Highway Analysis and the six available components of the Highway Analysis Module. Figure 1-11 summarizes the basic method utilized by the Bicycle and Pedestrian Analysis module. Each of these figures are discussed in detail in Chapters 2 through 7 of this report.

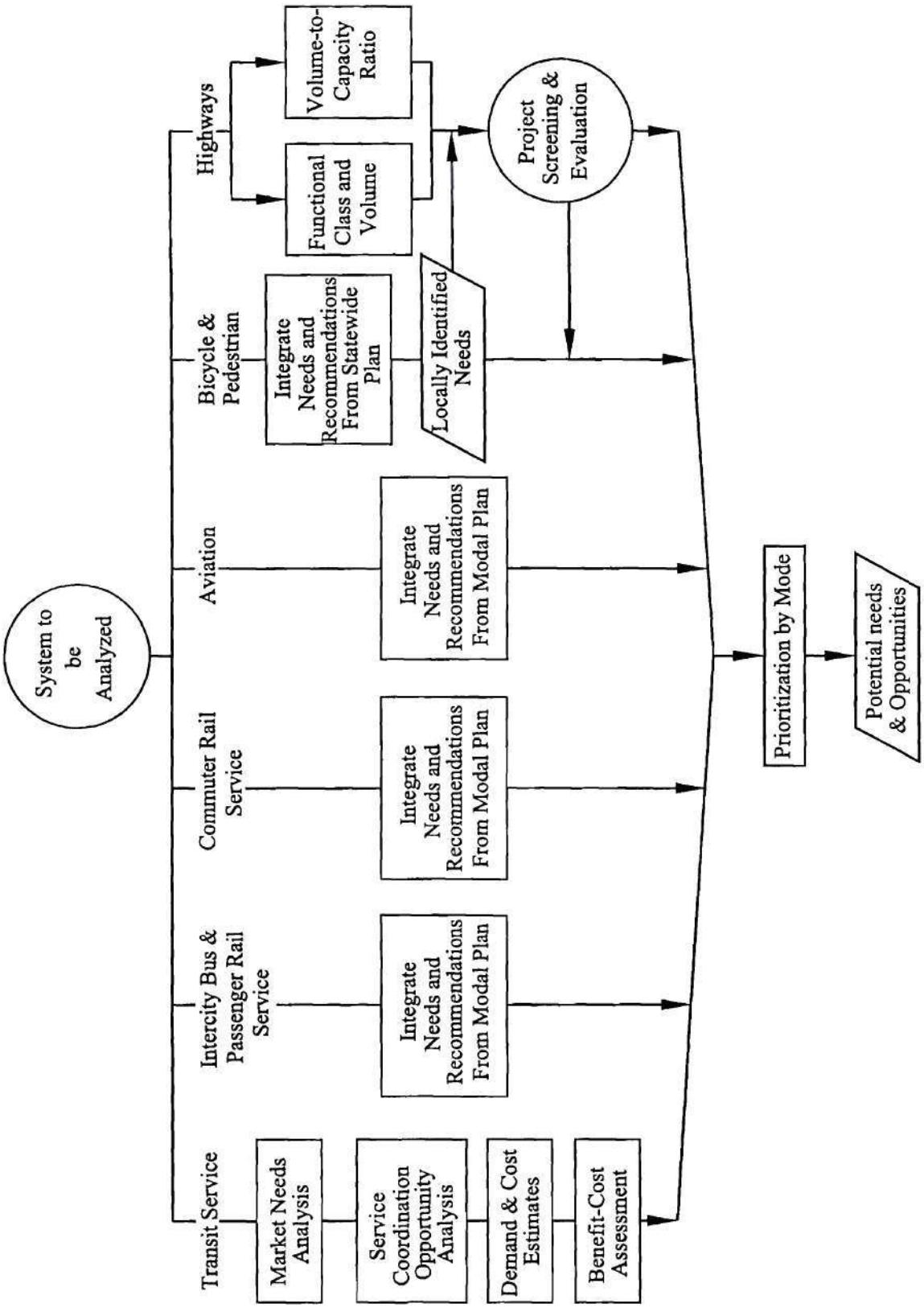

Figure 1-1. Decision Flow for MTPT System Screening Process

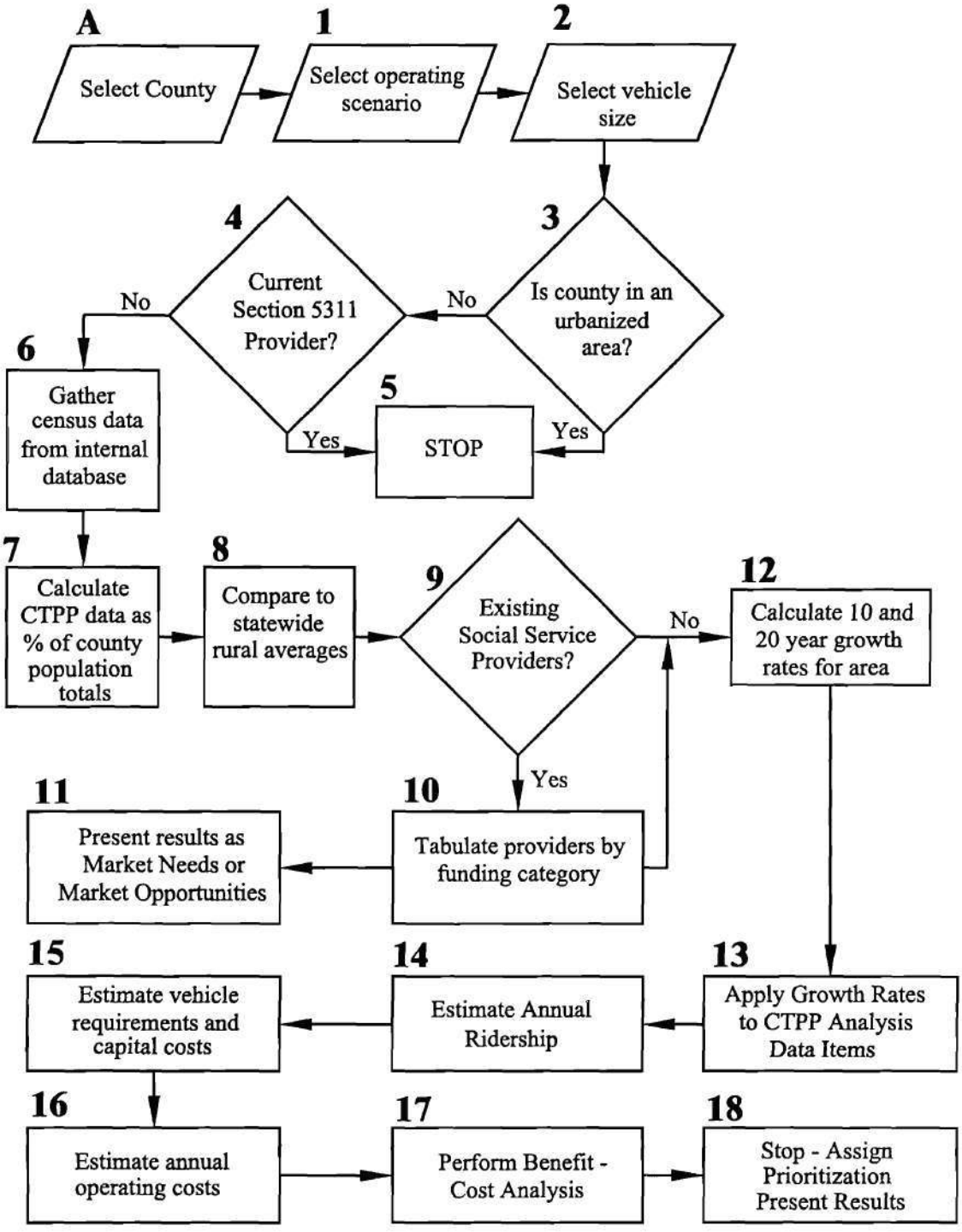

Figure 1-2. Transit System Screening

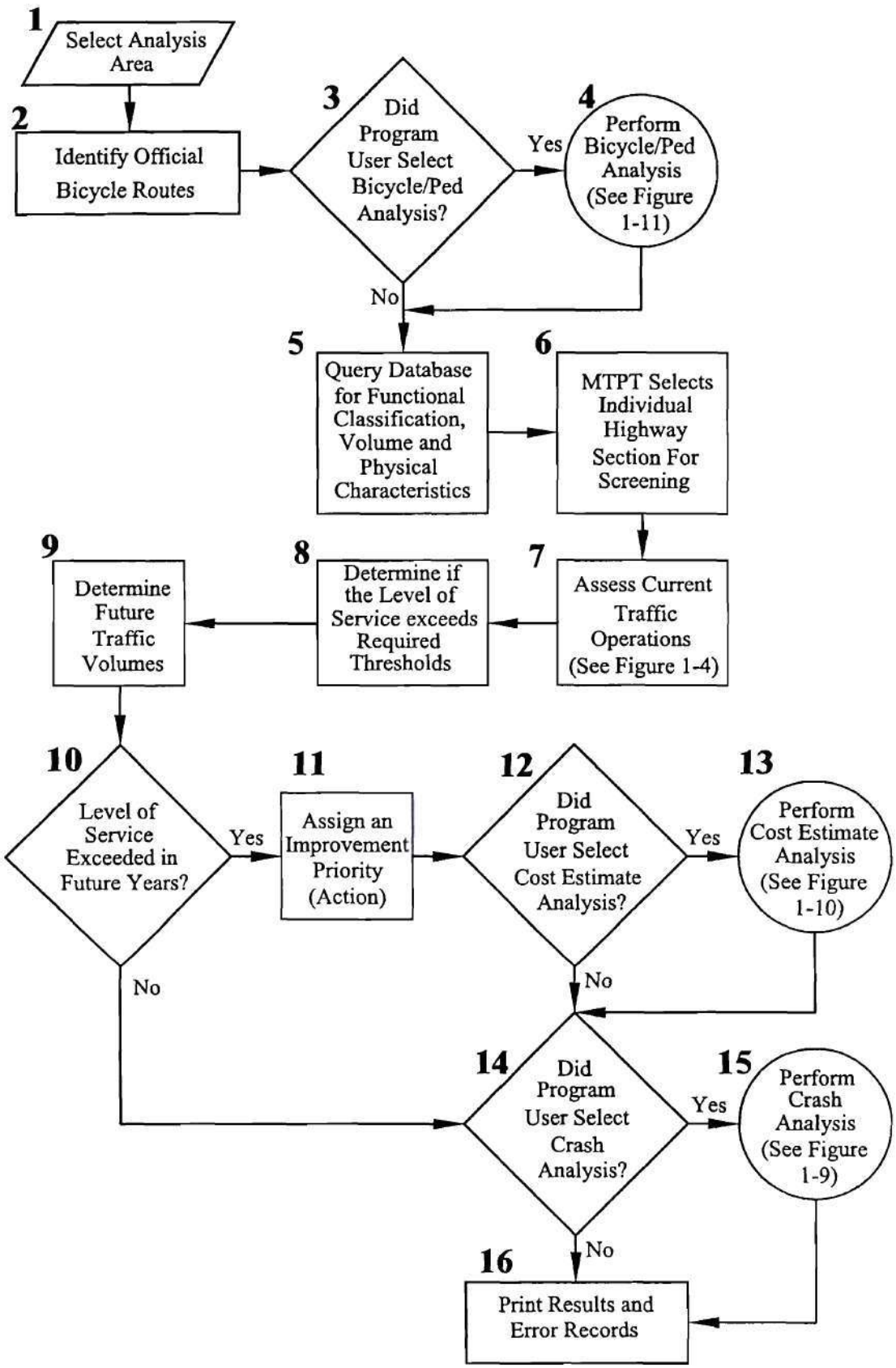

Figure 1-3. Highway Analysis Screening

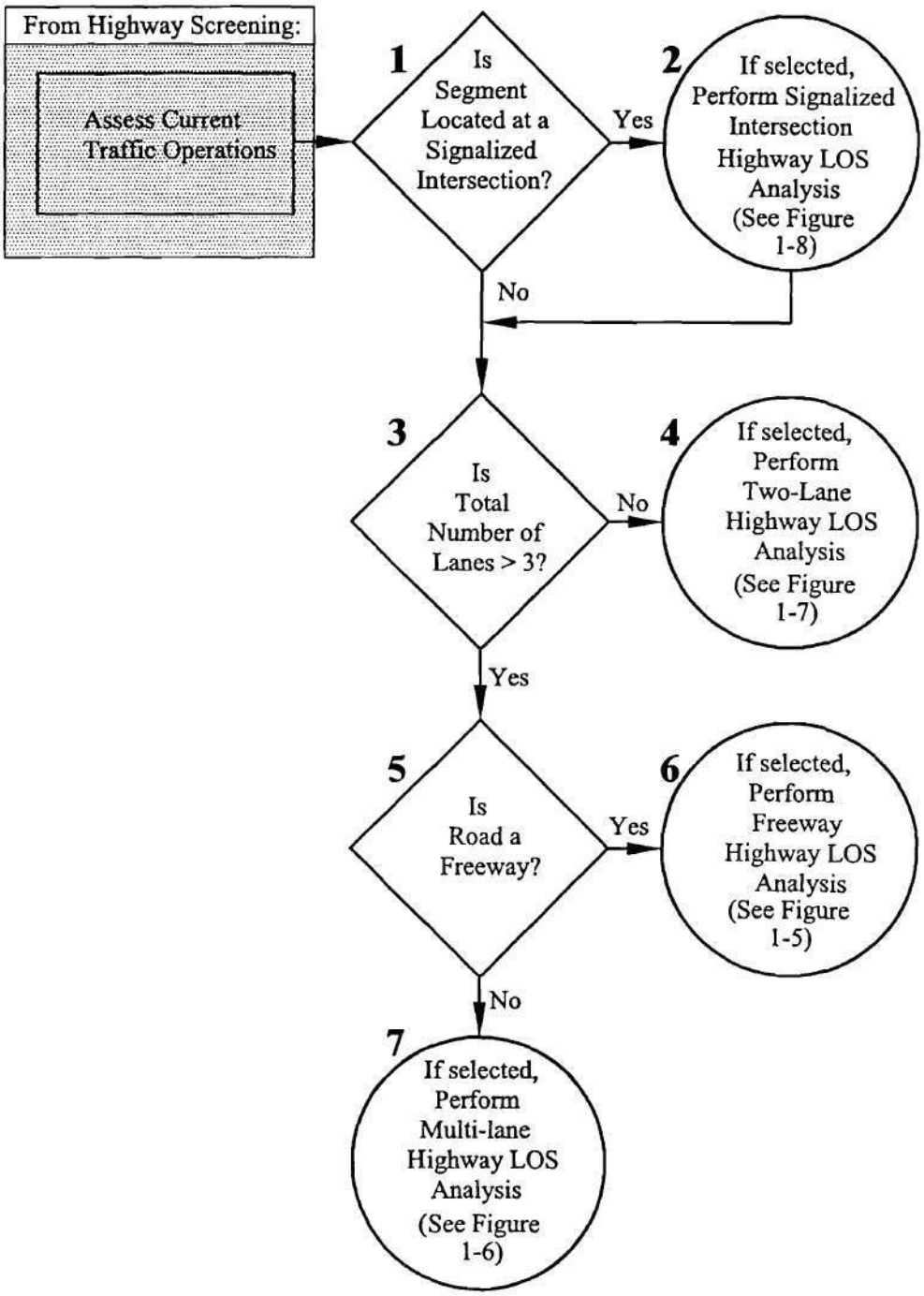

Figure 1-4. Highway Type Identification

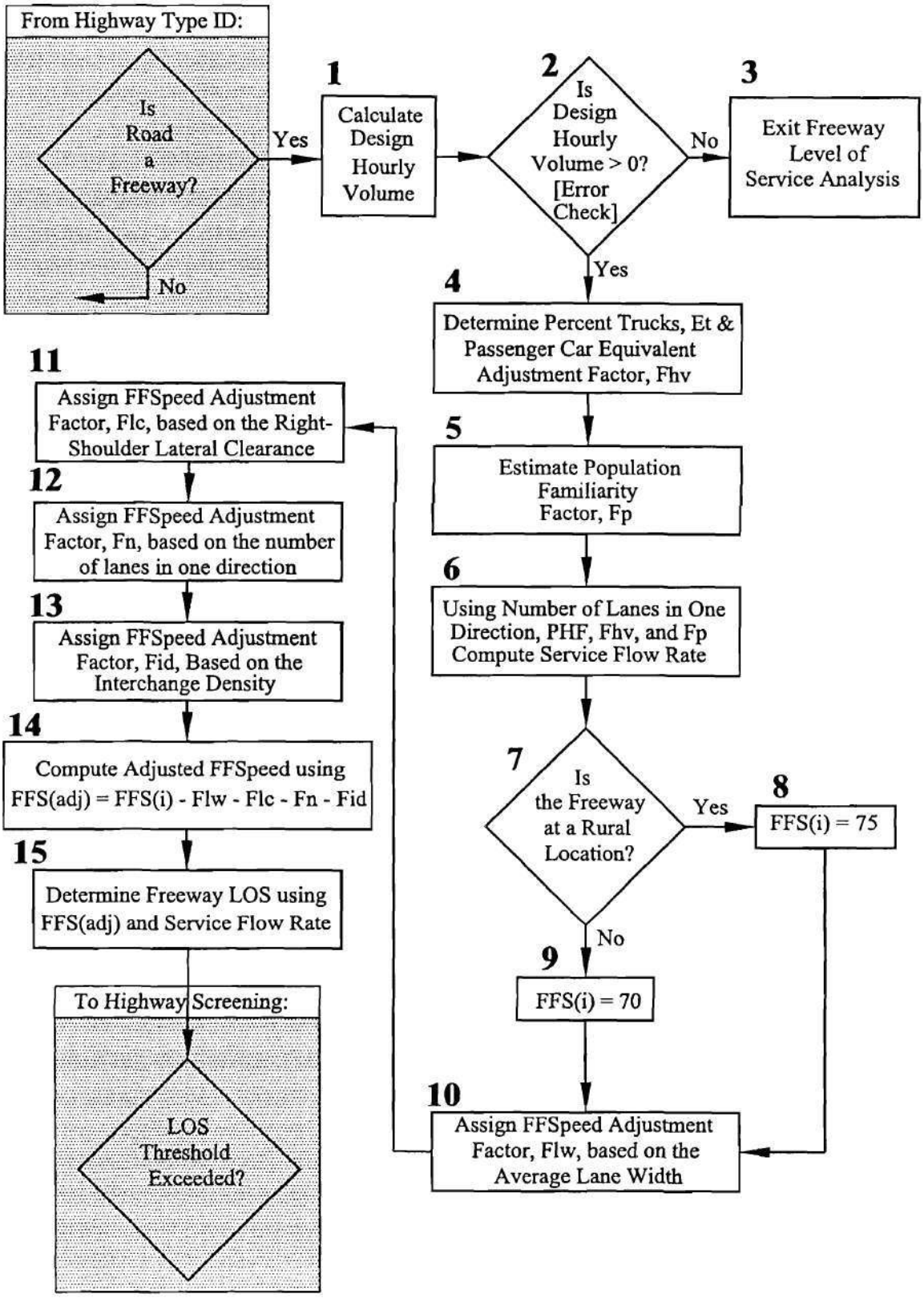

Figure 1-5. Freeway Level of Service Analysis

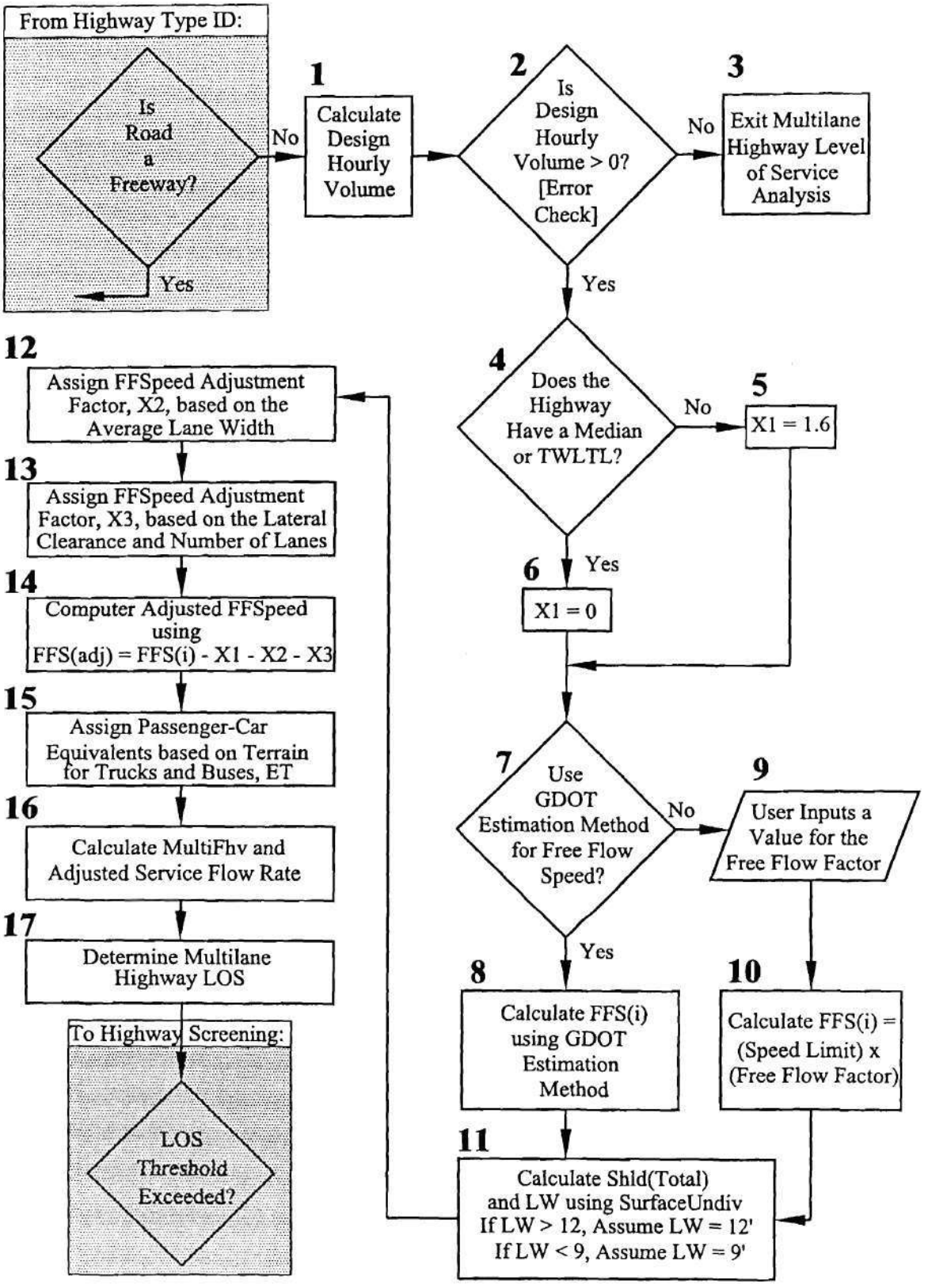

Figure 1-6. Multilane Highway Level of Service Analysis

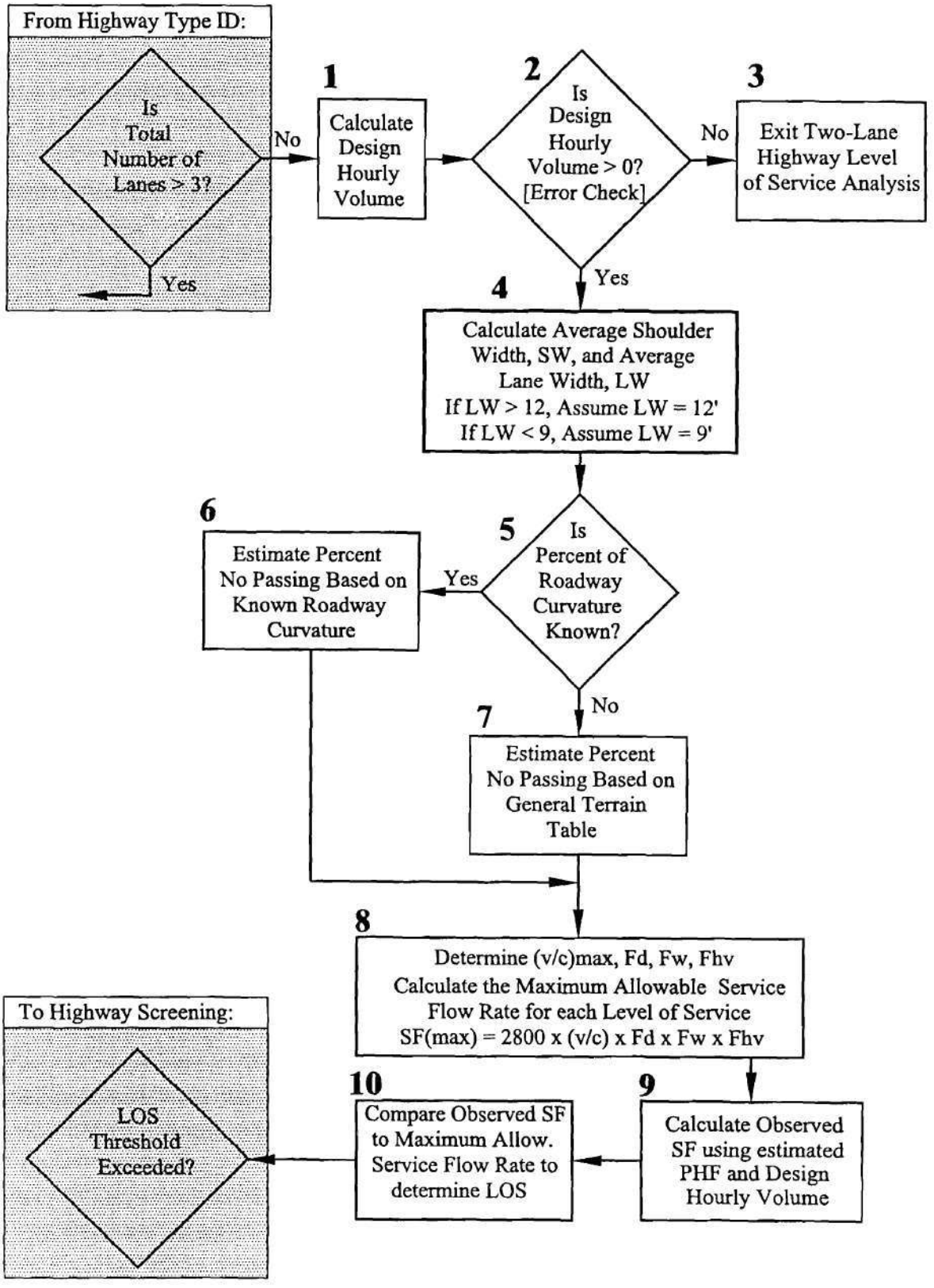

Figure 1-7. Two-lane Highway Level of Service Analysis

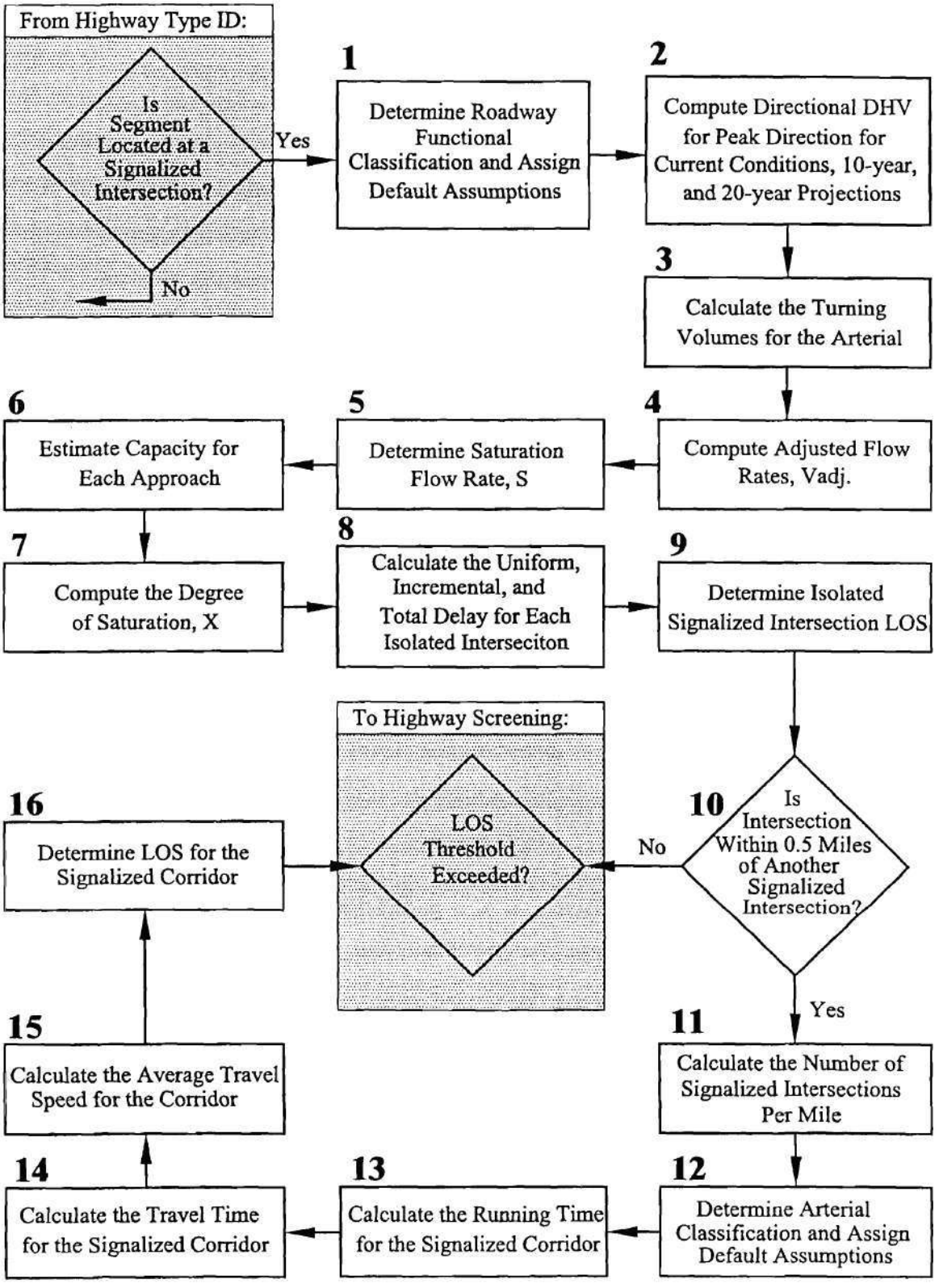

Figure 1-8. Signalized Intersection Level of Service Analysis

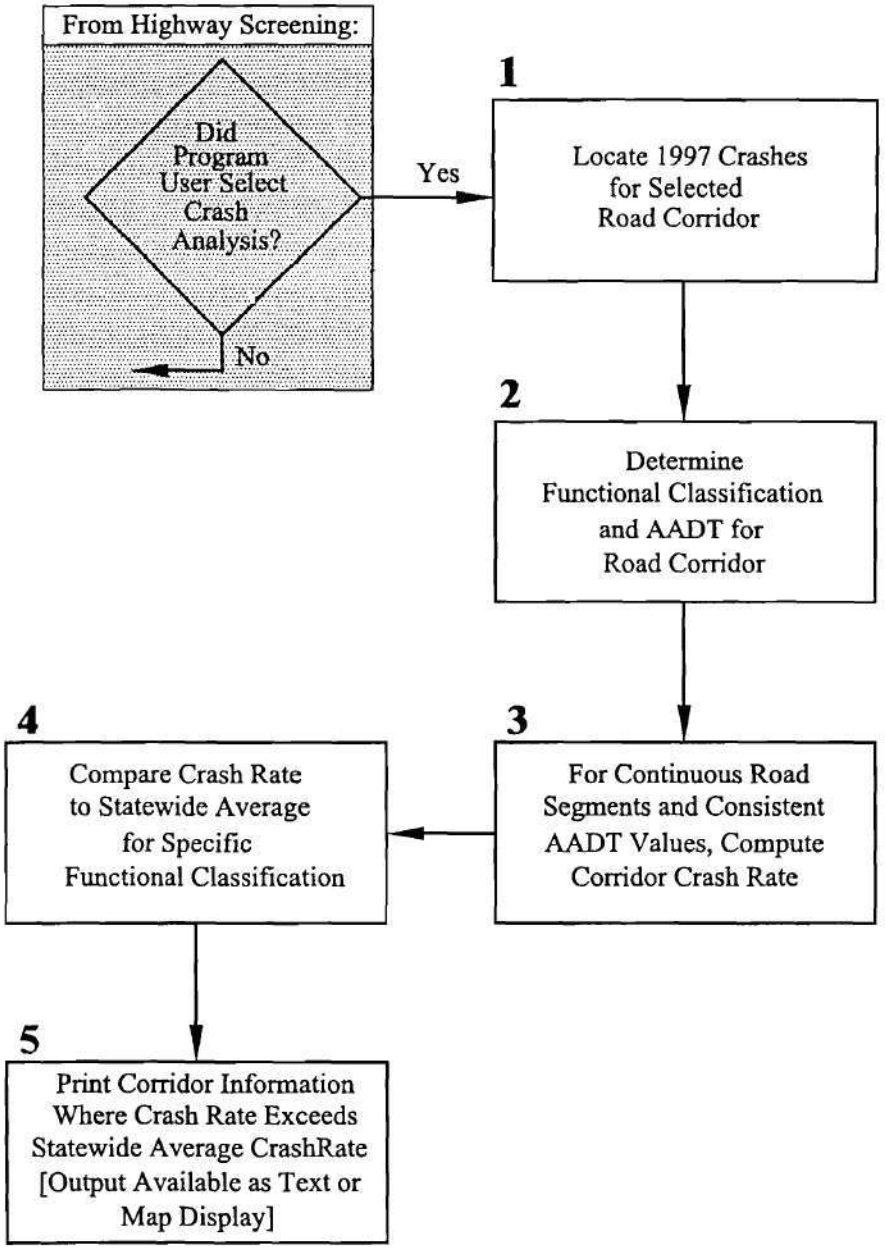

Figure 1-9. Highway Crash Analysis

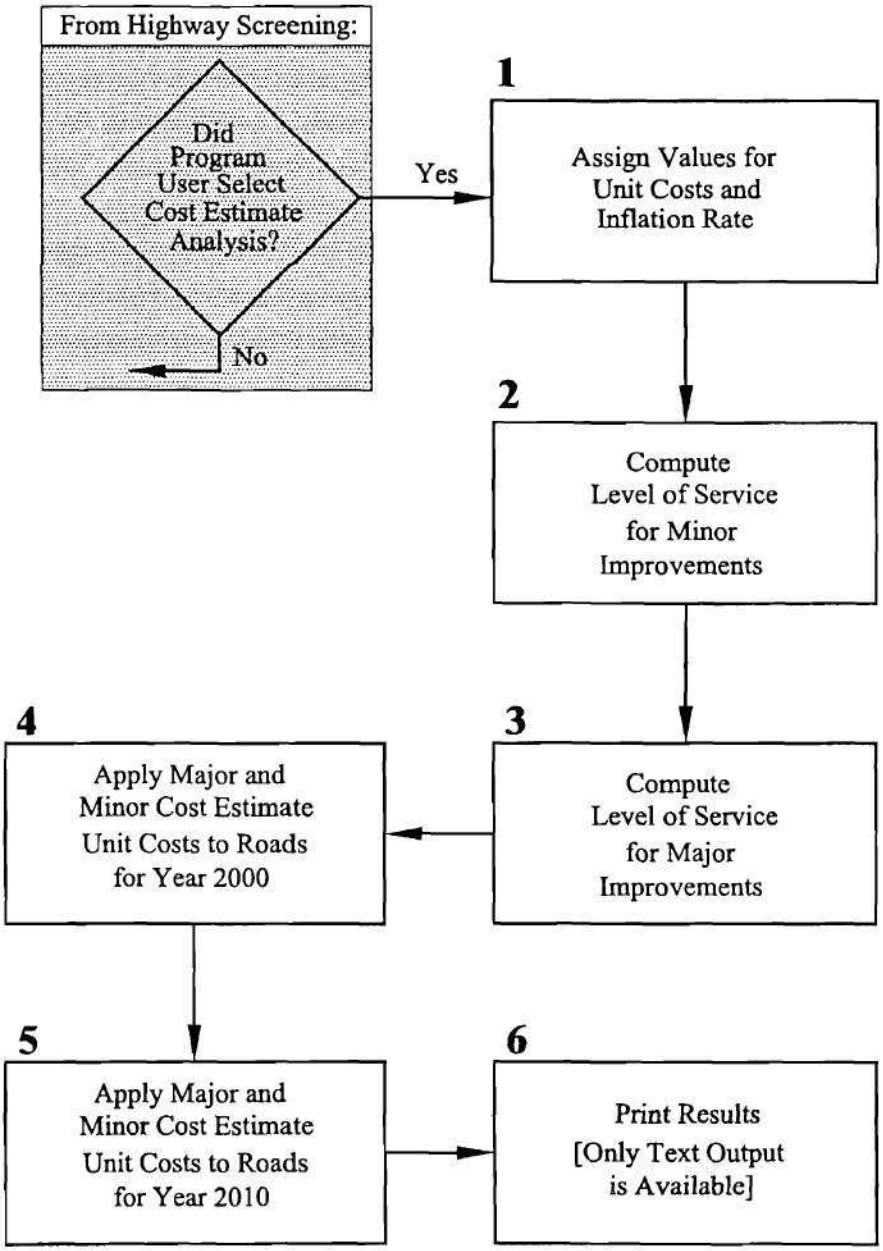

Figure 1-10. Cost Estimation Analysis

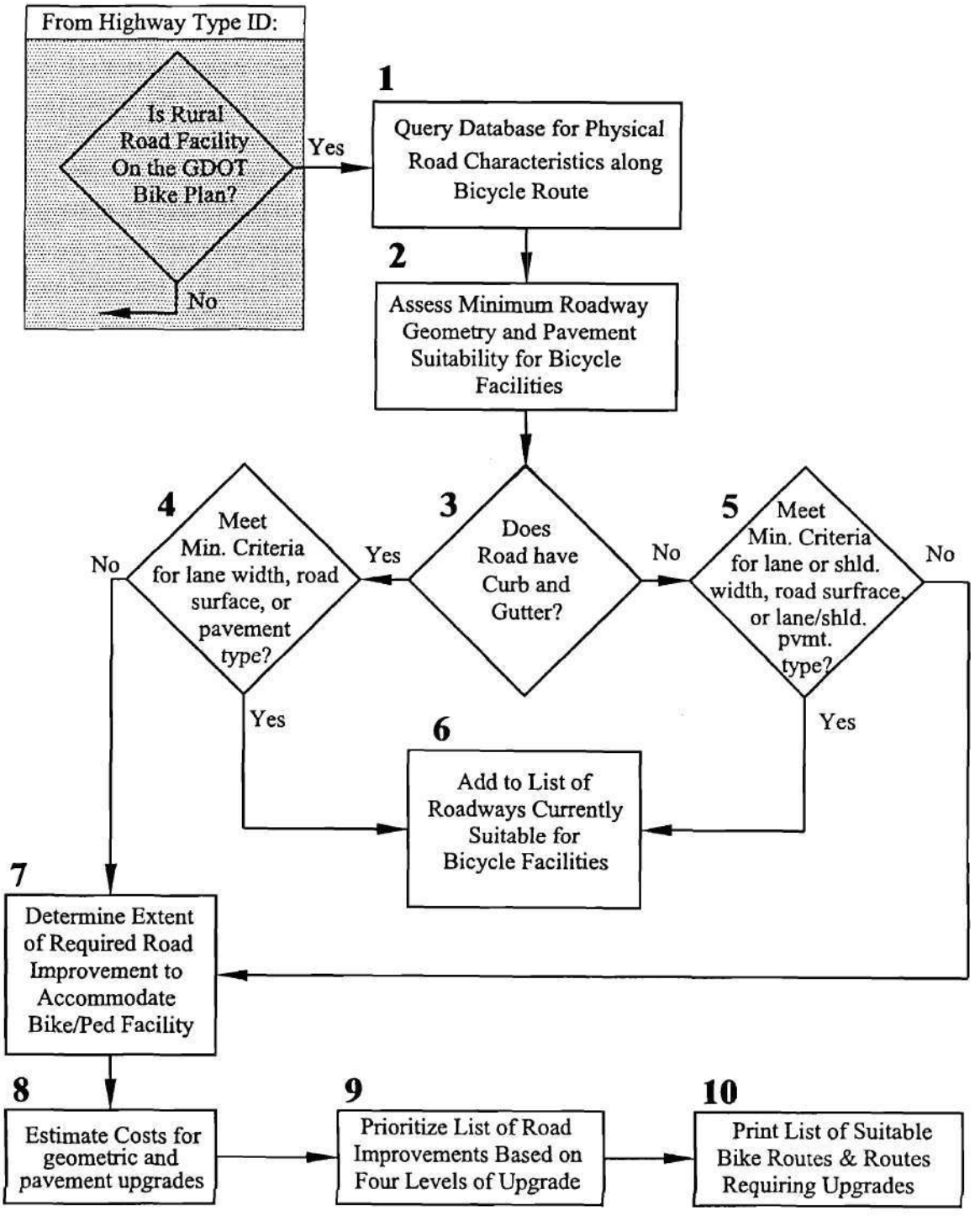

Figure 1-11. Bicycle and Pedestrian Analysis

CHAPTER 2. AVIATION ANALYSIS

2.1. Aviation Overview

The MTPT aviation analysis is based upon two GDOT data sources. The five-year aviation CIP provides anticipated improvement projects based upon local input. The CIP is updated annually, and is maintained in a Microsoft Access database in Intermodal Programs. Ed Ratigan has offered to provide the MTPT users with annual updates of the CIP. These updates should be available in June of each year.

A separate database record is maintained for each airport; the airports are categorized according to "associated city". Table A-1 (in the report appendix) includes a copy of the Georgia Statewide Aviation Plan. FAA funded airports are also available to the program, but are not included in Table A-1. Table A-1 includes the airport name, airport code, county, associated city, RDC, and the recommended priority level from the system plan. A list similar to Table A-1 is available to the MTPT in the form of an Access database. This resource permits the MTPT to include recommendations for the appropriate airport when a city or county analysis is undertaken.

2.2. Aviation Logic and Output Format

The analysis logic is as follows. A user first selects an analysis area (district, RDC, county or city). For a city-level analysis, the MTPT query's its aviation database to determine if there is a general aviation airport associated with the city. For a district, RDC or county-level analysis, the MTPT should query its aviation database to identify all general aviation airports in the selected county or counties. Using the "associated city" for each airport, the MTPT will then query aviation CIP information to determine the type, cost and year of programmed improvements. A "Level" assignment indicates the significance of the airport to its geographic region. Level 1 indicates the general aviation airport potentially impacts the economy of the local community. A Level 2 value indicates both local community and surrounding area economic impact. A Level 3 assignment represents an airport with a potential economic impact for a large region. If a general aviation airport is scheduled for replacement or closure, the program assigns a Level 4.

If the aviation database does not list any airport associated with the selected area, the MTPT will return the following statement as output:

> *The Multimodal Transportation Planning tool has not identified any airports from the Georgia Statewide Aviation System Plan in the selected area.*

If the aviation database lists one or more airports in the selected area, the MTPT will print the following information as output:

The Multimodal Transportation Planning tool has identified the following airports in the selected area from the Georgia Statewide Aviation System Plan		
City	*County*	*Level*
(The MTPT will fill in the columns with the appropriate information.)		

Following identification of associated airports in the analysis area, the program next queries the capital improvement program (CIP) database to identify proposed projects for the individual general aviation airports. The MTPT will then print the CIP results as follows:

The Multimodal Transportation Planning tool has identified the following airports and improvements from the Capital Improvement Program.					
				Project cost	
City	*Year*	*Project Description*	*Total*	*State*	*Local*
(The MTPT will fill in the columns with the appropriate information.)					

2.3. Program Functional Requirements for Aviation

The MTPT does not require the user to identify any aviation defaults, so analysis can be performed following selection of the Aviation mode and the analysis area. The databases required for aviation analysis are the access file *county.mdb* and *avi.mdb*. Tables in the county access database that are queried by the aviation module include the "AVIATION" and "DISTCITY" tables. The aviation database tables used by MTPT are "CIP- Current" and "FAA Facility." The aviation module also uses a key file called *aviation.key* as well as interim result files named *aviation.res* and *cip.res*.

CHAPTER 3. COMMUTER AND PASSENGER RAIL ANALYSIS

3.1. Commuter and Passenger Rail Overview

The Georgia State Commuter Rail Plan is available to the MTPT as a two-phase plan. The current program analysis includes a list of proposed station locations and the recommended implementation phase from the Commuter Rail Plan. Phase 1 indicates service proposed for initial plan implementation. Phase 2 represents rail service proposed for later implementation. Table A-2 in the appendix of this report summarizes the described Commuter Rail Plan.

3.2. Commuter and Passenger Rail Logic and Output Format

The MTPT performs the passenger rail analysis for the area selected by the program user. Valid analysis areas include a specific GDOT District, RDC, county, or city. In the event the user selects a roadway corridor using the map selection option, the program will evaluate the rail plan for the county in which the road is located.

If there are no recommended commuter rail stations within the selected area, the MTPT will return the following statement as output:

The Multimodal Transportation Planning tool did not identify commuter rail service as part of the State Commuter Rail Plan in the selected area.

If one or more commuter rail stations are recommended for the selected area, the MTPT will print the following information as output:

The Multimodal Transportation Planning tool identifies an existing or proposed commuter rail station as part of the State Commuter Rail Plan in the following cities.

-- *A commuter rail station at <City Name> is suggested for implementation in phase <plan phase number>*

-- *A commuter rail station ...*

3.3. Program Functional Requirements for Commuter and Passenger Rail

The MTPT does not require the program user to identify any rail defaults, so analysis can be performed following selection of the Passenger Rail mode and the analysis area. The database required for rail analysis is the access database file *county.mdb*. Tables in the county access database that are queried by the passenger rail module include the "RAIL", "COUCIT", and "CCDRDC" tables. The rail module also uses a key file called *rail.key* as well as an interim result file named *comrail.res*.

CHAPTER 4. INTERCITY BUS ANALYSIS

4.1. Intercity Bus Overview

The Georgia intercity bus plan provides information on where current services are potentially vulnerable to abandonment, and where new services should be considered. The MTPT includes an access file database that identifies potential new routes and all routes vulnerable to abandonment. A copy of the intercity bus list is depicted in Table A-3 of the Appendix. For new routes, the list includes the county name, potential highway route (from the Georgia plan) and designation as a potential new route (State Class 1). For vulnerable routes (State Class 3), the list includes the service provider, route number, cities currently served, highway routes used, and designation as a vulnerable route.

4.2. Intercity Bus Logic and Output Format

The analysis logic is as follows. A user first selects an analysis area (district, RDC, county or city). For a city-level analysis, the MTPT will query its intercity bus database to determine if "vulnerable" intercity bus service is currently provided to that city. For a district, RDC or county-level analysis, the MTPT will query its intercity bus database to identify either recommended new service in the county, or a "vulnerable" intercity bus service that serves cities within that district, RDC or county. The result of this system level analysis will be a list that identifies new service needs and potentially vulnerable service within the selected area. No separate prioritization or analysis will occur.

If the intercity bus database does not list any service information for the selected area, the MTPT will return the following statement as output:

> *The Georgia statewide intercity bus plan does not identify any new Intercity bus service needs or existing Intercity bus services potentially vulnerable to abandonment in the selected area.*

If the intercity bus database lists service information for the selected area, the MTPT will structure the presentation of output as follows:

The statewide intercity bus plan (Intercity Bus Transportation in Georgia) identifies the following intercity bus service(s) as potential new needs:

1. *In <County Name> county, along Highway Route <Route Number>.*
2. *In <County Name> ...*

The statewide intercity bus (Intercity Bus Transportation in Georgia) identifies the following intercity bus service(s) as potentially vulnerable to abandonment:

1. *In <County Name> county, Route <Bus Route> operated by <Service Provider>, providing services to <City 1>, <City 2>, <...> along Highway Route <Route Number>.*
2. *In <County Name> ...*

It is recommended that the user contact the Georgia Department of Transportation, Office of Intermodal Programs to discuss potential strategies for addressing these intercity bus needs.

4.3. Program Function Requirements for Intercity Bus

The MTPT does not require the program user to identify any intercity bus defaults, so analysis can be performed following selection of the Intercity Bus mode and the analysis area of study. The database queried for intercity bus analysis is the file *county.mdb*. The Table in the county access database that is specifically queried by the intercity bus module is the "BUSSYS1" table. The intercity bus module also uses an interim result file named *citybus.res*.

CHAPTER 5. TRANSIT ANALYSIS

5.1. Transit Overview

The transit analysis module performs several tasks. First it eliminates urbanized and FTA Section 5311 public transit service provider regions from analysis. Next, the module evaluates the socioeconomic characteristics for a region to determine transit needs, prioritizes the identified needs, and estimates implementation costs.

5.2. Transit Logic and Output Format

The transit logic can best be summarized as a step by step approach using Figure 1-2 (Transit System Screening) as a graphic guide. Each reference to a Box in the transit summary below is referring to Figure 1-2 flow chart boxes.

Box A: Prior to transit module initialization, the program user selects an analysis area. The transit analysis evaluates conditions on a county basis only. As a result, if a user selects a city, the analysis will evaluate the entire county in which the city is located. Similarly, if a GDOT District or RDC is selected, the analysis will perform a county-by-county evaluation for all of the associated counties.

Box 1: Box 1 represents a data input screen that allows the user to select the typical service characteristics for analysis area. The user will be allowed to select between low (default value), medium and high levels of service. The estimated value for the annual transit revenue vehicle miles per capita is determined based on a straight algebraic function involving total county population (for 1990, 2000, and 2010) as follows:

- Low level of service: RVM = 2.0 x total county population
- Medium level of service: RVM = 5.0 x total county population
- High level of service: RVM = 9.0 x total county population

The form for this selection can be activated in the MTPT by selecting from the main menu the following command:

Analysis → Input Data → Transit

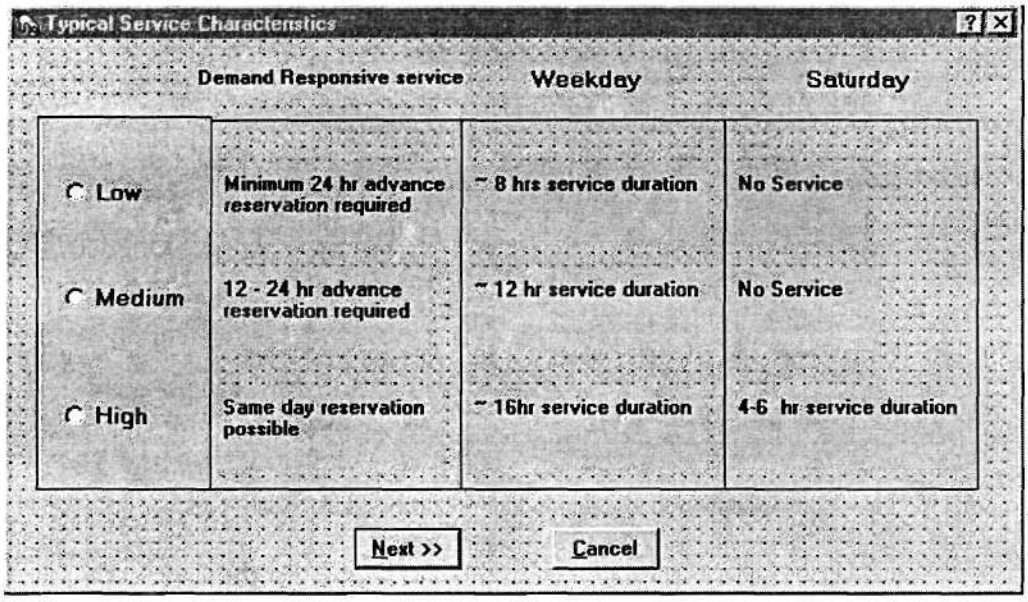

Figure 5-1. MTPT Transit Typical Service Characteristics Form

Box 2: Box 2 represents a data input screen where the program user selects Vehicle Size for analysis. This input form is reached by selecting the "Next>>" button on the Typical Service Characteristics Form shown in Figure 5-1. The Vehicle Size form is represented in Figure 5-2. The user is allowed to select between the following vehicles:

- Small Van: 8 passengers; not handicapped accessible; typical for additional service in lower demand areas.
- Large Van: 10 to 12 passengers; handicapped accessible; typical for service initiation.
- Mini Bus: 15 passengers; handicapped accessible; service initiation with higher demand.
- Shuttle Bus: 16+ passengers; handicapped accessible; heavier demand situations.

Box 3: At this point, the program will determine if the county under analysis is located in an urbanized area. The MTPT transit algorithms do not apply to urbanized regions so upon initiation of the transit analysis, the program searches the transit database to determine if the specific county is considered urbanized. Note that urbanized area designation often encompasses only a portion of a county [e.g. Muscogee]. For the purpose of the MTPT, the entire county will be considered urbanized. Table A-4 indicates Georgia counties identified as urbanized. In the event a "No" value is returned (indicating the county is not urbanized), the analysis will proceed to Box 4. If a "Yes" is

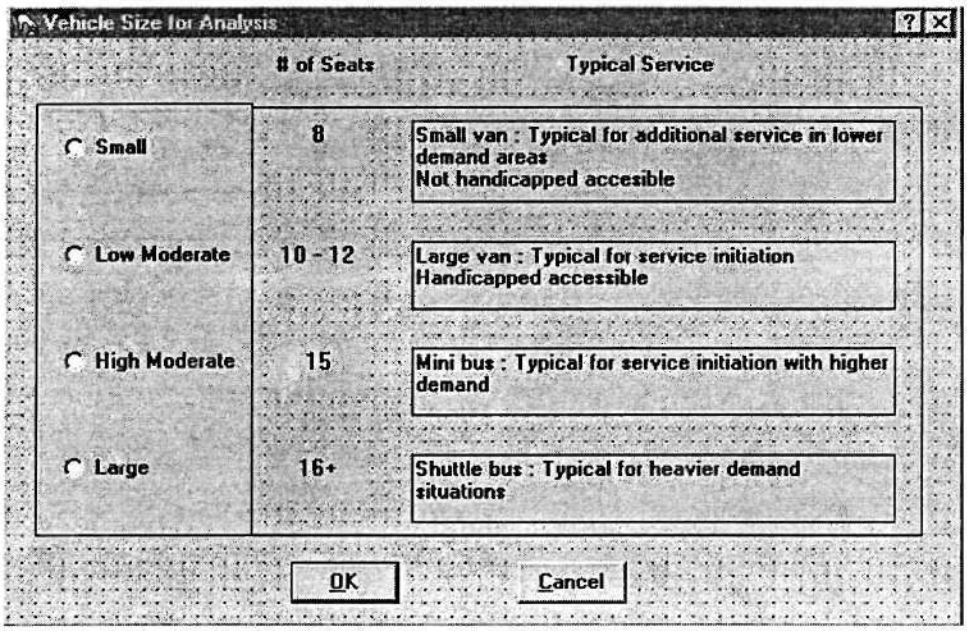

Figure 5-2. MTPT Transit Vehicle Size for Analysis Form

returned, the analysis will proceed to Box 5 where the analysis will then be stopped and the following message returned:

> *A portion of the selected area is located within a Census designated urbanized area. Rural transit analysis is not available for <County Name> County.*

Box 4: In the event Box 2 returned a value of "No", the program will evaluate the identified county to determine if rural transit is currently operated by an FTA Section 5311 funded provider. The MTPT analysis procedure does not apply to areas in which this service currently exists. A list of counties with Section 5311 providers is included in the MTPT database and is also included as Table A-5 in the Appendix of this document. In the event a "No" value is returned (indicating the county is not currently operated by an FTA Section 5311 funded provider), the analysis will proceed to Box 6. If a "Yes" is returned, the analysis will proceed to Box 5 where the analysis will then be stopped and the following message will be displayed:

> *<County Name> County currently has a FTA Section 5311 public transit service provider. Contact the Georgia Department of Transportation to inquire about potential service modifications.*

Box 5: As indicated in the description of Box 3 and Box 4, when Box 5 is encountered the program will terminate transit analysis due to area selection beyond the scope of the transit analysis included in the MTPT.

Box 6: In the event Box 4 returned a value of "No", the program next acquires relevant socioeconomic data based on census data as maintained in the MTPT transit database. The primary source for this data was the CTPP CD-ROM for Georgia. The transit database also includes land area and historical county population information.

Box 7: In this box, census data items for each county (as acquired in Box 6) are incorporated in the transit database in a format where each item is divided by the 1990 county total population. This format is provided to permit the program to directly apply the percent of total population in each category. The specific categories available in the database are summarized as follows:

- Total persons aged 60 and over (analysis item);
- Total persons living below poverty level (analysis item);
- Persons aged 16 to 64 with mobility limitation (analysis item);
- Persons enrolled in grade school;
- Persons enrolled in high school;
- Total persons with mobility limitations;
- Employed persons with mobility limitations;
- Total households with no vehicles;
- Persons using bus, walk or bicycle modes to work;
- Persons using carpool to work.

Box 8: In this box the program analyzes statewide averages for the ten summary data items identified in Box 7. Averages (based on 1990 Census data) are presented for the specific analysis county along with the values of the following two categories:

- Average of all Georgia rural (non-urbanized) counties; and,
- Average of all Georgia rural counties with existing public transit service.

Within this box, the program also compares the statewide averages for the ten summary data items to the county being analyzed. In this comparison, the number of the ten data items where the county average is larger than the overall statewide average is determined and assigned to a variable called *StatewideCount. A* similar comparison is made between the county average and the statewide average for current Section 5311 providers (this variable is called *Count5311*). Both of these variables are used in the prioritization summarized later in Box 18. Table 5-1 depicts the ten statewide averages used for this comparative analysis.

Table 5-1. Socioeconomic Characteristics of Rural Georgia

Data Category	Average for all Rural Counties*	Average for all Rural Counties with Transit Service*
Total Persons aged 60 and over	16.14	16.13
Total Persons living below poverty level	17.04	18.40
Persons aged 16 to 64 with mobility limitations	1.90	1.98
Persons enrolled in grade school	14.24	14.02
Persons enrolled in high school	4.27	4.44
Total persons with mobility limitations	4.68	4.73
Employed persons with mobility limitations	0.31	0.31
Total households with no vehicles	9.60	9.08
Persons using bus, walk, or cycle modes to work	1.31	1.20
Persons using carpool to work	8.24	8.50
* Values are expressed as percent of total population.		

Box 9: The program next determines if rural transit in the analysis county is currently operated by a State of Georgia or FTA Section 5310 funded social service provider. A list of counties with these providers is included in the MTPT transit database. The provider information includes the county name, service provider name, and city where the provider is located. Tables A-6 and A-7 (in the appendix) respectively show the Section 5310 and the State of Georgia provider information. If a "No" value is returned, the analysis will proceed to Box 12. If a "Yes" is returned, the analysis will proceed to Box 10.

Box 10: This box is only reached if Box 9 returns a "Yes" value. In this box, the names of the social service providers are categorized by funding source (Section 5310 or State of Georgia). Following this step, the analysis should temporarily proceed to Box 11 to print results, and then proceed to Box 12. Output format for Box 10 is as follows:

This program has determined that transit services in <County Name> County are operated by the following social service transportation providers:

<List of service provider names and cities>

These providers operate transportation services for select groups of individuals who meet specific eligibility requirements. Opportunities may exist to coordinate more extensive transit services in conjunction with these providers. Contact the Georgia Department of Transportation, Office of Intermodal Programs for further information on coordinating areawide transportation services.

Box 11: This box returns the results of Boxes 8 and 10 to the user by means of a report format.

Box 12: This box estimates an annual growth rate for population characteristics for the specific county under analysis. The rate is determined by comparing 1960 to 1990 county total population using the following equation:

$$i = \left(\frac{Pop_{1990}}{Pop_{1960}} \right)^{\left(\frac{1}{30}\right)} - 1$$

The ten year growth factor is then $(1 + i)^{10}$, while the twenty year growth factor is $(1+i)^{20}$, where "i" is the annual growth rate. As it stands now, the maximum allowable twenty year growth factor used in the MTPT is twice the ten year growth factor (e.g. if the ten year growth factor is 4, corresponding to a 15% annual growth rate, the twenty year growth factor defaults to 8 instead of the value 16 that would be found using $(1 + i)^{20}$).

Box 13: This box applies the ten and twenty year growth factors calculated in Box 12 to estimate future values for the following four data items for the county:

- Total number of persons;
- Number of persons aged 60 and over;
- Total persons below poverty line;
- Persons between the age 16 and 64 with a mobility limitation.

(This calculation assumes that the proportion of people in each category will remain relatively stable over time.)

Box 14: This box estimates demand for transit service (annual one-way trips) for 1990, 2000 and 2010 using an analysis methodology developed specifically for the MTPT. This procedure applies directly to rural areas. The following data items are required by this methodology:

- Number of persons aged 60 and over (1990, 2000 and 2010);
- Number of persons aged 16 to 64 with mobility limitation (1990, 2000 and 2010);
- Number of persons living below poverty level (1990, 2000, and 2010);
- Area of the County; and
- Annual revenue vehicle-miles of transit service based on Typical Service Characteristics previously identified in Box 1.

The methodology used by MTPT for transit demand estimation is of a form where an approximate estimate as well as a low and high range of the trip rate is computed. These values are developed as follows:

Estimate: $$Y = 0.8983 \times X^{0.822}$$

Low Range: $$Y = e^{\left\{-0.1073+\left[0.822\times\ln(X)\right]-0.646\times\left[1.004+\sqrt{\frac{\langle\ln(X)-1.17\rangle^2}{359}}\right]\right\}}$$

High Range: $$Y = e^{\left\{-0.1073+\left[0.822\times\ln(X)\right]+0.646\times\left[1.004+\sqrt{\frac{\langle\ln(X)-1.17\rangle^2}{359}}\right]\right\}}$$

Where:

Y = annual trips per person within all targeted market segments (elderly, mobility limited, and persons in poverty), and

X = annual transit revenue vehicle miles per capita (from Box 1 -- user selected option where X = 2, 5, or 9 dependant upon the Typical Service Characteristics)

The Annual Demand for a specific county can then be estimated using the Y values applied to the following equation:

AnnualDemand = Y * [(1990 elderly Population) + (1990 mobility impaired Population) + (1990 persons in poverty)]

Similarly, a BaseRVM value can be computed for a given county using the following equation:

BaseRVM = X * (Total 1990 County Population).

Box 15: Box 15 implements a methodology for estimating vehicle requirements and capital costs based on the vehicle size selected by the user in Box 2, the level of transit service selected in Box 2, and the estimated demand calculated in Box 14. Both vehicle and capital cost needs are estimated using the Corradino nomograph, with costs updated to 1997 using the Transit Price Index. These estimates should be developed only for start-up.

Two methods are used to estimate vehicle requirements. The methods are similar, with one based on average revenue vehicle miles (RVM) and the other based on annual demand. The results of the two methods are presented as an estimated range of vehicle needs. The equations are:

$$NumVehicles = \left(\frac{1.6 \times BaseRVM}{8000} \right)^{\left(\frac{1}{1.7}\right)}$$

$$NumVehicles = \left(\frac{AnnualDemand}{6000} \right)^{\left(\frac{1}{1.8}\right)}$$

Capital cost estimates are based on a straight linear relationship to the number of vehicles (using the average of the two values calculated above with each *NumVehicles* **rounded to the next higher integer** [to eliminate consideration of "partial vehicles"]):

• Small van:	Estimated capital cost (1997$) =	$65,000 x 2.2 x (Average NumVehicles)
• Large van:	Estimated capital cost (1997$) =	$85,000 x 2.2 x (Average NumVehicles)
• Mini Bus:	Estimated capital cost (1997$) =	$100,000 x 2.2 x (Average NumVehicles)
• Shuttle Bus:	Estimated capital cost (1997$) =	$115,000 x 2.2 x (Average NumVehicles)

Box 16: Box 16 estimates annual operating costs using cost data from TCRP Report 6. Both an average annual operating cost and a range of annual operating costs are calculated and presented. The equations for these calculations are as follows:

- average annual operating cost (1997$) = $6.33 x annual demand
- low range: annual operating cost (1997$) = min[($0.45 x RVM) or ($1.68 x annual demand)]
- high range: annual operating cost (1997$) = max[($5.04 x RVM) or ($10.86 x annual demand)]

Box 17: Box 17 estimates the economic and fiscal revenue benefits potentially accruing to the local economy from provision of transit service. The methodology is based on the Peng and Nelson report prepared for GDOT. The equations are as follows:

- Local Economic Impact (with FTA funding) = 50.31 x (average annual operating cost)
- Local Economic Impact (without FTA funding) = 27.81 x (average annual operating cost)
- Local Government Revenue Impact (with FTA funding) = 2.12 x (average annual operating cost)
- Local Government Revenue Impact (without FTA funding) = 0.35 x (average annual operating cost)

Box 18: Box 18 presents the results of all scenarios which have been selected for analysis by the user. This box will also determine the relative prioritization for service in the selected county. The StatewideCount and Count5311 variables referred to in Table 5-2 were determined in Box 8. Prioritization will be based on up to three issues as follows:

Table 5-2. Transit County Prioritization

Prioritization Class	StatewideCount Variable	Count5311 Variable	Annual Demand
Highest Potential Opportunity	Value must be 5 or larger	Value must be 6 or larger	Must be larger than average of current providers (22,000)
High Potential Opportunity	Value must be 5 or larger	Value must be 5 or larger	Must be larger than 80% of average for current providers (17,600)
Moderate Potential Opportunity	Value must be 5 or larger	Value must be 3 or larger	N/A
Potential Opportunity	Value must be 2 or larger	N/A	N/A

The current average annual demand for existing providers based on 1990 demand is 22,000. The analysis value for LOW level of transit service (RVM = 2.0 x [total county population]) should be compared to this current average. This discrete analysis value assuming the "Low Level of Service" (as summarized in Box 1) is used to assure consistent comparative analysis between all rural counties.

5.3. Program Functional Requirements for Transit

The MTPT requires program user input for two variables as shown in Figures 5-1 and 5-2, so analysis can be performed following Transit, Area, and Default Value selection. The database required for transit analysis is the file *transit.mdb*. Tables in the transit access database queried during analysis include the "Urban", "PRO5310", "PRO5311", "PROGAST", "SOCDAT", "Growth", and "County" tables. The transit module also uses an interim result file named *trans.tmp*.

CHAPTER 6. HIGHWAY ANALYSIS

The highway analysis module provides six analysis options. These options include freeway, multilane, two-lane, signalized intersection, crash, and cost estimate analysis. In addition, the highway analysis module interfaces with a Bicycle and Pedestrian Module (Chapter 7).

The program user can select his or her preferred analysis method in the "Type of Highway Analysis" form depicted in Figure 6-1. This form can be activated by selecting the following commands:

Analysis → Input Data →Highway

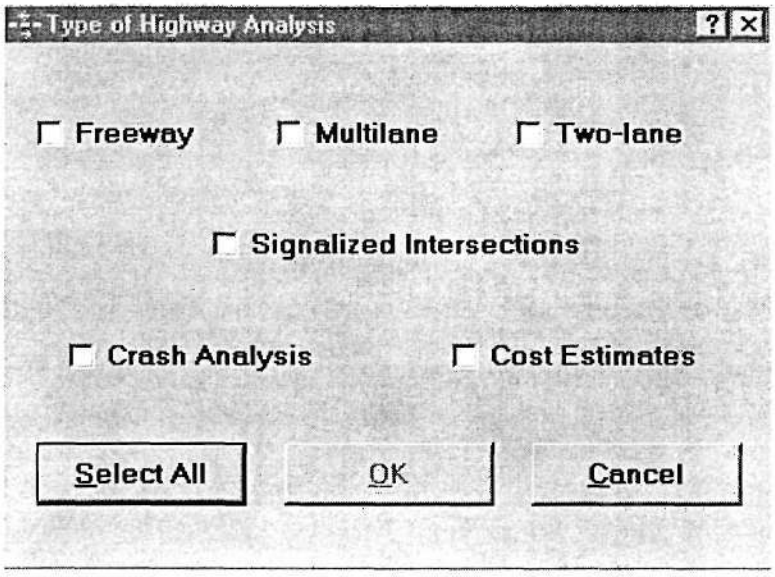

Figure 6-1. MTPT Type of Highway Analysis Form

Upon identification of the user preferred analysis method, the program initiates Highway Analysis Screening as depicted in the flow chart (Figure 1-3). This process can best be summarized as a step by step approach using Figure 1-3 as a graphic guide. Each reference to a box in the highway analysis summary below is therefore referring to Figure 1-3 flow chart boxes.

Box 1: The program user must select an area for analysis. This could be an entire county, GDOT district, RDC, selection from a map display, or a specific corridor by road number.

Box 2: In an effort to assure compatibility with proposed state bike routes, the program identifies affected bike routes in the analysis area selected in Box 1.

Box 3: No additional bicycle or pedestrian facility analysis will be performed unless the program user specifically selects the bicycle and pedestrian module. If the program user does not select bicycle and pedestrian analysis, the program proceeds to Box 4. Otherwise, the program directly proceeds to Box 5.

Box 4: In the event Box 3 returned a value of "Yes" (indicating bicycle and pedestrian analysis should be performed), the program executes a series of commands depicted in Figure 1-11 and further described in Chapter 7.

Box 5: In the event box 3 returned a value of "No" (indicated bicycle and pedestrian analysis should not be performed), the program proceeds to query the road characteristic database in an effort to determine highway facility characteristics for the analysis area.

Box 6: The program next steps through the database and selects each record for analysis. Specifically, the MTPT determines if the database record represents a signalized location, computes the number of active travel lanes, and identifies the specific functional classification of the database record.

Box 7: The MTPT evaluates the specific database record information, determines what type of facility is present (signalized intersection, two-lane road, multilane road, or freeway), and executes the respective module analysis. Figure 1-4 summarizes the Highway Type Identification process performed by the program. Sections 6.1 through 6.4 of this report identify each highway type analysis module.

Box 8: Based upon the road type, user identified level of service thresholds, and standard *Highway Capacity Manual* procedures, the program compares current traffic operation level of service to acceptable level of service values.

Box 9: The program next estimates future traffic volumes for ten and twenty years into the future based on an annual growth rate and the current AADT. The growth rates shown in Figure 6-2 were developed through a statistical analysis of historic volume data. These growth rates are not compounded annually. The growth rates for arterials apply to both major and minor arterials. Growth rates for collectors apply to both major and minor collectors. Growth rates are identified based on GDOT District. A program user may override these values by executing the Growth Rate Default form (see Figure 6-2) available in the program options section of the main menu. This form can be activated by selecting the following commands:

Options → Growth Rate Defaults

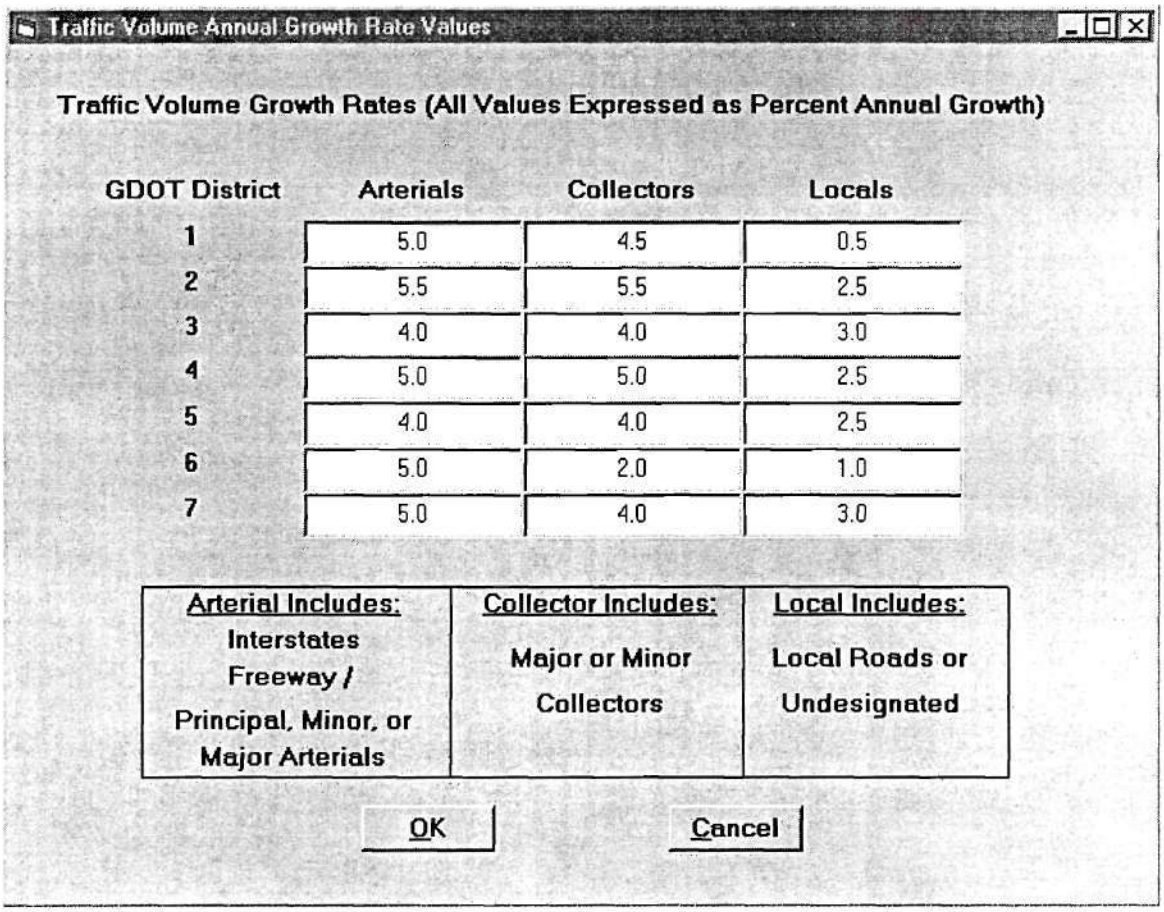

Figure 6-2. MTPT Growth Rate Default Form

The future traffic volume is then computed using the following equations:

$$Volume_{10YR} = CurrentVolume\left(1 + [GrowthRate \times 10]\right)$$

$$Volume_{20YR} = CurrentVolume\left(1 + [GrowthRate \times 20]\right)$$

Box 10: This Yes or No box repeats the logic shown for box 8 but uses the future traffic volumes determined in Box 9. If the level of service is exceeded in future years (also representing corridors where the level of service is currently exceeded), the program proceeds to Box 11. If an acceptable level of service for current, ten year, and twenty year traffic volumes is achieved, the program proceeds to Box 14 and bypasses cost estimate analysis for improvement

Box 11: In the event Box 10 returned a value of "Yes" (indicating level of service was exceeded in current or future years), the program prioritizes improvement requirements

based on a ranking scale associated with functional classification and existing road characteristics. The program evaluates average lane width, total shoulder width, combined road width, and pavement type to determine if existing road conditions meet minimum conditions as identified in Table 6-1.

Table 6-1. Minimum Operational Conditions for Roadway Facilities

	Functional Classification					
	Major*** Arterial	Minor Arterial (AADT > 2000)	Minor Arterial (AADT < 2000)	Major Collector	Minor Collector	Local
Roads without Curb:						
Lane Width	11	11	10	10	10	9
Shoulder Width	2	2	0	0	0	0
Combined Lane & Shoulder Width	14	14	10	10	10	9
Roads with Curb:						
Lane Width	11	11	10	10	10	9
Shoulder Type*	I, J, O, P or F	I, J, O, P or F	I, J, O, P or F	I, J, O, P or F	I, J, O, P or F	I, J, O, P or F
Pavement Type**	I, J	I, J	I, J	I, J	I, J, or G	I, J, or G

* Shoulder Type Index: I = Bituminous concrete (high), J = Portland cement (high), O = Bituminous concrete (high) with curb & gutter, P = Bituminous surface treatment (low) with curb & gutter, F = Bituminous surface treatment (low)

** Pavement Type Index: I = High flexible, J = High rigid, G = Mixed bituminous

*** Multilane facilities (more than two-lane) should conform to Major Arterial criteria

Table 6-2. Functional Classification Priority Point Assignment

Functional Classification	Priority Point Assignment
Rural Interstate Rural Principal Arterial Urban Interstate Urban Freeway / Expressway Urban Principal Arterial	3
Rural Minor Arterial Urban Minor Arterial Rural Major Collector	2
NFA Rural Minor Collector Urban Collector	1
Rural Local Road Urban Local Road Undesignated Road	0

For facilities with at least one substandard condition as identified in Table 6-1, a point value of one is assigned to indicate that priority consideration should be given to upgrading these unsuitable road characteristics. Acceptable conditions are assigned a point value of zero. This point assignment is then added to the functional classification priority point assignment depicted in Table 6-2. For example, a Rural Minor Arterial (2 points) with substandard lane widths (1 point) would be assigned a "Total Point Rating" of 3 (2 + 1). The action priority is then assigned based on values depicted in Table 6-3. Items with adequate level of service are assigned an action value of "X" and are not screened by the priority analysis procedure.

Table 6-3. Assignment of Action Priorities

Level of Service (LOS) Condition	Total Point Rating		
	0 or 1	2 or 3	≥ 4
Current and Future LOS Exceeded	M	N	I
Current LOS Acceptable, Future LOS Exceeded	L	M	N
Current & 10-Year LOS Acceptable, 20-Year LOS Exceeded	L	L	M
Current and Future LOS Acceptable		X	

X ≡ No Action Required
L ≡ Long Term Action (more than 10 years before action is required)
M ≡ Medium Term Action (within approximately 7 to 10 years)
N ≡ Near Term Action (within approximately 3 to 6 years)
I ≡ Immediate Action Required (within approximately 0 to 2 years)

Box 12: Following improvement priority assignments (Box 11), the program determines if the program user requested cost estimate analysis. If "Yes", the program proceeds to Box 13. Otherwise, the program proceeds to Box 14.

Box 13: In the event Box 12 returned a value of "Yes" (indicating the program user selected cost estimate analysis), the program executes a series of commands depicted in Figure 1-10 and further described in Section 6.6 of this report.

Box 14: In the event the user selected "No" in Box 10 or 12 OR the program has completed Box 13, the program next determines if the program user selected crash analysis for highway facilities. If "Yes", the program proceeds to Box 15. Otherwise, the program proceeds to Box 16.

Box 15: In the event Box 14 returned a value of "Yes" (indicating the program user selected highway crash analysis), the program executes a series of commands depicted in Figure 1-9 and further described in Section 6.5 of this report.

Box 16: At this point, highway analysis is complete. Results can be displayed as a text report or, with the exception of the cost estimate analysis, as a map result display. Any analysis records that did not have valid AADT values (greater than zero) are printed as

error records at the end of the text report for highway analysis. Error output format is as follows:

Error Records for Highway Analysis				
<Two-lane, Multilane, or Freeway> Road Segments Unavailable for analysis in <county name> County.				
RTE#	BMP	EMP	RTE	FC
(The MTPT will fill in the columns with the appropriate information.)				

6.1. Freeway Analysis

6.1.1. Freeway Overview

The freeway analysis module evaluates level of service conditions for basic freeway sections (using current traffic volumes as well as predicted volumes). The methodology used for this analysis is based on the *Highway Capacity Manual* Basic Freeway Chapter as revised in 1997.

6.1.2. Freeway Logic and Output Format

The freeway logic can best be summarized as a step by step approach using Figure 1-5 (Freeway Level of Service Analysis) as a graphic guide. Each reference to a box in the freeway summary below is therefore referring to Figure 1-5 flow chart boxes.

Box 1: The freeway Level of Service analysis is activated when the Highway Type Identification method identifies the roadway segment as a freeway. The program determines the number of lanes and average annual daily traffic (AADT) in vehicles per day from the road characteristic file. Values for the percent of AADT occurring in the peak direction (K) and percent of peak hour traffic in peak direction (D) are determined based on user input in the freeway input form depicted in Figure 6-3. This form can be activated in the MTPT by selecting from the main menu the following commands:

Analysis → Input Data → Highway → Freeway

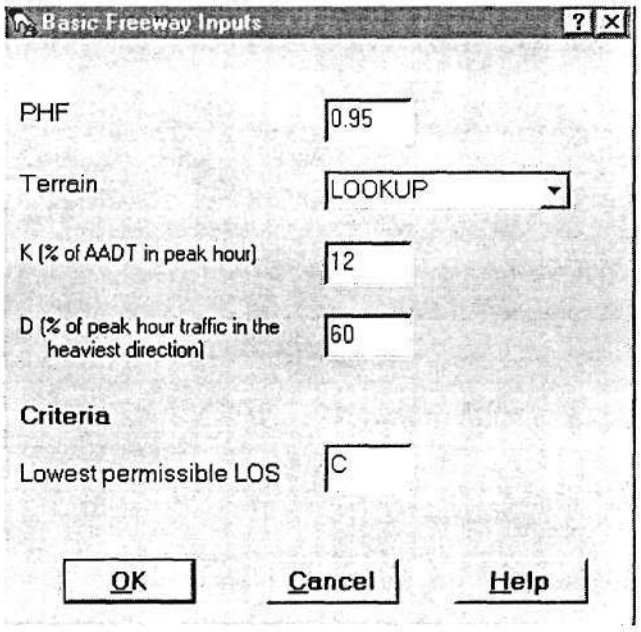

Figure 6-3. MTPT Freeway Input Form

Upon identification of all the variables, the Design Hourly Volume (DHV) is calculated using the following equation:

$$DHV = AADT \times K \times D$$

Where:

DHV is in vehicles per hour (one direction), AADT represents total two-directional daily volume, and both K and D represent the input values the user identified in Figure 6-3 expressed in decimal format (a K value of 12% from Figure 6-3 would be used as 0.12 in the equation).

Box 2: Verify the road characteristic file value of the AADT has an hourly traffic volume greater than zero. The purpose of this box is to provide an error check to verify that the AADT field in the road characteristic file has a positive value assigned. This will prevent future erroneous computations based on an incorrect traffic volume.

Box 3: In the event Box 2 returned a value of "No" (indicating incorrect traffic volume values), the freeway level of service analysis for that specific road section will be terminated and the road segment will be indicated in the "Error Summary" available in the text output.

Box 4: In the event Box 2 returned a value of "Yes", this box determines the proportion of trucks (based on the percent of trucks identified in the road characteristic file), determines the Passenger-Car Equivalents based on Terrain for Trucks and Buses, ET, and then computes the Fhv correction factor using the following equation:

$$Fhv = \frac{1}{1 + \left(\frac{PT}{100}\right)(ET - 1)}$$

The value of ET is determined from general terrain conditions as shown in Table 6-4 (based on Table 3-2 of the 1997 HCM). If the program user selected the "LOOKUP" terrain option in Figure 6-3, relative terrain conditions are estimated for a specific county based on the values shown in Table A-8 (of the appendix). These approximate terrain conditions are based on data collected for the two-lane and multilane analysis module development.

Table 6-4. Passenger-Car Equivalents for Trucks and Buses

Type of Terrain	Adjustment Factor, ET
Level	1.5
Rolling	3.0
Mountainous	6.0

Box 5: The MTPT will next estimate a driver population adjustment value, Fp. Since the familiarity of the driver is difficult to estimate from the road characteristic file, a simple value of Fp = 1.0 (primarily commuter traffic during peak conditions) for non-rural conditions is assigned while a value of Fp = 0.95 (not as familiar with the road) is assumed for rural conditions.

Box 6: MTPT next uses the number of lanes in one direction (acquired from the road characteristic file), the peak hour factor (user input as shown in Figure 6-3), and the Fhv and Fp values determined in Box 4 and Box 5 respectively to determine a service flow rate, V with units of passenger cars per hour per lane (pcphpl). The following equation is used by MTPT for this computation and is based on equation 3-1 of the 1997 HCM.

$$V = \frac{DHV}{PHF \times N \times Fhv \times Fp}$$

Box 7: Different "ideal" condition free flow speed values are assumed based on rural versus urban or sub-urban environments. Box 7 queries whether the analysis section is a rural road. If the answer is yes, the program proceeds to Box 8. If the answer is no, then the program proceeds to Box 9.

Box 8: In the event Box 7 returned a value of "Yes" (indicating the road is located in a rural region), the program assigns a value for the free flow speed under "ideal" conditions as FFS(I) = 75 mph. This value is recommended by the 1997 HCM as a rule of thumb for estimation purposes.

Box 9: In the event Box 7 returned a value of "No" (indicating the road is not located in a rural region), the program assigns a value for the free flow speed under "ideal" conditions as FFS(I) = 70 mph. This value is recommended by the 1997 HCM as a rule of thumb for estimation purposes.

Box 10: The program next determines the free flow speed adjustment value (in mph) based on the average lane width, F_{LW}. Table 6-5 shows the values used by the program. This table is based on Table 3-6 of the 1997 HCM.

Table 6-5. FFSpeed Adjustment Based on Lane Width

Lane Width (feet)	Reduction in Free Flow Speed, F_{LW} (mph)
≥12	0.0
11	2.0
≤ 10	6.5

Box 11: The program next determines the free flow speed adjustment value (in mph) based on the available right-shoulder lateral clearance, F_{LC}. Table 6-6 shows the values used by the program. This table is based on Table 3-7 of the 1997 HCM.

Table 6-6. FFSpeed Adjustment for Right-Shoulder Lateral Clearance

Right Shoulder Lateral Clearance (ft)	Reduction Value, F_{LC} (mph)		
	Lanes in One Direction		
	2	3	4
≥ 6	0.0	0.0	0.0
5	0.6	0.4	0.2
4	1.2	0.8	0.4
3	1.8	1.2	0.6
2	2.4	1.6	0.8
1	3.0	2.0	1.0
0	3.6	2.4	1.2

Box 12: The program next determines the free flow speed adjustment value (in mph) based on the number of lanes in one direction. The fewer the number of one directional lanes, the more likely an individual vehicle's speed will be constricted. Table 6-7 shows the values for F_N used by the program. This table is based on Table 3-8 of the 1997 HCM.

Table 6-7. FFSpeed Adjustment Based on Number of Lanes

Number of Lanes (One Direction)	Reduction in Free Flow Speed, F_N (mph)	
	Urban or Sub-Urban	Rural
≥5	0.0	0.0
4	1.5	0.0
3	3.0	0.0
≤2	4.5	0.0

Box 13: The program next determines the free flow speed adjustment value (in mph) based on interchange density, F_{ID}. Primarily when traffic enters the freeway on an on-

ramp, this value is used and averaged over a 6-mile segment. For the purposes of the MTPT, Table 6-8 was developed to represent approximate interchange density for the individual freeway functional classifications in Georgia. This table is based on Table 3-9 of the 1997 HCM.

Table 6-8. FFSpeed Adjustment Based on Interchange Density

Georgia Functional Classification	Reduction in Free Flow Speed, F_{ID} (mph)
Rural -- Interstate principal arterial	0.0
Urban -- Interstate Principal arterial	2.5
Urban -- Freeway and Expressway	2.5

Box 14: Based on the free flow speed adjustment factors F_{LW} (identified in either Box 10), F_{LC} (identified in Box 11), F_N (identified in Box 12), and F_{ID} (identified in Box 13), the program computes an adjusted free flow speed using the following equation:

$$FFS(adj) = FFS(I) - F_{LW} - F_{LC} - F_N - F_{ID}$$

Box 15: Based upon the adjusted free flow speed (computed in Box 14) and the service flow rate (computed in Box 6), determine the level of service using the maximum values shown in Table 6-9 (based on Table 3-1 of the 1997 HCM).

Table 6-9. LOS Table for Freeways

Level of Service	FFS ≥ 75 mph	75 > FFS ≥ 70 mph	70 > FFS ≥ 65 mph	65 > FFS ≥ 60 mph	FFS < 60 mph
A	750	700	650	600	550
B	1200	1120	1040	960	880
C	1704	1632	1548	1440	1320
D	2080	2048	1984	1856	1744
E	2400	2400	2350	2300	2250

Once the MTPT determines the Freeway Level of Service condition, it repeats the calculation for future traffic volumes. The output then prints a series of information keys that summarize route types, functional classifications, priority ratings, and column headings for the tabular results. Output as a result of this module is as follows:

HIGHWAY ANALYSIS -- BASIC FREEWAY
Input for freeways
Peak hour factor in Dir 1 : <value>
Peak hour factor in Dir 2 : <value>
Terrain : <type assigned>
Lowest acceptable LOS : <value assigned>
K : <value in percent>
D : <value in percent>

Results of freeway analysis

RTE#	BMP	EMP	RTE	FC	AADT/YR	TRL	SPD	LOS(3)	ACT
(The MTPT will fill in the columns with the appropriate information.)									

Upon completion of Box 15 of the Freeway Level of Service Analysis, the program returns to the Highway Screening flow chart "LOS Threshold Exceeded?" box.

6.1.3. Program Functional Requirements for Freeways

Since the freeway analysis module is dependent on unique road conditions, the MTPT must query the GDOT road characteristic file. As a result, analysis can be performed following Freeway Module selection, Area identification, Freeway Default Values selected by the program user, and the RC file link and location. The program uses an interim text file (*free.res*) during analysis.

6.2. Multilane Highway Analysis

6.2.1. Multilane Overview

The multilane highway analysis in the MTPT is based on *Highway Capacity Manual* techniques. One limitation to the HCM method is the assumption of a known free-flow speed. Estimation of this value is difficult because the maximum speed limit for multilane highways was 55-mph when the HCM techniques were developed and suggested estimation techniques for 55-mph were limited. Since the work included in the HCM predates the repeal of the maximum speed limit that occurred as a result of the National Highway System Designation Act of 1995, an effort to quantify the free-flow speed for both 55- and 65-mph speed limit conditions was a focus for multilane evaluation. The research team performed data collection activities for development of this module. The focus of this effort was to determine a more direct correlation between posted speed (a variable available in the RC file), and free-flow speed.

The team sought to acquire speed and volume data for several multilane facilities in the state of Georgia. With this data sample, they could then identify unique road or traffic characteristics using the GDOT video log. The field collected speed values had to conform to the Highway Capacity Manual (HCM) definition of field measured free-flow speeds. The HCM indicates that the average operating speed is similar to free-flow speed for low-volume conditions (1400 passenger cars per hour per lane (pcphpl) or less). The HCM further indicates speed data that include both passenger-car and heavy-vehicle speeds can probably be used for free-flow speeds for level terrain or moderate down grades. Following data collection, two basic objectives were established. First, the HCM rules-of-thumb for estimating free-flow speed were evaluated for both the 55-mph and 65-mph condition. Transferability of these HCM estimation techniques for the 65-mph speed limit required evaluation. Second, the team performed a regression analysis to further determine the observed relationship between free-flow speed and posted speed for Georgia multilane facilities using critical factors as identified using statistical analysis. The results of these statistical evaluations are included in the following multilane highway logic summary section.

Speed values for low-volume multilane highways were acquired from Dwayne Maddox of the GDOT Traffic Operations. Mr. Maddox used static count stations for sites where speed limits were recently increased (from 55- to 65-mph). He provided speeds for both the 55-mph posted speed condition as well as the 65-mph condition. As a result, the only variable that changed between the data sets (other than minor fluctuations in daily traffic volume) was the posted speed limit. Table A-9 identifies the specific site characteristics observed for the studied sites. Geographic distribution of the sites was randomly selected across the State of Georgia. The physical road characteristics (such as grade, access points, and road curvature) were acquired from the GDOT video log. Though these characteristics may not be directly available in the RC file, literature reviews and field observations indicated that they might be critical to the free-flow speed. Table A-10

summarizes the site speeds for both speed limit conditions. Table A-11 shows the volumes and percentage of heavy vehicles in one direction of travel (i.e. a two-lane section) for each site. Daily traffic volumes ranged from 1889 vehicles per day (vpd) to 9085 vpd. The highest hourly volume observed was 614 vehicles per hour (vph) prior to the speed limit change, and 636 vph following the speed limit change. All multilane road sites studied were four-lane sections (two-lanes per direction). All data sites, therefore, easily met the 1400 pcphpl criteria established by the HCM for field measurement of free-flow speeds.

As a result of the statistical analysis, two critical variables that influence free-flow speed were identified. These two variables are the number of access points and the approximate grade of the road. During the data collection stage for this project, vertical grade values were collected for several Georgia multilane and two-lane highways. The MTPT includes a "look-up" table for model use (see Table A-8) that estimates vertical grade by county (using the HCM level, rolling, and mountainous ranges). The number of access points could not be directly extracted from the RC file, though this file does include intersection information. [Access points include the influence of driveways located along the right edge of the road (in the direction of travel).] The research team created a data collection form to use in estimating a reasonable estimate of access point density (based on nearest town population and distance from the city limits). From the data collected using the data collection form and review of multilane highway video tapes, the research team developed an approximate number of access points based on observations and associated regional population data. Figure B-1 (Appendix B) shows a sample of the video collection data sheet used for this effort.

6.2.2. Multilane Logic and Output Format

The multilane logic can best be summarized as a step by step approach using Figure 1-6 (Multilane Highway Level of Service Analysis) as a graphic guide. Each reference to a box in the multilane highway summary below is therefore referring to Figure 1-6 flow chart boxes.

Box 1: The multilane Level of Service analysis is activated when the Highway Type Identification method identifies the roadway segment as a multilane highway. The program determines the number of lanes and average annual daily traffic (AADT) in vehicles per day from the road characteristic file. Values for the percent of AADT occurring in the peak direction (K) and percent of peak hour traffic in peak direction (D) are determined based on user input in the multilane input form depicted in Figure 6-4. This form can be activated in the MTPT by selecting from the main menu the following commands:

Analysis ➔ Input Data ➔ Highway ➔ Multilane

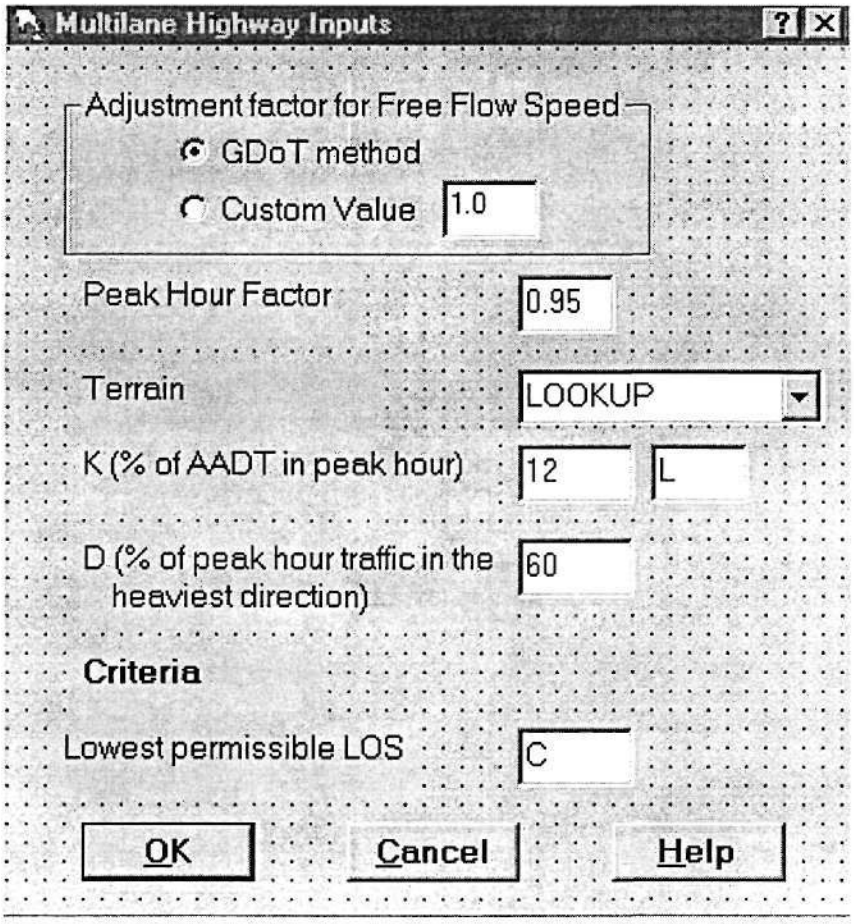

Figure 6-4. MTPT Multilane Highway Input Form

Upon identification of all the variables, the Design Hourly Volume (DHV) is calculated using the following equation:

$$DHV = \frac{\frac{K \times D}{100} \times (AADT)}{NumberLanes_{OneDirection}}$$

Box 2: Verify the road characteristic file value of the AADT has an hourly traffic volume greater than zero. The purpose of this box is to provide an error check to verify that the AADT field in the road characteristic file has a positive value assigned. This will prevent future erroneous computations based on an incorrect traffic volume.

Box 3: In the event Box 2 returned a value of "No" (indicating incorrect traffic volume values), the multilane level of service analysis for that specific road section will be

terminated and the specific road segment will be indicated in the "Error Output" printed at the end of the text results.

Box 4: In the event Box 2 returned a value of "Yes", this box next determines if the multilane highway is divided. If the program determines the road is undivided it then proceeds to Box 5. If the road in divided or has a two-way left turn lane (TWLTL), the program proceeds to Box 6.

Box 5: In the event Box 4 returned a value of "No" (indicating the highway is not divided), the program assigns a value of X1 = 1.6 for a free flow speed reduction adjustment value for median type for undivided highways. This value is based on Table 7-2 of the Highway Capacity Manual (1997 update).

Box 6: In the event Box 4 returned a value of "Yes" (indicating the highway is divided), the program assigns a value of X1 = 0 for a median type free flow speed reduction adjustment value for divided highways. This value is based on Table 7-2 of the Highway Capacity Manual (1997 update).

Box 7: Two free flow speed estimation methods are available to the user as indicated in the multilane input form (Figure 1). Box 7 asks if the user has selected the GDOT Estimation Method for Free Flow Speed.

Box 8: In the event Box 7 returned a value of "Yes" (indicating the user selected the GDOT Estimation Method for Free Flow Speed), the program first determines if the speed limit is below 55 mph. If so, the Free Flow Speed for ideal conditions [FFS(i)] is assumed to be:

$$FFS(i) = (Speed\ Limit) + 7\ mph \quad \text{[for 40 or 45 mph speed limits]}$$

$$FFS(i) = (Speed\ Limit) + 5\ mph \quad \text{[for 50 mph speed limit]}$$

If the speed limit is 55 mph or greater, the program determines an ideal condition free flow speed based on the approximate number of access points (estimated based on population of adjacent region), speed limit, and terrain type. The access point adjustment factor (based on population) is depicted in Table 6-10.

Table 6-10. Access Point Adjustment Factor

Location	Population	a-Factor	Access Points per Mile
Not a City	< 15,000	0	0 to 1.5
	15,000 ≤ Population < 30,000	1	2 to 3.5
	30,000 ≤ Population < 80,000	2	4 to 5.5
	≥ 80,000	2	≥ 6
City	Varies	1	2 to 3.5

Table 6-11 identifies an estimated value for a speed limit s-factor that ranges from 0 to 1.

Table 6-11. Speed Limit Adjustment Factor

s-factor	Speed Limit (mph)
0	≤ 55
[(Speed Limit) – 55] / 10	55 < (Speed Limit) < 65
1	≥ 65

Table 6-12 similarly assigns a t-factor based on identified terrain conditions. If the user selected the terrain "LOOKUP" option from Figure 6-4, the MTPT uses terrain values as shown in Table A-8.

Table 6-12. Terrain Type Factor

t-factor	Terrain
0	Level
1	Rolling
2	Mountainous

The approximate free flow speed for ideal conditions is then determined as follows:

$$FFS(i) = 63.3 - 1.3a - t + 2.9s$$

Box 9: In the event Box 7 returned a value of "No" (indicating a user defined free flow factor selected), a direct free flow speed adjustment factor is identified for use in Box 10.

Box 10: The user defined free flow speed adjustment factor (from Box 9) is next used to approximate the free flow speed for ideal conditions as follows:

$$FFS(i) = (Speed\ Limit) \times (User\ Defined\ Adjustment\ Factor)$$

Box 11: Following free flow speed estimation (for ideal conditions) as computed in Box 8 or Box 10, the total shoulder width (SW) is calculated as follows:

$$SW = (Left\ Shoulder\ Width) + (Right\ Shoulder\ Width)$$

Where the Left and Right Shoulder maximum width is six feet each for a maximum value of $SW = 12$. These values are provided in the road characteristic file. The average lane width (LW) is also determined using the following relationship:

$$LW = \frac{PW}{N_{LT} + N_{RT}}$$

Where:

PW = total pavement width (feet);

N_{LT} = number of lanes on the left; and

N_{RT} = number of lanes on the right.

For divided roads, PW is calculated using only one side of the road and the lanes associated with that side. For roads with the TWLTL configuration, PW excludes the width of the center lane.

If $LW > 12$, assume $LW = 12$.

If $LW < 9$, assume $LW = 9$.

Box 12: Compute a free flow speed adjustment factor, X2, based on the average lane width (computed in Box 11) as depicted in Table 6-13 (based on Table 7-3 of the Highway Capacity Manual).

Table 6-13. FFSpeed Adjustment Based on Lane Width

Lane Width (feet)	Reduction in Free Flow Speed, X2 (mph)
LW ≤ 10	6.6
10 < LW ≤ 11	1.9
11 < LW ≤ 12	0.0

Box 13: Compute a free flow speed adjustment factor, X3, based on the available lateral clearance to adjacent roadside obstacles as shown in Table 6-14 (based on Table 7-4 of the Highway Capacity Manual).

Table 6-14. FFSpeed Adjustment Based on Lateral Clearance

Total Shoulder Width (feet)	Adjustment Factor, X3	
	Four-Lane Highway	Six-Lane Highway
0	5.4	3.9
1	4.5	3.35
2	3.6	2.8
3	2.7	2.15
4	1.8	1.7
5	1.55	1.5
6	1.3	1.3
7	1.1	1.1
8	0.9	0.9
9	0.65	0.65
10	0.4	0.4
11	0.2	0.2
12	0	0

Box 14: Based on the free flow speed adjustment factors X1 (identified in either box 5 or 6), X2 (identified in box 12), and X3 (computed in box 13), the program computes an adjusted free flow speed using the following equation:

$$FFS(adj) = FFS(i) - X1 - X2 - X3$$

Box 15: Compute a heavy vehicle passenger-car equivalent factor (ET) based on type of terrain as depicted in Table 6-15 (based on Table 7-7 of the Highway Capacity Manual).

Table 6-15. Passenger-Car Equivalents for Trucks and Buses

Type of Terrain	Adjustment Factor, ET
Level	1.5
Rolling	3.0
Mountainous	6.0

Box 16: The program determines the percent of trucks (PT) from the road characteristic file. The PT and the ET values are then used to determine a heavy vehicle correction factor, Fhv, using the following equation:

$$Fhv = \frac{1}{1 + \left(\frac{PT}{100}\right)(ET - 1)}$$

The Adjusted Service Flow Rate, V, is then determined using the following equation:

$$V = \frac{DHV}{PHF \times Fhv}$$

where the average number of lanes and the peak hour factor are determined from the road characteristic file and user input (Figure 6-4) respectively.

Box 17: Based upon the adjusted free flow speed (computed either in Box 8 or Box 10) and the service flow rate (computed in Box 15), determine the level of service based on the maximum service flow rate values and free flow speed as shown in Table 6-16 (based on Table 7-1 of the Highway Capacity Manual).

Table 6-16. LOS Table for Multilane Highways

Level of Service	FFS ≥ 60 mph	60 > FFS ≥ 55 mph	55 > FFS ≥ 50 mph	FFS < 50 mph
A	720	660	600	540
B	1200	1100	1000	900
C	1650	1510	1400	1260
D	1940	1800	1670	1500
E	2200	2100	2000	1900

Once the MTPT determines the Multilane Level of Service condition, it repeats the calculation for future traffic volumes. The output then prints a series of information keys that summarize route types, functional classifications, priority ratings, and column headings for the tabular results. Output as a result of this module is as follows:

HIGHWAY ANALYSIS -- MULTILANE
Input for multilane highways
Adjustment factor for free flow speed : <value>
Directional distribution : <value>
Terrain : <type assigned>
Lowest acceptable LOS : <value assigned>
K : <value in percent>
D : <value in percent>

Results of multilane highway analysis

RTE#	BMP	EMP	RTE	FC	AADT/YR	TRL	SPD	LOS(3)	ACT

(The MTPT will fill in the columns with the appropriate information.)

Upon completion of Box 17 of the Multilane Highway Level of Service Analysis, the program returns to the Highway Screening flow chart "LOS Threshold Exceeded?" box.

6.2.3. Program Functional Requirements for Multilane Highways

The multilane highway level of service analysis module is dependent on unique road conditions, therefore the MTPT must query the GDOT road characteristic file. As a result, analysis can be performed following Multilane Highway Module selection, Area identification, Multilane Highway Default value assignment, and selection of the road characteristic file. The program uses an interim text file (*multi.res*) during analysis.

6.3. Two-lane Highway Analysis

6.3.1. Two-lane Overview

The two-lane highway level of service analysis in the MTPT is based on *Highway Capacity Manual* techniques. In the HCM, the percent no passing is identified as a significant contributor to the level of service for these facilities. Before the MTPT model could be refined for this analysis, the research team developed a technique by which the no passing zone percentage could be estimated.

Since Districts 1 through 6 of the Georgia Department of Transportation (GDOT) all have rural two-lane roads, the first step of this analysis was to identify candidate roadways for no passing analysis that were geographically distributed across the State of Georgia. The Manual of Uniform Traffic Control Devices identifies the critical elements that influence no passing conditions as horizontal curvature and vertical curvature (generally crest vertical curves). Additionally, no passing limitations may be placed at intersections, railroad crossings, or narrow road sections (often occurring at bridges). The primary objective of this task was to evaluate passing conditions on a district basis. Statistical analysis techniques were used to determine critical variables that contribute to no passing conditions. In the Phase I version of the MTPT, a "look up" table was used based solely on functional classification as a means of determining two-lane road no passing conditions. The table has now been modified to be a District specific table due to differences in topography and striping techniques unique to the various GDOT regions.

The primary method of acquiring no passing information is by inspection. By observing specific roadways, the percent no passing for each geometric feature within a specific region can be directly determined. The Georgia Tech research team prepared a video log summary sheet (Figure B-2) for team members to view tapes from the GDOT video library. Table A-12 summarizes the roads evaluated per district. More than 1600 miles of Georgia two-lane roadways were reviewed in an effort to develop a robust data set suitable for this analysis. As shown in Figure B-2, roadway information including milepoint, grade, center stripe configuration, bridges, intersections, driveways, and roadway curvature were identified. This information was entered into a database to permit comparative analysis.

Initially, data for one district was evaluated for critical variables and "trends" in the data set. As expected, horizontal curvature was determined to be a statistically significant variable in no passing designations. For road sections that did not occur in horizontal curvature, vertical grade (or difference in grades) and intersections were identified to be the primary influences. This statistical analysis was then applied to the remaining districts in an effort to determine characteristics that are unique to the individual Georgia regions. Following the statistical regression analysis and trend evaluation, an evaluation of percentage of road conditions was performed in an effort to determine a relationship that could be directly utilized by the Multi-Modal Transportation Planning Tool.

The GDOT RC file does not include grade or horizontal curvature information, so the research team had to determine a reasonable approximation for these values. Table A-13 shows a total percentage no passing for each of the six districts studied. Since passing can occur for vehicles traveling in either direction on a two-lane highway, the data was evaluated as though the analyst was traveling in one direction and observing conditions in the opposing direction. These two values were averaged to determine approximate percent no passing on a district-by-district basis. Unfortunately, each district is characterized by a variety of terrain and horizontal curvature conditions. For example, District 5 exhibited on average only 27.7% no passing zones. Since this district is situated adjacent to the Atlantic coastline, it is reasonable to assume that many of the areas adjacent to the ocean are near sea level and likely to exhibit level terrain conditions. Similarly, regions with natural undulations (hills, valleys, etc.) typically exhibit a higher percentage of curved roads, because the roads tend to follow natural topography. It is unlikely that level, straight roads are characteristic for the entire District 5 region. Some additional method for evaluating counties within the region is therefore appropriate.

Table A-14 shows that general terrain conditions (grades less than +3%) exhibit a substantially smaller percentage of no passing zones than regions with grades greater than +3%. Similarly, Table A-15 indicates that curved roads versus straight roads substantially differ between districts. This influence is more clearly demonstrated by Table A-16 where the percent no passing in curved regions on average exceeds a value of 70%, while tangent sections only exhibit a no passing average of approximately 25%. Though no passing zone distributions exhibit clear trends for the individual regions, the research team developed a method used by the MTPT for speedy determination of no passing percentages using terrain and curvature estimations. For corridors that were directly analyzed in the data collection phase, the MTPT will look up the actual percent no passing observed. For corridors that do not coincide with data collection locations, a statistical model is used to estimate the no passing zone. This relationship is further identified in the two-lane logic section.

6.3.2. Two-lane Logic and Output Format

The two-lane highway logic can best be summarized as a step by step approach using Figure 1-7 (Two-lane Highway Level of Service Analysis) as a graphic guide. Each reference to a box in the following two-lane summary is therefore referring to Figure 1-7 flow chart boxes.

Box 1: The two-lane highway Level of Service analysis input information form (Figure 6-5) is activated by the MTPT when the program user selects the following commands from the main menu:

Analysis → Input Data → Highway → Two-lane highway

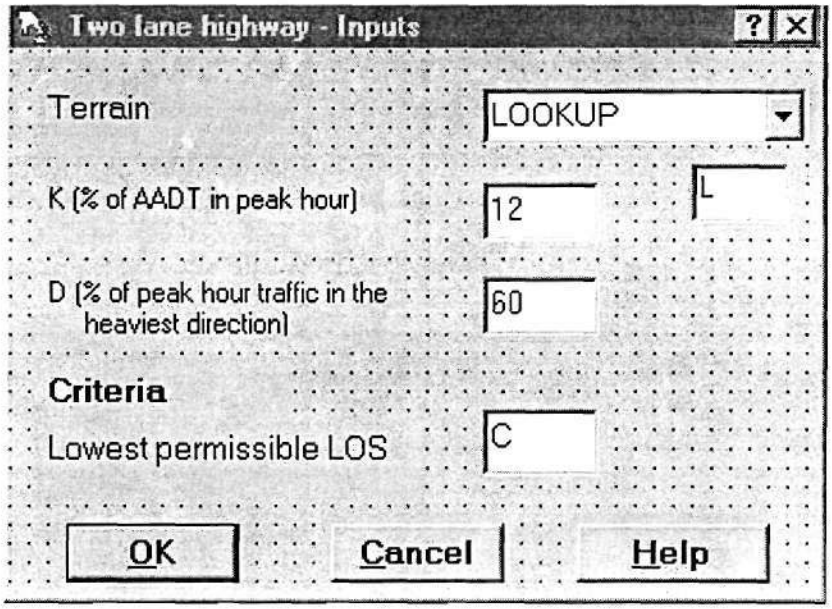

Figure 6-5. MTPT Two-lane Highway Input Form

Upon identification of all the variables, the Design Hourly Volume (DHV) is calculated using the following equation:

$$DHV = AADT \times \left(\frac{K}{100} \right)$$

Where the AADT is a two-direction daily traffic volume obtained from the road characteristic file and K represents the percentage of the daily traffic occurring during the peak hour.

Box 2: Verify the value of the design hourly volume (derived from the road characteristic file AADT) has an hourly traffic volume greater than zero. The purpose of this box is to provide an error check to verify that the AADT field in the road characteristic file has a positive value assigned. This will prevent future erroneous computations based on an incorrect traffic volume.

Box 3: In the event Box 2 returned a value of "No" (indicating incorrect traffic volume values), the two-lane highway level of service analysis for that specific road section will

be terminated and the specific road segment will be indicated in the "Error Output" printed at the end of the text results report.

Box 4: In the event Box 2 returned a value of "Yes" (indicating a positive value for the design hourly volume), the two-lane module next calculates an average shoulder width as well as an average lane width. The average shoulder width (rounded to the nearest integer value) is determined as follows:

$$SW(avg) = \left[\frac{\left(Shld_{LT} + Shld_{RT} \right)}{2} \right]$$

The average lane width is computed as:

$$LW = \left(\frac{PvmtWidth}{2} \right)$$

If LW > 12, assume LW = 12.

If LW < 9, assume LW = 9.

Box 5: The percent of roadway curvature is required to evaluate the maximum service flow value for a specific level of service. Where possible, this value has been computed from the video log data reduction effort; however, if the specific corridor was not directly evaluated during data collection then an alternative estimate for percent no passing is available. This box asks the program to check to see if a specific road curvature is known. If so, it proceeds to Box 6. If not, the program proceeds to Box 7.

Box 6: In the event Box 5 returned a value of "Yes" (indicating a known percent of roadway curvature from the data collection records [as depicted in the County.mdb access database, "CurvePercent" table]), then the program estimates the percent of no-passing zones using the following relationship (as determined from extensive field data evaluation):

$$PercentNoPass = \left(\left[0.7664 \times \frac{PercentCurve}{100} \right] + 0.1063 \right) \times 100$$

Box 7: In the event Box 5 returned a value of "No" (indicating a percent of roadway curvature is unknown), the program will approximate the percentage of no passing zones using the general terrain conditions of level, rolling, or mountainous. Table 6-17 shows

the actual values used to make this approximation. As previously indicated, Table A-14 depicts the actual data set observations.

Table 6-17. Table for Estimating Percent No-Passing (If Not Available in Database)

District	General Terrain Condition		
	Level	Rolling	Mountainous
1	61%	93%	100%
2	38%	64%	100%
3	55%	83%	100%
4	39%	71%	100%
5	27%	65%	100%
6	55%	80%	100%
7 (Estimated Only)	61%	93%	100%

Box 8: Following the estimation of the percent of no-passing zones as computed in Box 6 or Box 7, several values should next be estimated. First, a maximum volume to capacity ratio for each level of service should be estimated using Table 6-18 (Level Terrain), Table 6-19 (Rolling Terrain), or Table 6-20 (Mountainous Terrain). These three tables are based on Table 8-1 of the *Highway Capacity Manual* and are input into the MTPT program using a text file named Twolane3.dat. The MTPT will interpolate V/C ratios for determining the appropriate level of service from the appropriate table.

Table 6-18. LOS for Two-Lane Highways on Level Terrain

LOS	Maximum V/C Ratio						
	Avg. Speed	Percent No Passing					
		0	20	40	60	80	100
A	≥ 58	0.15	0.12	0.09	0.07	0.05	0.04
B	≥ 55	0.27	0.24	0.21	0.19	0.17	0.16
C	≥ 52	0.43	0.39	0.36	0.34	0.33	0.32
D	≥ 50	0.64	0.62	0.60	0.59	0.58	0.57
E	≥ 45	1.00	1.00	1.00	1.00	1.00	1.00
F	< 45	---	---	---	---	---	---

Table 6-19. LOS for Two-Lane Highways on Rolling Terrain

LOS	Maximum V/C Ratio						
	Avg. Speed	Percent No Passing					
		0	20	40	60	80	100
A	≥ 57	0.15	0.10	0.07	0.05	0.04	0.03
B	≥ 54	0.26	0.23	0.19	0.17	0.15	0.13
C	≥ 51	0.42	0.39	0.35	0.32	0.30	0.28
D	≥ 49	0.62	0.57	0.52	0.48	0.46	0.43
E	≥ 40	0.97	0.94	0.92	0.91	0.90	0.90
F	< 40	---	---	---	---	---	---

Table 6-20. LOS for Two-Lane Highways on Mountainous Terrain

LOS	Maximum V/C Ratio						
	Avg. Speed	Percent No Passing					
		0	20	40	60	80	100
A	≥ 56	0.14	0.09	0.07	0.04	0.02	0.01
B	≥ 54	0.25	0.20	0.16	0.13	0.12	0.10
C	≥ 49	0.39	0.33	0.28	0.23	0.20	0.16
D	≥ 45	0.58	0.50	0.45	0.40	0.37	0.33
E	≥ 35	0.91	0.87	0.84	0.82	0.80	0.78
F	< 35	---	---	---	---	---	---

Following estimation of the maximum v/c ratio, the program then estimates a service flow adjustment factor for the directional distribution, Fd, based on the user selected directional distribution value, D (Figure 6-5). Table 6-21 depicts the values used. This table is based on Table 8-4 of the *Highway Capacity Manual*.

Table 6-21. Factor for Directional Distribution on General Terrain

Directional Distribution	100/0	90/10	80/20	70/30	60/40	50/50
Adjustment Factor, Fd	0.71	0.75	0.83	0.89	0.94	1.00

Next, an adjustment factor for narrow lanes and restricted shoulder width, Fw, is estimated using Table 6-22. This table is based on Table 8-5 of the *Highway Capacity Manual*.

Table 6-22. Factor for Narrow Lanes and Restricted Shoulder Width

Average Lane Widths (ft.)	Usable Shoulder Width (ft.)	Value for Fw Factor	
		LOS A-D	LOS E
12-foot lanes	≥ 6	1.00	1.00
	5	0.96	0.985
	4	0.92	0.97
	3	0.865	0.95
	2	0.81	0.93
	1	0.755	0.905
	0	0.70	0.88
11- foot lanes	≥ 6	0.93	0.94
	5	0.89	0.91
	4	0.85	0.92
	3	0.80	0.90
	2	0.75	0.88
	2	0.70	0.85
	0	0.65	0.82
10-foot lanes	≥ 6	0.84	0.87
	5	0.805	0.86
	4	0.77	0.85
	3	0.725	0.83
	2	0.68	0.81
	1	0.63	0.78
	0	0.58	0.75
9-foot lanes	≥ 6	0.70	0.76
	5	0.675	0.75
	4	0.65	0.74
	3	0.61	0.72
	2	0.57	0.70
	1	0.53	0.68
	0	0.49	0.66

The final adjustment factor, Fhv, corrects for the presence of heavy vehicles in the traffic stream. This factor is determined using the values of Et, Er, and Eb obtained from Table 6-23 (based on Table 8-6 of the *Highway Capacity Manual*).

Table 6-23. Average Passenger-Car Equivalents

Vehicle Type	Level of Service	Type of Terrain		
		Level	Rolling	Mountainous
Trucks, Et	A	2.0	4.0	7.0
	B and C	2.2	5.0	10.0
	D and E	2.0	5.0	12.0
RV's, Er	A	2.2	3.2	5.0
	B and C	2.5	3.9	5.2
	D and E	1.6	3.3	5.2
Buses, Eb	A	1.8	3.0	5.7
	B and C	2.0	3.4	6.0
	D and E	1.6	2.9	6.5

The MTPT determines the percent of trucks (PT) from the road characteristic file. Based on recommendations from the HCM, if the percent of RV's or percent of Buses is not known, then a value of PR=0.04 and PB=0.00 [proportional representation of the percent of RV's and buses respectively] should be used. The MTPT, therefore, currently only estimates the influence of the trucks and RV's since the proportional value of zero for buses negates any influence by that type of vehicle.

The F_{HV} is then determined using the following equation:

$$F_{HV} = \frac{1}{1 + \left(\frac{P_T}{100} \times \left[E_T - 1\right]\right) + 0.04 \times \left[E_R - 1\right]}$$

Finally, the MTPT computes the Service Flow value for each feasible level of service using the following equation:

$$SF_{(LOS_i)} = 2800 \times \left(\frac{v}{c}\right)_{\max} \times F_d \times F_w \times F_{HV}$$

These values of service flow (based on the maximum v/c ratio) will later be used for comparison purposes to determine the actual level of service for a specific roadway segment. It is important to note that the units for the SF are in vehicles per hour. The value of 2800 represents an ideal two-directional capacity in passenger cars per hour where the directional distribution is 50/50. Multiplying this value by the $(v/c)_{max}$ value corrects the ideal value for no-passing zones. Similarly, multiplying the 2800 value by Fd, Fw, and Fhv serves to correct for other "imperfections" in the traffic stream or physical roadway geometry.

Box 9: The Adjusted Service Flow Rate, V, is next computed using the design hourly volume calculated in Box 1 and the peak hour factor. The peak hour factor, PHF, is approximated based on the total two-way hourly traffic volume as shown in Table 6-24 (based on Table 8-3 of the *Highway Capacity Manual*).

Table 6-24. Two-Lane Peak Hour Factors Based on Random Flow

Total 2-Way Hourly Volume (vph)	Peak Hour Factor (PHF)
100	0.83
200	0.87
300	0.90
400	0.91
500	0.91
600	0.92
700	0.92
800	0.93
900	0.93
1,000	0.93
1,100	0.94
1,200	0.94
1,300	0.94
1,400	0.94
1,500	0.95
1,600	0.95
1,700	0.95
1,800	0.95
≥ 1,900	0.96

The observed service flow rate, v, is then computed using the following equation:

$$v = \frac{DHV}{PHF}$$

Box 10: Based upon the observed service flow rate (computed in Box 9) compared to the maximum service flow rate for a given level of service (as determined in Box 8), determine the level of service for the two-lane highway.

Once the MTPT determines the Two-Lane Level of Service condition, it repeats the calculation for future traffic volumes. The output then prints a series of information keys that summarize route types, functional classifications, priority ratings, and column headings for the tabular results. Output as a result of this module is as follows:

HIGHWAY ANALYSIS -- TWO-LANE
Input for two-lane highways
Terrain : <type assigned>
Lowest acceptable LOS : <value assigned>
K : <value in percent>
D : <value in percent>

Results of two-lane highway analysis

RTE#	BMP	EMP	RTE	FC	AADT/YR	TRL	SPD	LOS(3)	ACT
(The MTPT will fill in the columns with the appropriate information.)									

Upon completion of Box 10 of the Two-lane Highway Level of ServiceAnalysis, the program returns to the Highway Screening Flow Chart "LOS Threshold Exceeded?" box.

6.3.3. Program Function Requirements for Two-Lane Highways

The two-lane highway level of service analysis is dependent on unique road conditions, therefore the MTPT must query the GDOT road characteristic file. As a result, analysis can be performed following Two-Lane Highway Module selection, Area identification, Multilane Highway Default Value assignment, and selection of the RC file. The program uses an interim text file (*two.res*) during analysis.

6.4. Signalized Intersection Analysis

6.4.1. Signalized Intersection Overview

The objective of this module was to develop a methodology for assigning level of service to isolated signalized intersections as well as densely spaced (less than or equal to 0.5 miles apart) signalized intersections within a roadway network. In the previous version of the MTPT level of service was not assigned to interrupted portions of roadways. This was due to limitations with the road characteristic file that does not provide full details on the geometric conditions or turning movement volumes at intersections. The module developed for this version of the MTPT addresses the signalized intersection condition since it is a significant contributing factor to the delay experienced in a roadway corridor with intersections. This measure of effectiveness is particularly useful for locations where queues extend upstream from the signalized intersection, affecting the flow of vehicles along the roadway.

6.4.2. Signalized Intersection Methodology

To overcome this limitation of the previous version of the MTPT, the research team developed a methodology to assign level of service to roadways influenced by signalized intersections. The methodology was developed recognizing the limitations of the road characteristic file to provide detailed information about signalized intersections within the network. Three procedures were evaluated for their ability to adequately estimate operating conditions for signalized intersections at the system level. The procedures include:(1) the methodology outlined in the *Highway Capacity Manual* (HCM) for performing a planning evaluation for arterial roadways and signalized intersections; (2) a probabilistic procedure for estimating delay; and (3) a methodology used by the Florida Department of Transportation to develop generalized level of service tables. The following describes each of these procedures and discuss the evaluation performed to identify the methodology with the best results.

6.4.2.1. HCM Signalized Intersection Planning Methodology

The *Highway Capacity Manual* provides an approach for evaluating arterial systems where one level of service is provided incorporating both the operation at the signalized intersections and the operation for the uninterrupted portion of the roadway between the signals. The level of service for the arterial is based on average travel speed. The procedure, however, requires detailed information about the geometric, volume and signalization at the intersections. To use the methodology, assumptions about this information can be made. The HCM provides recommended values for some of these parameters to perform a planning analysis of a signalized intersection. A planning analysis is typically performed for a proposed intersection where many parameters used

in the analysis are unknown. Borrowing from this analysis approach, level of service and delay estimates were determined using the default values recommended in the HCM.

Table 6-25. HCM Recommended Default Values

Characteristics	Default Values
Traffic	
Ideal Saturation Flow Rate	1,900 pcphgpl
Conflicting Pedestrian Volume	None: 0 peds/hr Low: 50 peds/hr Moderate: 200 peds/hr High: 400 peds/hr
Percent Heavy Vehicles	2
Grade (%)	0
Number of Stopping Buses	0/hr
Parking Conditions	No Parking
Parking Maneuvers	20/hr where parking exists
Arrival Type	
Lane Group with through movements	3 if isolated 4 if coordinated
Lane Group without through movements	3
Peak Hour Factor	0.90
Lane Utilization Factor	Table 9-4 HCM
Facility and Traffic Signal	
Signal Type	Pre-timed
Cycle Length Range	60-120 sec
Lost Time	3.0 sec/phase
Yellow plus all red	4.0 sec/phase
Area Type	Non-CBD
Lane Width	12 ft

The recommended values provided in the HCM for performing an intersection analysis are shown in Table 6-25. These values could be further evaluated and expanded to ensure compatibility with conditions in rural Georgia and to include values for various roadway classification. Further discussion of the field studies to evaluate the appropriateness of these recommended values are provided below.

6.4.2.2 Expected Travel Time Approach

The second methodology evaluated for assigning level of service to roadway systems influenced by signalized intersections was the use of a probabilistic procedure for determining delay and estimating travel time. The procedure was proposed by

researchers at the Urban Transportation Center in Chicago to provide better estimates of travel times along links with signalized intersections. The data requirements for this methodology are less intensive than the HCM approach, however, the methodology requires field validation to ensure the adequacy of the approach. The approach involves determining the long term frequency of expected travel times on a signalized roadway. Given these travel times, the average travel speed is then determined and a level of service assigned based on the criteria used in the *Highway Capacity Manual* for arterial roadways. The procedure calculates expected travel time as follows:

$$E(T) = E(T_c) + E(d) = T_c + E(d)$$

where: E(T) = expected travel time,
$E(T_c)$ = expected free-flow travel time, and
E(d) = expected delay.

The assumption of this approach is that the variability in travel times along the signalized roadway is strictly caused by delay variability at downstream signals. The procedure also assumes that the free-flow travel time is fixed. This assumption results in the primary feature of the procedure the determination of the expected delay. The expected delay is a function of many parameters including the level of congestion at the intersection and the time during the cycle at which the vehicle arrives at the signal. The procedure provides delay distribution functions for three conditions when the vehicle arrives at the signal. The distribution describes the delay when the vehicle arrives during the green before the queue clears, during the green after the queue has cleared, and during the red phase.

The expected delay is a function of the flow rate, saturation flow rate, cycle length, percent arrivals on green and effective green time. The expression used for calculating this expected delay is given as follows:

$$E(d) = d_g^{\,2} \frac{P}{2C(\lambda - py)} + [d_r^{\,2} - d_g^{\,2}] \frac{1-p}{2C[(1-\lambda) - y(1-p)]}$$

$$d_g = \frac{Q_o}{s} + yC(1-p)$$

$$d_r = \frac{Q_o}{s} + C(1-\lambda)$$

where: d_g = delay if the vehicle arrives during the green phase;

d_r = delay if the vehicle arrives during the red phase;

p = long term probability of arrivals in the green phase

C = cycle length;

λ = effective green to cycle ratio (g/C);

Q_o = queue length at the start of the cycle; and

Y = flow ratio (q/s).

6.4.2.3. Generalized Level of Service Tables

The third methodology evaluated for use in assigning level of service was generalized level of service tables. Generalized level of service tables provide daily maximum volumes for various levels of service and are typically used to perform general planning procedures such as determining level of service or thorough lane requirements. This methodology is based on the generalized level of service tables developed by the Florida Department of Transportation (FDOT) Bureau of Multimodal Systems Planning.

The tables developed by FDOT are broken down by three types of uninterrupted flow facilities, four types of interrupted facilities, number of through lanes, and degree of urbanization. To develop similar tables for the state of Georgia, data is required on the volume, geometric and signalization characteristics for each roadway type, number of through lanes and degree of urbanization. The specific data requirements to use this methodology are shown in Table 6-26.

Table 6-26. Data Requirements for Generalized Level of Service Tables

Traffic Characteristics	Roadway Characteristics	Signalization Characteristics
K, Design Hour Factor	Arterial Classification	Arrival Type
D, Directional Factor	Lane Capacity	Signalized Intersection per mile
PHF, Peak Hour Factor	Presence of Left-turn bays	C, Cycle Length
Percentage Left Turns	Terrain	g/C, effective green to Cycle
	Free Flow Speed	

Although the three procedures described above are fundamentally similar in the approach used for estimating delay at signalized intersections, each approach differs in the degree

of detail used in estimating this delay. The HCM procedure explicitly calculates delay, however, the procedure uses default values to calculate this delay. The use of an expected delay approach also explicitly calculates delay while using more detailed information about the time the vehicle arrives at the intersection than the HCM approach. The generalized level of service tables does not calculate delay but determines maximum volumes from which levels of service can be determined.

6.4.3. Data Collection

Field studies were performed to determine the traffic, roadway and signalization characteristics of various roadway types in rural Georgia. The intent of the data collection was to collect a sample of data from intersections in six of the seven districts within the State for use in establishing default values for assigning a level of service to an intersection. Data were not collected in District 7 as this district is primarily an urbanized area. Using this data, the research team compared delay estimated from the HCM Planning methodology and the expected travel time approach to measured delays. This comparison enabled the analysts to determine which approach provided the best results.

The data were collected using video cameras at two or more adjacent intersections during the AM or PM peak period. Intersection delay and percent arrivals on green were observed in the field. Travel time studies were performed at a limited number of roadways simultaneously during the time that volumes were collected for the length of the arterial system.

Study sites were selected to obtain characteristic data for each of six districts within the State of Georgia. The intersections studied are shown in Table A-17. Sites were selected based on the functional classification of the intersecting roadways, volume levels, intersection spacing, design category, progression quality, and turning percentages. A total of 24 intersections were observed with at least two intersections studied within each district.

6.4.4. Evaluation of Methodologies

The team evaluated four intersections and compared the estimate of delay using the HCM Planning methodology, the HCM methodology using geometric and signalization parameters collected in the field and using the expected travel time approach for estimating delay. The evaluation was performed prior to the completion of the data collection to identify potential problem areas with the data collection and to get a preliminary indication of the final methodology that would be used in assigning level of service. The results from this comparison are shown in Figure 6-6 and Table A-18.

The comparison shows that estimated delay using the HCM planning methodology, the HCM recommended values, and the HCM operational analysis procedure, where

parameter values are determined using field data, provide similar estimates of delay. This result is consistent with previous research which indicated that reliable estimates of intersection level of service on delay can be obtained using only field-measured turning movements, lane geometry, and signal timing plus the HCM-recommended values for the rest of the required input data. Both procedures underestimated delay, with the greatest discrepancy at the higher delay values.

The expected travel time approach, provided the best estimate of delay. A regression analysis for this comparison resulted in an R^2 of 0.88 and an x-value coefficient of 0.91. These results indicate that there is a strong relationship between the estimated and measured delay using the expected travel time approach. Despite these results, it is the belief of the research team that this approach would not provide good results when applied at intersections where the arrival condition was unknown. For this reason, the decision was made to use the HCM Planning methodology with recommended values obtained from the field data collection.

6.4.5. Signalized Level of Service Analysis Methodology Applied to the MTPT

The methodology used in the MTPT for assigning level of service to a roadway influenced by signalized intersections is based on the HCM Planning Methodology for an arterial system with adjustments to account for roadway functional classification. The procedure uses three data sources including: (1) road-characteristics files; (2) an assumptions table developed from field studies; and (3) tables provided in the Highway Capacity Manual. The assumptions table describes the values of parameters used in performing a level of service analysis. These values are based on measured data as well as values obtained from the Highway Capacity Manual's recommended values for planning studies. The table provides values based on the functional classification for the primary roadway only. The functional classification of the intersecting road can also influence the level of service; however, additional extensive field studies are essential before analysis could be expanded and variables determined for this variety of conditions. The values shown in Table 6-27 are conservative and assume the cross-street has an arterial classification. The four functional classifications used for this analysis include: principal arterial, minor arterial, collector, and local roadway.

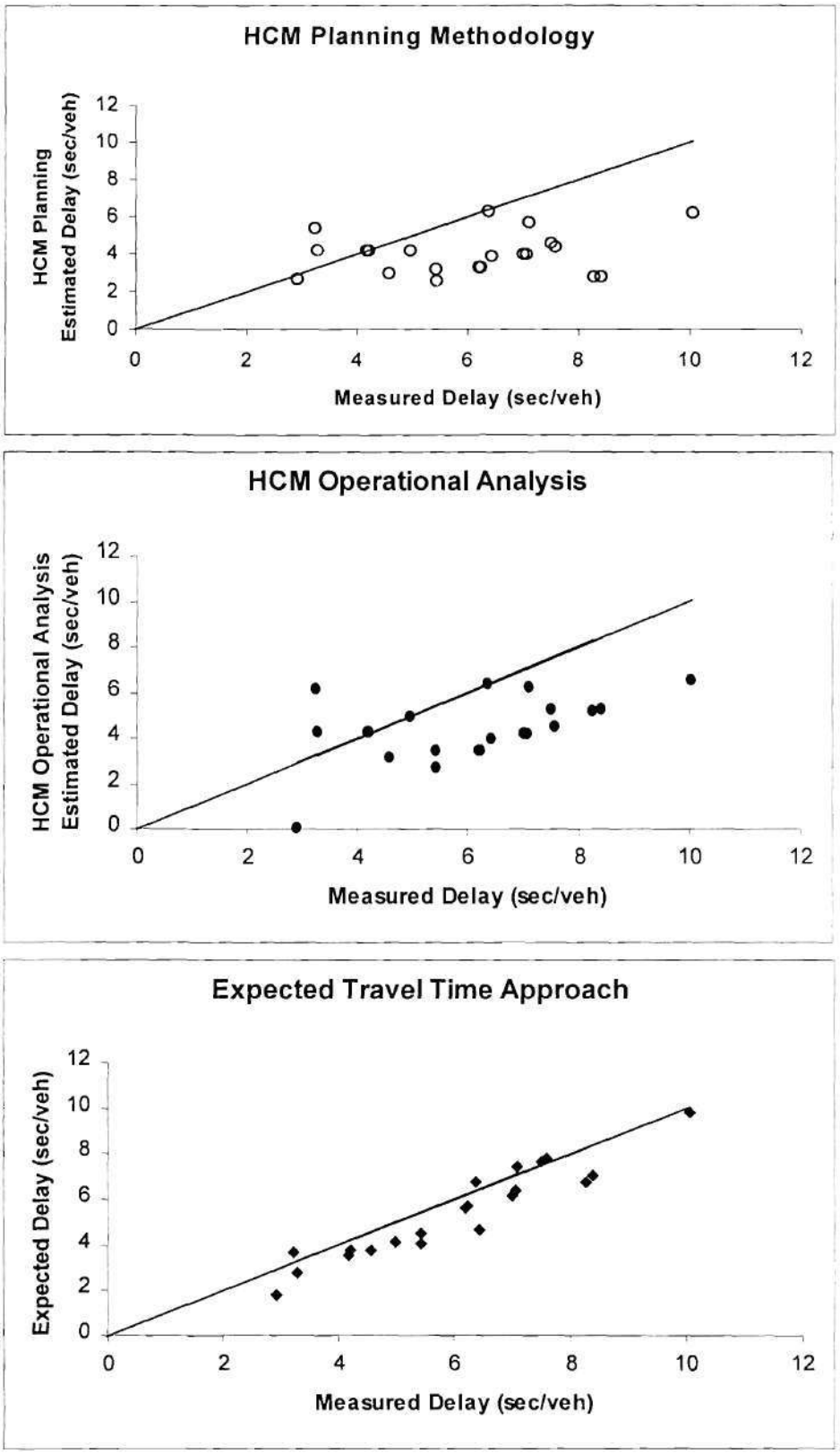

Figure 6-6. Graphical Comparison of Delay Estimates

Table 6-27. Arterial Analysis Assumptions Table

	Principal Arterial	Minor Arterial	Collector	Local
K	.09	.09	.09	.09
D	.58	.58	.58	.54
PHF	.92	.92	.92	.92
P_{LT}	.07	.09	.07	.07
P_{RT}	.03	.02	.01	.01
S_{adj}	1900	1900	1900	1900
Arrival Type	4	4	5	3
C	120	120	120	120
g/C	0.5	0.45	0.55	0.5
PF	.767	.831	.175	1
m	12	12	8	16

Values for the following parameters (as indicated in Table 6-27) are provided:

K = proportion of vehicles traveling during the peak hour;
D = proportion of vehicles traveling in the peak direction;
PHF = peak hour factor;
P_{LT} = proportion left turns;
P_{RT} = proportion right turns
LT Bay = Is a left-turn bay present at the intersection;
Arrival Type = Describes the level of progression along the roadway;
g/C = effective green time to cycle length ratio;
PF = progression adjustment factor;
m = incremental delay calibration term.

The arrival type at the intersection describes the quality of progression along the arterial. The quality of progression can range from poor to excellent, where poor describes the condition when the vehicles arriving at the intersection form a dense platoon and arrive at the start of the red phase and excellent describes the condition when a dense platoon arrives at the start of the green phase. Poor progression results in higher delays as each vehicle in the platoon must wait at the red signal. Excellent progression results in low delays as vehicles are not delayed by the signal. The MTPT assumes arrival types 4 and 5 for principal, minor and collector roadways. These arrival types describe good progression. Arrival type 3 is used for local roadways. This arrival type refers to a condition where there may not be adjacent signalized intersections to cause the formation of platoons and vehicles are arriving randomly to the intersection. The progression adjustment factor and incremental delay calibration term are directly related to the arrival type at the intersection.

6.4.6. Signalized Intersection Logic and Output Format

The methodology is applied to both directions of a roadway on which there are more than one signalized intersection within one-half mile of each other. A level of service is determined for each direction using the analysis procedure outlined in this section. The methodology for signalized intersection analysis can be summarized as a step by step approach using Figure 1-8 (Signalized Intersection Level of Service Analysis) as a graphic guide. Each reference to a box in the following signalized intersection summary is therefore referring to Figure 1-8 flow chart boxes.

Box 1: The signalized intersection level of service analysis is activated when the Highway Type Identification method identifies the roadway segment as a signalized intersection corridor with closely spaced signalized intersections. Upon identification, the MTPT will determine the functional classification of the arterial segment and of the intersecting roadway. The source of this information is the road characteristic file.

Box 2: In this box, the program determines the directional design hour for the peak direction for the subject arterial corridor. Since it is not feasible to have a "partial" vehicle, all values for *DDHV* are rounded to the next higher integer before proceeding with analysis.

$$DDHV = AADT \times K \times D$$

Where:

DDHV = directional design hour for the peak direction (veh/hr);
K = proportion of AADT travelling during the peak hour (assigned in Box 1); and
D = proportion of peak hour volume travelling in the peak direction (assigned in Box 1).

Box 3: Next, the program determines the turning movement volumes for the arterial approaches at each intersection using the following equations:

$$V_L = P_{LT} \times DDHV$$

$$V_R = P_{RT} \times DDHV$$

$$V_T = DDHV - V_L - V_R$$

Where:

V_L = left-turning volume (veh/hr) rounded up to the next higher integer value;
V_R = right-turning volume (veh/hr) rounded up to the next higher integer value;
V_T = through volume (veh/hr);
P_{LT} = proportion left turning volume (assigned in Box 1);

P_{RT}= proportion right turning volume (assigned in Box 1).

Box 4: Calculate adjusted flow rates (rounded to the next highest integer value)as follows:

Left Turn Lane Available	No Left Turn Lane Available
$V_{adj} = \left(\frac{V_T + V_R}{PHF}\right) \times U$	$V_{adj} = \left(\frac{V_L + V_T + V_R}{PHF}\right) \times U$

Where:

V_i = turning movement volume (veh/hr) , i = L, T or R;
PHF = peak hour factor (Table 6-27 or User Modified Input);
U = lane utilization factor (Table 6-28 [Based on Table 9-4 of the 1994 HCM]).

Table 6-28. Default Lane Utilization Factors

No. of Lanes on Approach	Lane Utilization Adjustment Factor (U)
1	1.00
2	1.05
≥ 3	1.10

Box 5: Next, the program determines a right-turn adjustment factor calculated as:

$$f_{RT} = 1 - 0.15P_{RT}$$

If a left-turn bay is present the left-turn adjustment factor is f_{LT}= 1.0. Otherwise, the left-turn adjustment factor is calculated as follows:

$$f_{LT} = \frac{1.0}{1.0 + 0.05P_{LT}}$$

The program can now calculate an integer value for the saturation flow rate (vehicles per hour of green per lane, vphgpl) using the following equation:

$$S = S_{adj} \times f_{RT} \times f_{LT}$$

Where:

S_{adj} = adjusted saturation flow rate (vphgpl) (assigned in Box 1);
f_{RT} = right-turn adjustment factor;
f_{LT} = left-turn adjustment factor.

Box 6: The program next determines the capacity for the arterial approach using the following relationship:

$$c = (g/C) \times S$$

Where:

c = capacity (veh/hr);
g/C = green time to cycle length ratio (Table 6-27 or User Modified Input);
S = saturation flow rate (vphgpl).

Box 7: Next, the MTPT calculates the approximate degree of saturation, X, as follows:

$$X = \frac{V_{adj}}{c}$$

Box 8: Approximate delay (sec/veh) is next calculated for each intersection using a three step approach. First, the program calculates the uniform delay for each arterial approach as follows:

$$d_1 = \frac{0.38C(1-g/C)^2}{1-(g/C)X}$$

Where:

C = cycle length (sec) (assigned in Box 1);
X = degree of saturation (computed in Box 7);
g/C = green to cycle length ratio (assigned in Box 1).

Next, the incremental delay (sec/veh) for each arterial approach is determined as follows:

$$d_2 = 173 \times X^2 \left[(X-1) + \sqrt{(X-1)^2 + \frac{m \times X}{c}} \right]$$

Where:

m = incremental delay calibration term (Table 6-27 based on Arrival Type);
c = capacity (computed in Box 6).

Finally, the total delay (sec/veh) for each arterial approach is computed as follows:

$$d = d_1 PF + d_2$$

Where:

d_1 = uniform delay (sec/veh);
d_2 = incremental delay (sec/veh); and
PF = progression adjustment factor (assigned in Box 1).

Box 9: Using the total delay, d, for each isolated intersection, the MTPT determines a level of service for conditions unique to the specific intersection based on values shown in Table 6-29.

Table 6-29. Level of Service Criteria for Signalized Intersections

Level of Service	Stopped Delay Per Vehicle (sec.)
A	$d \leq 5.0$
B	$5.0 < d \leq 15.0$
C	$15.0 < d \leq 25.0$
D	$25.0 < d \leq 40.0$
E	$40.0 < d \leq 60.0$
F	$d > 60.0$

Box 10: The program next will determine the length, in miles, of the arterial segment. The arterial length includes the distance from the first signalized intersection to the last signalized intersection in the segment. All signalized intersections within ½ mile of another signalized intersection are included in determining the arterial length. If the segment is greater than ½ mile, the program returns to the Highway Screening Module. If the length is less than or equal to ½ mile between intersections, the program proceeds to Box 11.

Box 11: In the event Box 10 returned a value of "Yes" (indicating the signalized intersections are spaced within ½ mile), the procedure then divides the number of signalized intersections by the length of the arterial segment to determine the number of signalized intersections per mile along the route.

Box 12: The program next determines the arterial classification based on the number of signalized intersection per mile, functional classification and posted speed. Default values are depicted in Table 6-30. The program user may elect to modify default assumption values for signalized analysis (as shown in Table 6-27) in the signalized intersection input form as shown in Figure 6-7. This form can be activated in the MTPT by selecting from the main menu the following commands:

Analysis → Input Data → Highway → Signalized Intersection

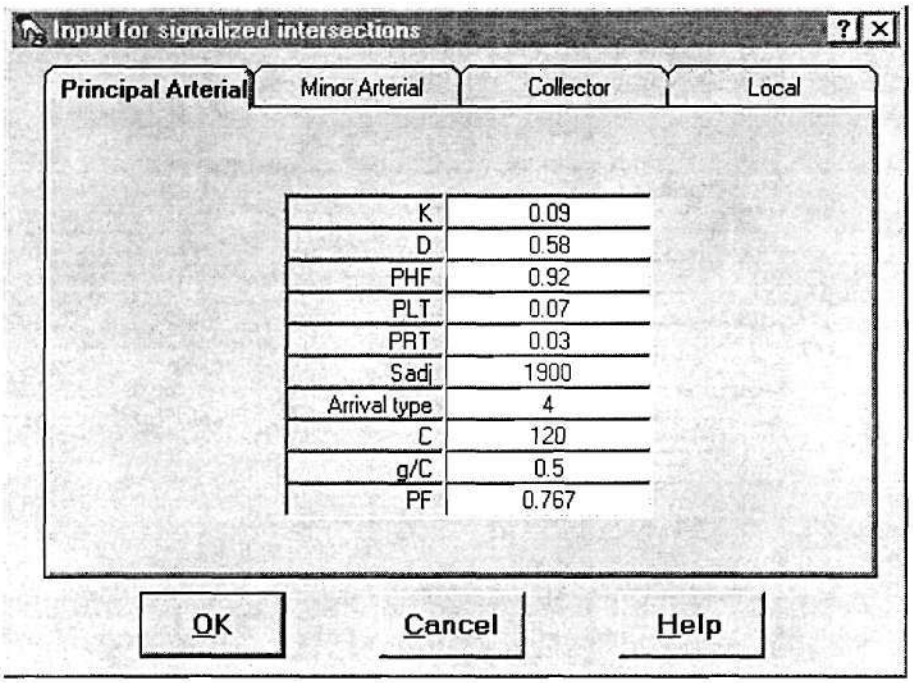

Figure 6-7. MTPT Signalized Intersection Input Form

Table 6-30. Arterial Classification

	Signals Per Mile	Speed Limit				
		25	30	35	40	45
Principal Arterial	≤ 3	III	II	II	I	I
	4-5	III	II	II	I	I
	6-10	III	III	II	II	II
	≥ 10	III	III	III	II	II
Minor Arterial/ Collector/ Local	≤ 3	III	III	III	III	II
	4-5	III	III	III	III	
	6-10	III	III	III		
	≥ 10	III	III			

Box 13: The MTPT next determines the running time per mile (hrs) along the arterial as follows:

$$RT = \frac{L}{PS}$$

Where:

PS = posted speed limit determined from the road characteristic file (mph);
L = arterial length (miles as determined by subtracting the beginning milepoint value from the ending milepoint value for the corridor length where intersections are spaced less than 0.5 miles apart).

Box 14: Next, the program determines the travel time (sec) along the arterial using the following relationship:

$$TT = 3600RT + \sum d$$

Where:

d = arterial approach delay at each intersection as calculated in box 8 (sec).

Box 15: Prior to identifying approximate corridor level of service, the MTPT computes the average travel speed (mph) along the arterial as follows:

$$ART\ SPD = \frac{3600 \times L}{TT}$$

Box 16: Finally, the program determines the arterial corridor level of service (as a result of peak hour signalized intersection delays) using Table 6-31 (based on Table 11-1, 1994 HCM). The arterial classification value was determined in box 12 (Table 6-30).

Table 6-31. Arterial Level of Service

Level of Service	Arterial Classification		
	I	II	III
	Average Travel Speed (MPH)		
A	≥ 35	≥ 30	≥ 25
B	≥ 28	≥ 24	≥ 19
C	≥ 22	≥ 18	≥ 13
D	≥ 17	≥ 14	≥ 9
E	≥ 13	≥ 10	≥ 7
F	< 13	< 10	< 7

Upon completion of Box 16 of the Signalized Intersection Level of Service analysis, the program returns to the Highway Screening Flow Chart "LOS Threshold Exceeded?" box.

6.4.6. Program Functional Requirements for Signalized Intersections

The signalized intersection level of service analysis is dependent on unique road characteristics such as speed limit, number of approach lanes, and left-turn bays. As a result, the MTPT must query the GDOT road characteristic file. Signalized intersection analysis can be performed following selection of the signalized intersection module, area identification, signalized intersection default value assignments, and selection of the road characteristic file. The program creates three interim text files during analysis: *inter.tmp*, *inter1.res*, and *inter2.res*.

6.5. Highway Crash Analysis

6.5.1. Crash Analysis Overview

The crash analysis module evaluates the 1997 crash database for the state of Georgia. Currently, the tool is restricted to this single year of data due to limited crash database information. In the future, it would be desirable to evaluate multiple years of crash data in an effort to filter out unique crash conditions (such as a work zone location). Currently, the crash analysis module identifies a corridor for analysis and determines the crash rate observed on that corridor. If the crash rate exceeds the statewide average for similar functional classifications then the program will include the corridor in the program output.

6.5.2. Crash Analysis Logic and Output Format

The crash analysis logic can best be summarized as a step by step approach using Figure 1-9 (Highway Crash Analysis) as a graphic guide. Each reference to a box in the following crash analysis summary is therefore referring to Figure 1-9 flow chart boxes.

Box 1: Crash analysis is activated when the program user selects crash analysis and then identifies a road segment or area for analysis. Since the module queries a crash database present with the program, no additional crash-based user input information is required. The crash analysis is dependent upon and will only evaluate the highway modules selected for analysis (freeway, multilane, or two-lane). To activate the Crash Analysis Module, the program user selects the following commands from the main menu:

Analysis → Input Data → Highway → Crash Analysis

Upon roadway identification, the MTPT queries the 1997 crash database (*crash.mdb*) and determines how many and where crashes occurred along the selected roadway corridor.

Box 2: The MTPT crash analysis module next identifies the functional classification and the AADT for each roadway segment identified in Box 1 where crashes occurred in 1997. This information is obtained from the road characteristic file (*rcfiles.mdb*).

Box 3: Next, the crash analysis determines continuous and consistent corridors for analysis. For example, if two consecutive road segments have the same functional classification and AADT, then they will be combined as one corridor for analysis purposes. If, however, either the functional classification or the AADT should change, they will be evaluated separately. Upon road segment identification, the crash analysis module computes a crash rate for the specific road segment. The crash rate is determined using the following equation:

$$CrashRate = \frac{NumCrashes \times 10^8}{AADT \times 365 \times Length}$$

Box 4: The crash analysis module next compares the crash rate determined in Box 3 to the statewide average crash rate for similar functional classification roads. The statewide average values are depicted in Table 6-32 below.

Table 6-32. 1997 Statewide Average Crash Rates

Functional Classification		Average Crash Rate
Rural	Interstate	49
	Principal Arterial	143
	Minor Arterial	202
	Major Collector	196
	NFA Minor Collector	118
	Local	245
Urban	Interstate	166
	Freeway / Expressway	216
	Principal Arterial	646
	Minor Arterial	540
	Collector	453
	Local	607
Undesignated Road		325

Box 5: Upon completion of Box 4, the MTPT prepares text output that displays "crash corridors" where the crash rate exceeds the statewide average. Output as a result of this module is as follows:

1997 Highway Crash Analysis (Corridors Exceeding Statewide Average)						
Crash Corridor Analysis results for <County Name> County are as follows:						
RTE#	BMP	EMP	AADT	FC	1997 Site Crash Rate	1997 Average Crash Rate
(The MTPT will fill in the columns with the appropriate information.)						

The map results display option permits the program user to display the actual crash locations as well as the identified "crash corridors."

Upon completion of Box 5 of the Highway Crash Analysis Module, the program returns to the Highway Screening flow chart.

6.5.3. Program Functional Requirements for Highway Crash Analysis

The crash analysis module is dependent upon discrete road conditions; therefore the MTPT must query the GDOT road characteristic file. As a result, analysis can only be performed following Highway Crash Analysis Module selection, Area identification, selection of a Highway Module (Freeway, Multilane, or Two-Lane), and selection of the road characteristic file. In addition, the cost estimate module queries the "County" table located in the database file *county.mdb* and the crash database (*crash.mdb*). The crash analysis module uses two interim result files named *crash1.res* and *crash2.res*.

6.6. Cost Estimate Analysis

6.6.1. Cost Estimate Overview

The cost estimate module evaluates "minor" and "major" roadway improvements for the freeway, multilane, and two-lane modules. It also provides cost estimate default values for the bike module (this estimation technique is further discussed in Chapter 7). Essentially, the cost estimate analysis technique evaluates the influence of road improvements on the computed level of service of the facility and estimates the cost for both the year 2000 and 2010 using a program user selected inflation rate as well as user identified unit costs.

6.6.2. Cost Estimate Logic and Output Format

The cost estimation logic can best be summarized as a step by step approach using Figure 1-10 (Cost Estimate Analysis) as a graphic guide. Each reference to a box in the following cost estimate summary is therefore referring to Figure 1-10 flow chart boxes.

Box 1: Cost estimation is activated when the program user identifies a road segment where the level of service is exceeded in current or future years. Default values for unit costs and an approximate annual inflation rate may be modified in the cost estimate input form depicted in Figure 6-8. This form can be activated by the MTPT when the program user selects the following commands from the main menu:

Analysis → Input Data → Highway → Cost Estimates

Only modules selected for analysis (freeway, multilane, two-lane, or bike) will be available for unit input in the Cost Input form. For the highway components, the following improvement options are available:

Two-Lane Facilities

1. Minor Improvement assumes an average lane width of 12-feet and a right shoulder width of 6-feet.

2. Major Improvement assumes one passing lane is added for the length of the segment, resulting in a zero-percent no passing zone. The Major Improvement also includes all items indicated for the Minor Improvement option.

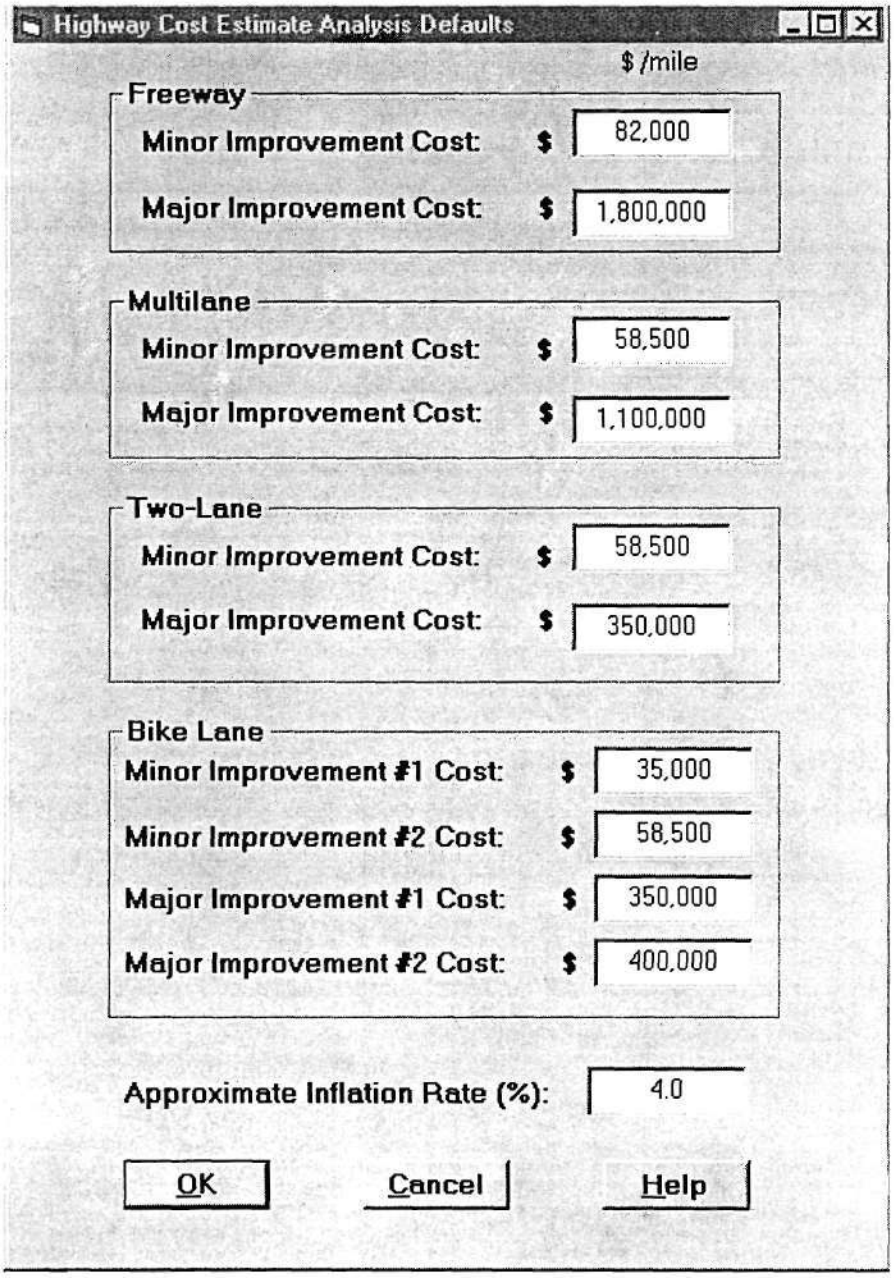

Figure 6-8. Cost Estimate Input Form

Multilane Facilities

1. Minor Improvement assumes an average lane width of 12-feet and a total shoulder width (for one direction of travel including the left shoulder plus the right shoulder) of 12-feet.

2. Major Improvement assumes an additional lane in each direction (for a total of two additional lanes) as well as all items indicated for the Minor Improvement option.

Freeways

1. Minor Improvement assumes an average lane width of 12-feet and a right shoulder of 6-feet.

2. Major Improvement assumes one additional lane in each direction (for a total of two additional lanes) as well as all items indicated for the Minor Improvement option.

Box 2: The estimation module next assumes the minor improvements for the specific facility (freeway, multilane, or two-lane), and determines the current, ten-year, and twenty-year level of service based on these enhancements by re-executing the respective highway level of service analysis based on implementation of the minor roadway improvements.

Box 3: The estimation module next assumes the major improvements for the specific facility (freeway, multilane, or two-lane), and determines the current, ten-year, and twenty-year level of service based on these enhancements by re-executing the respective highway level of service analysis based on implementation of the major roadway improvements.

Box 4: Upon determination of the level of service resulting from the minor (Box 2) and major (Box 3) improvements, the MTPT next computes the estimated improvement cost for the year 2000 based on the corridor length and the user selected unit costs shown in Figure 6-8. For consecutive road corridors with identical level of service values for both minor and major improvements, the cost will extend the length of the similar road segments. For example, if Route 000100 has a minor level of service of C, D, E (current, ten-year, and twenty-year value respectively) from milepoint 10.0 to 11.5 and similar level of services from 11.5 to 13.0, the program will compute costs for the corridor extending from milepoint 10.0 to 13.0 and treat the corridor as one continuous segment.

Box 5: Upon estimation of costs for the year 2000, the MTPT uses the user selected annual inflation rate (default value of 4.0%) to approximate the projected major and minor improvement cost estimates for the year 2010. The inflation rate is applied directly to the year 2000 cost using the following equation:

$$Cost_{2010} = Cost_{2000}\left(1 + \frac{InflationRate}{100}\right)^{10}$$

Box 6: Upon completion of Box 5, the MTPT prepares text output sorted first by analysis type (freeway, multilane, or two-lane) and then by county. Output as a result of this module is as follows:

Highway Cost Estimate Analysis

Cost Estimates for <highway analysis type> facilities in <County Name> County:
[Prices shown are in $1000 increments, so $6 means $6,000]

			Minor Improvements			Major Improvements		
RTE#	BMP	EMP	LOS(3)	2000 [1000$]	2010 [1000$]	LOS(3)	2000 [1000$]	2010 [1000$]

(The MTPT will fill in the columns with the appropriate information.)

6.6.3. Program Functional Requirements for Highway Cost Estimate Analysis

The cost estimate analysis module is dependent upon discrete road conditions; therefore the MTPT must query the GDOT road characteristic file. As a result, analysis can only be performed following Highway Type Cost Estimate Module selection, Area identification, Cost Estimate Default value assignment, and selection of the road characteristic file. In addition, the cost estimate module queries the "County" table located in the database file *county.mdb*. The cost estimation module also uses a key file called *cost.key* and interim result files named *twocost.res*, *multicost.res*, and *fwycost.res*.

CHAPTER 7. BICYCLE AND PEDESTRIAN ANALYSIS

7.1. Bicycle and Pedestrian Overview

The bicycle and pedestrian analysis module evaluates highway and road corridors to determine if a specific road segment is located on one of the State of Georgia designated bicycle routes (Table A-19). In the event the program determines the road does occur along a bike route, the MTPT evaluates road characteristics, identifies required improvement options, and estimates current improvement costs as well as costs for the year 2010.

7.2. Bicycle and Pedestrian Facility Logic and Output Format

The MTPT method for Bicycle and Pedestrian (BP) facility analysis evaluates rural two-lane and multilane roads. The BP method evaluates the individual road sections concurrent to the selected highway analysis method (if the user selects the BP option). Due to the close interactions between road characteristic variables for the BP analysis and the Highway analysis, the user cannot evaluate the BP conditions without also performing a Highway analysis. For this reason, the BP algorithms are executed within the Highway Modules.

Box A: Box A represents the starting point for bicycle-only analysis. Box A is the same as Box 3 for the Highway, Bicycle and Pedestrian (HBP) System Screening. Box A represents the connection point to transmit the list of official bicycle routes. This list identifies the roadway segments that need to be analyzed. The full bicycle-only analysis will occur only if this box has returned a "Yes."

Box 1: The program accesses the RC files to obtain the data for the area selected. The following data items need to be retrieved:

- Pavement width,
- Number of lanes,
- Right shoulder width,
- Right shoulder type,
- Pavement type,
- Paces rating, and
- Existence of curb and gutter.

Box 2: In Box 2, the MTPT identifies the type of road (functional classification) and then queries an internal minimum criteria table to determine acceptable minimum thresholds for bicycle suitability. Table 7-1 identifies the criteria (based on the AASHTO Bicycle Facility Design Guidelines) for bicycle lane facilities. This table is incorporated into the MTPT evaluation procedures.

Table 7-1. Minimum Conditions for Bicycle Lanes

	Functional Classification					
	Major** * Arterial	Minor Arterial (AADT > 2000)	Minor Arterial (AADT < 2000)	Major Collector	Minor Collector	Local
Roads without Curb:						
Lane Width	14	14	13	13	13	13
Shoulder Width	6	6	4	4	4	4
Combined Lane & Shoulder Width	16	16	14	14	14	14
Roads with Curb:						
Lane Width	14	14	13	13	13	13
Shoulder Type*	I, J, or O	I, J, or O	I, J, or O	I, J, or O	I, J, or O	I, J, or O
Pavement Type**	I, J, or G	I, J, or G	I, J, or G	I, J, or G	I, J, or G	I, J, or G
Paces Rating Min. Acc.	70	70	70	70	70	70
Paces Rating Overlay	60	60	60	60	60	60

* Shoulder Type Index: I = Bituminous concrete (high), J = Portland cement (high), O = Bituminous concrete (high) with curb & gutter

** Pavement Type Index: I = High flexible, J = High rigid, G = Mixed bituminous

*** Multilane facilities (more than two-lane) should conform to Major Arterial criteria

Box 3: Since roads with curb and gutter do not permit bicycle activity on a paved shoulder, these roads must be evaluated separately. As a result, in Box 3 the MTPT asks if the road section has curb and gutter longitudinally positioned to the roadway. If so, the program proceeds to Box 4. If the road does not have adjacent curb and gutter, then the program proceeds to Box 5.

Box 4: This yes/no box is reached if a "Yes" response was returned in Box 3. For roads with curb and gutter, the physical characteristics of the current roadway link (right lane width, pavement type, and pavement condition) are compared to design standards for roadways with bicycle or pedestrian facilities. The suggested design standards are identical to those displayed in Table 7-1. For multi-lane roads, the MTPT computes the effective width of the right lane by assuming the total travel lane pavement width maintains 12-foot lanes and that any excess width may be assigned to the right lane in each direction.

Box 5: This yes/no box is reached if a "No" response was returned in Box 3. In this box, the physical characteristics of the current roadway link (right lane width, right shoulder width, pavement type, pavement condition, and shoulder type) are compared to design standards for roadways with bicycle or pedestrian facilities. The suggested design standards are identical to those displayed in Table 7-1.

Box 6: This box is based directly upon the results of analysis performed in Boxes 4 & 5. If a "Yes" is returned from either box, then this indicates that the roadway is suitable for including bicycle lane facilities in its current condition. The MTPT will compile a list of acceptable road sections for later display in program output.

Box 7: This box is reached if a "No" value is returned from either Box 4 or Box 5. In the event the MTPT determines that at least one road characteristic does not conform to the minimum bike lane criteria summarized in Table 7-1, the program systematically evaluates what type of improvements are necessary to upgrade the facility.

Box 8: The MTPT assigns an upgrade rating to the road section. If the road was determined to be acceptable in its current configuration (Box 6), then a "None" value is assigned. If, however, road improvements are required, the MTPT assigns one of four improvement categories to the road section. Table 7-2 identifies the upgrade designations used by the MTPT.

Table 7-2. Bicycle Lane Upgrade Designation Categories

Key	Upgrade Designation Stands for
Minor 1	A facility improvement on the order of a pavement overlay
Minor 2	A facility improvement on the order of 1. Minor widening of a lane (<= 1 foot) or shoulder (<= 4 feet) or 2. Reconstruction or installation of a paved shoulder to a maximum width of 4'
Major 1	A facility improvement on the order of a widening project.
Major 2	A facility improvement on the order of full roadway reconstruction and roadway widening.

Box 9: Based on the required upgrade improvements determined in Box 7 and the upgrade designation identified in Box 8, the program applies costs based on year 2000 estimated cost values to determine the approximate cost of implementing the required upgrade. The proposed improvement costs for on-road bicycle facility use per-roadway-mile unit costs. Table 7-3 summarizes the default year 2000 unit costs. The prices shown will vary substantially for various geographic regions, corridors with right-of-way restrictions, of project size (a two-mile project typically will have a greater per-mile cost than a 20-mile improvement project). Due to the uncertain nature of the anticipated

inflation rate, a value of 4.0-percent has been assumed up to the year 2010. Unit prices for the year 2010 are estimated using the following equation:

$$Year_{2010} = \left(1 + \frac{\%\,Inflation}{100}\right)^{10} \times Year_{2000}$$

Table 7-3. Bicycle Lane Facility Upgrade Costs

Type of Upgrade	2000 Unit Costs [$/mile]
Minor 1	$35,000
Minor 2	$58,500
Major 1	$350,000
Major 2	$400,000

Default values for unit costs as well as inflation rate can be modified by the program user as previously discussed in Section 6.6 of this report and as shown in Figure 6-8.

Box 10: Box 10 includes routines to display and print results after all bicycle/roadway segments analyzed. Prior to printing program results, all bicycle/roadway links are sorted by highway route number, then by bicycle route number. In the event a roadway corridor is designated to have two bicycle route numbers assigned to the same road, the output will print segment-by-segment information for this corridor. The format for summary output is as follows:

BICYCLE AND PEDESTRIAN ANALYSIS

Bike Routes located in <county name> County are summarized as follows:

Hwy. RTE#	BMP	EMP	TRL	Bike RTE#	Upgrade	Improvement Cost 2000	2010

(Information sorted by Highway Route Number, Then Bike Route Number)

Upon completion of Box 10 of the Bicycle and Pedestrian Analysis, the program logic returns to Figure 1-4 to determine additional highway analysis requirements.

7.3. Program Functional Requirements for Bicycle and Pedestrian Analysis

The Bicycle and Pedestrian Analysis is dependent on unique road conditions, therefore the MTPT must query the GDOT road characteristic file. As a result, analysis can be performed following Bicycle and Pedestrian Module selection, Area identification, and selection of the RC file. The analysis will only be performed on the highway sections (i.e. Freeway, Multilane, or Two-Lane) also selected for evaluation.

APPENDIX A

SUPPLEMENTAL TABLES

Table A-1. Georgia Statewide Aviation Plan

RDC	County	City	Code	Airport	Level
Altamaha Georgia So.	Appling	Hazelhurst	AZE	Hazelhurst	1
Altamaha Georgia So.	Bulloch	Statesboro	TBR	Statesboro Municipal	3
Altamaha Georgia So.	Candler	Metter	MHP	Metter Municipal	1
Altamaha Georgia So.	Evans	Claxton	CWV	Claxton - Evans Co.	2
Altamaha Georgia So.	Jeff Davis	Baxley	30J	Baxley Municipal	2
Altamaha Georgia So.	Tattnall	Reidsville	RVJ	Reidsville	1
Altamaha Georgia So.	Toombs	Vidalia	VDI	Vidalia Municipal	3
Altamaha Georgia So.	Wayne	Jesup	JES	Jessup - Wayne Co.	3
Cent. Savannah River	Columbia	~		New System Airport	2
Cent. Savannah River	Burke	Waynesboro	BXG	Burke County	1
Cent. Savannah River	Emanuel	Swainsboro	SBO	Emanuel County	2
Cent. Savannah River	Jefferson	Louisville	2J3	Louisville Municipal	3
Cent. Savannah River	Jefferson	Wrens	65J	Wrens Memorial	1
Cent. Savannah River	Jenkins	Millen	2J5	Millen	1
Cent. Savannah River	McDuffie	Thomson	48J	Thomson - McDuffie Co.	3
Cent. Savannah River	Richmond	Augusta	AGS	Bush Field	3
Cent. Savannah River	Richmond	Augusta	DNL	Daniel Field	1
Cent. Savannah River	Screven	Sylvania	JYL	Plantation Airpark	2
Cent. Savannah River	Washington	Sandersville	OKZ	Kaolin Field	2
Cent. Savannah River	Wilkes	Washington	IIV	Washington -- Wilkes Co.	2
Chattahoochee Flint	Carroll	Carrollton	CTJ	West Georgia Regional	3
Chattahoochee Flint	Coweta	Newnan	CCO	Newnan - Coweta Co.	3
Chattahoochee Flint	Meriwether	Warm Springs	5A9	Roosevelt Memorial	1
Chattahoochee Flint	Troup	LaGrange	LGC	Callaway	3
Coastal Georgia	Bryan	~		New System Airport	2
Coastal Georgia	Camden	St. Mary's	46J	St. Mary's	2
Coastal Georgia	Chatham	Savannah	SAV	Savannah International	3
Coastal Georgia	Effingham	Springfield		New System Airport	1
Coastal Georgia	Glynn	Brunswick	SSI	Malcolm McKinnon	3
Coastal Georgia	Glynn	Brunswick	BQK	Glyco Jetport	3
Coastal Georgia	Glynn	Jekyll Island	09J	Jekyll Island	1
Coastal Georgia	Liberty	Hinesville	2J2	Liberty County	1
Coosa Valley	Bartow	Cartersville	VPC	Cartersville	2
Coosa Valley	Floyd	Rome	RMG	Richard B. Russell	3
Coosa Valley	Gordon	Calhoun	CZL	Tom B. David Field	3
Coosa Valley	Paulding	Dallas		New System Airport	2
Coosa Valley	Polk	Cedartown	4A4	Cornelius Moore Field	1
Coosa Valley	Walker	Lafayette	9A5	Barwick - Lafayette	2
Georgia Mountains	Forsyth	Cumming	84A	Mathis	4
Georgia Mountains	Forsyth	Cumming		New System Airport	2
Georgia Mountains	Franklin	Canon	18A	Franklin County	1

Level Key

Level	Stands for
1	General aviation airport that potentially impacts economy of the local community
2	General aviation airport that potentially impacts economy of the local community and surrounding area
3	General aviation airport that potentially impacts economy of a large region
4	General aviation airport to be replaced or closed

Table A-1 (continued). Georgia Statewide Aviation Plan

RDC	County	City	Code	Airport	Level
Georgia Mountains	Habersham	Cornelia	AJR	Habersham County	3
Georgia Mountains	Hall	Gainesville	GVL	Lee Gilmer Memorial	3
Georgia Mountains	Lumpkin	Dahlonega	9A0	Lumpkin Co.-Wimpy's Fld.	4
Georgia Mountains	Lumpkin	Dahlonega		New System Airport	2
Georgia Mountains	Rabun	Clayton		New System Airport	2
Georgia Mountains	Stephens	Toccoa	TOC	Toccoa - R. G. LeTourneau	2
Georgia Mountains	Union	Blairsville	46A	Blairsville	2
Heart of Georgia	Bleckley	Cochran	48A	Cochran	1
Heart of Georgia	Dodge	Eastman	EZM	Eastman - Dodge County	3
Heart of Georgia	Laurens	Dublin	DBN	W. H. "Bud" Barron	3
Heart of Georgia	Pulaski	Hawkinsville	51A	Hawkinsville - Pulaski Co.	1
Heart of Georgia	Treutlen	Sperton	4J8	Treutlen County	1
Heart of Georgia	Wheeler	McRae	MQW	Telfair - Wheeler County	1
Lower Chattahoochee	Harris	Pine Mountain	PIM	Callaway Grdn.-Harris Co.	2
Lower Chattahoochee	Muscogee	Columbus	CSG	Columbus Metropolitan	3
Lower Chattahoochee	Randolph	Cuthbert	25J	Cuthbert Randolph	1
McIntosh Trail	Newton	Covington	9A1	Covington Municipal	3
McIntosh Trail	Pike	Williamson	3GA7	Peach State	4
McIntosh Trail	Spalding	Griffin	6A2	Griffin - Spalding County	1
McIntosh Trail	Upson	Thomaston	OPN	Thomaston - Upson County	3
Middle Flint	Crisp	Cordele	CKF	Crisp County - Cordele	2
Middle Flint	Macon	Montezuma	53A	Dr. C. P. Savage Sr.	1
Middle Flint	Marion	Buena Vista	82A	Marion County	1
Middle Flint	Sumter	Americus	ACJ	Souther Field	3
Middle Flint	Taylor	Butler	6A1	Butler Municipal	2
Middle Georgia	Baldwin	Milledgeville	MJL	Baldwin County	3
Middle Georgia	Bibb	Macon	MCN	Middle Georgia Regional	3
Middle Georgia	Bibb	Macon	MAC	Herbert Smart Downtown	2
Middle Georgia	Houston	Perry	PXE	Perry - Fort Valley	2
Middle Georgia	Houston	Warner-Robbins	5AZ	Warner Robbins Air Park	3
Middle Georgia	Monroe	Forsyth		New System Airport	1
North Georgia	Cherokee	Canton	47A	Cherokee County	1
North Georgia	Gilmer	Ellijay	49A	Gilmer County	1
North Georgia	Pickens	Jasper	JZP	Pickens County	2
North Georgia	Whitfield	Dalton	DNN	Dalton Municipal	3
Northeast Georgia	Barrow	Winder	WDR	Winder	2
Northeast Georgia	Clarke	Athens	AHN	Athens - Ben Epps	3
Northeast Georgia	Elbert	Elberton	27A	Elbert County - Patz Field	1
Northeast Georgia	Greene	Greensboro	3J7	Green County Airpark	1
Northeast Georgia	Jackson	Jefferson	19A	Jackson County	2
Northeast Georgia	Morgan	Madison	52A	Madison Municipal	4

Level Key

Level	Stands for
1	General aviation airport that potentially impacts economy of the local community
2	General aviation airport that potentially impacts economy of the local community and surrounding area
3	General aviation airport that potentially impacts economy of a large region
4	General aviation airport to be replaced or closed

Table A-1 (continued). Georgia Statewide Aviation Plan

RDC	County	City	Code	Airport	Level
Northeast Georgia	Morgan	Madison		New System Airport	3
Northeast Georgia	Walton	Monroe	D73	Monroe - Walton County	1
South Georgia	Ben Hill	Fitzgerald	FZG	Fitzgerald Municipal	2
South Georgia	Berrien	Nashville	4J2	Berrien County	1
South Georgia	Brooks	Quitman	4JS	Quitman - Brooks County	1
South Georgia	Cook	Adel	15J	Cook County	1
South Georgia	Lowndes	Valdosta	VLD	Valdosta Regional	3
South Georgia	Tift	Tifton	TMA	Henry - Tift - Myers	3
South Georgia	Turner	Ashburn	75J	Turner County	1
Southeast Georgia	Bacon	Alma	AMG	Bacon County	2
Southeast Georgia	Brantley	Nahunta	4J1	Brantley County	1
Southeast Georgia	Charlton	Folkston	3J6	Davis Field	1
Southeast Georgia	Clinch	Homerville	HOE	Homerville	2
Southeast Georgia	Coffee	Douglas	DQH	Douglas Municipal	3
Southeast Georgia	Ware	Waycross	AYS	Waycross - Ware County	3
Southwest Georgia	Colquitt	Moultrie	MUL	Spence Field	2
Southwest Georgia	Colquitt	Moultrie	MGR	Moultrie Municipal	1
Southwest Georgia	Decatur	Bainbridge	GBE	Decatur County Industrial Airpark	3
Southwest Georgia	Dougherty	Albany	ABY	Southwest Georgia Regional	3
Southwest Georgia	Early	Blakely	11J	Early County	3
Southwest Georgia	Grady	Cairo	70J	Cairo - Grady County	1
Southwest Georgia	Mitchell	Camilla	CXU	Camilla - Mitchell County	1
Southwest Georgia	Seminole	Donalsonville	17J	Donalsonville Municipal	2
Southwest Georgia	Terrell	Dawson	16J	Dawson Municipal	2
Southwest Georgia	Thomas	Thomasville	TVI	Thomasville Municipal	3
Southwest Georgia	Worth	Sylvester	SYV	Sylvester	1

Level Key

Level	Stands for
1	General aviation airport that potentially impacts economy of the local community
2	General aviation airport that potentially impacts economy of the local community and surrounding area
3	General aviation airport that potentially impacts economy of a large region
4	General aviation airport to be replaced or closed

Table A-2. Georgia State Commuter Rail Plan

Phase 1 -- Initial Implementation	Phase 2 -- Later Implementation
Athens	Avondale Estates
Austell	Canton
Bogart	Conyers
Bremen	Covington
Dacula	Cumberland Mall
Douglasville	Duluth
East Point	Gainsville
Emory	Holly Springs
Five Points	Lenox
Lawrenceville	Lithonia
Lilburn	Madison
Mableton	Marietta
Peachtree City	Norcross
Reagan Pkwy	Oakwood
Red Oak	Sandy Plains Rd.
Senoia	Social Circle
Temple	Stone Mountain
Tucker	Sugar Hill
Tyrone	Suwanee
Vila Rica	
Winder	

Table A-3. Georgia Intercity Bus Plan Potential New Service Needs and Abandonment Concerns

County	Bus Rte.	Operator	City 1	City 2	City 3	City 4	Hwy. Rte.	State Class
Fannin	0	~	~	~	~	~	S.R. 5	1
Gilmer	0	~	~	~	~	~	S.R. 5	1
Pickens	0	~	~	~	~	~	S.R. 5	1
Cherokee	0	~	~	~	~	~	Int. 575	1
Union	0	~	~	~	~	~	U.S. 19	1
Lumpkin	0	~	~	~	~	~	U.S. 19	1
Dawson	0	~	~	~	~	~	U.S. 19 / S.R. 400	1
Forsyth	0	~	~	~	~	~	U.S. 19 / S.R. 400	1
Rabun	0	~	~	~	~	~	U.S. 23	1
Habersham	0	~	~	~	~	~	U.S. 23	1
Hall	0	~	~	~	~	~	U.S. 23	1
Clayton	2790	C& H Bus	Riverdale	~	~	~	S.R. 85	3
Fayette	2790	C& H Bus	Fayetteville	~	~	~	S.R. 85	3
Coweta	2790	C& H Bus	Senoia	~	~	~	S.R. 85	3
Meriwether	2790	C& H Bus	Alvaton	Gay	Wood-bury	Warm Springs	S.R. 85	3
Talbot	2790	C& H Bus	Woodland	Talbotton	~	~	S.R. 41/22	3
Muscogee	2790	C& H Bus	Columbus	~	~	~	S.R. 22 / U.S. 27	3
Chattahoochee	2791	C& H Bus	Cusseta	~	~	~	U.S. 27	3
Stewart	2790	C& H Bus	Lumpkin	~	~	~	U.S. 27	3
Randolph	2790	C& H Bus	Cuthbert	~	~	~	U.S. 27	3
Clay	2790	C& H Bus	~	~	~	~	U.S. 27	3
Early	2790	C& H Bus	Blakely	~	~	~	U.S. 27	3
Miller	2790	C& H Bus	Colquitt	~	~	~	U.S. 27	3
Decatur	2790	C& H Bus	Bainbridge	~	~	~	U.S. 27	3
Seminole	7500	Capital Trailways	Donalsonville	~	~	~	U.S. 84	3
Decatur	7500	Capital Trailways	Bainbridge	Attapulgus	~	~	U.S. 84/27	3
Muscogee	443	Greyhound	Columbus	~	~	~	U.S. 280	3
Chattahoochee	443	Greyhound	Cusseta	~	~	~	U.S. 280	3
Stewart	443	Greyhound	Richland	~	~	~	U.S. 280	3
Webster	443	Greyhound	~	~	~	~	U.S. 280	3
Terrell	443	Greyhound	Dawson	~	~	~	U.S. 280	3
Dougherty	443	Greyhound	Albany	~	~	~	U.S. 280/82	3
Worth	443	Greyhound	Sylvester	~	~	~	U.S. 82	3
Tift	443	Greyhound	Tifton	~	~	~	U.S. 82	3
Berrien	443	Greyhound	~	~	~	~	U.S. 82	3
Atkinson	443	Greyhound	Willacoochee	~	~	~	U.S. 82	3
Ware	443	Greyhound	Waycross	~	~	~	U.S. 82	3
Long	442	Greyhound	Jesup	~	~	~	U.S. 84	3

Table A-3 (continued). Georgia Intercity Bus Plan
Potential New Service Needs and Abandonment Concerns

County	Bus Rte.	Operator	City 1	City 2	City 3	City 4	Hwy. Rte.	State Class
Pierce	442	Greyhound	Patterson	Blackshear	~	~	U.S. 84	3
Ware	442	Greyhound	Waycross	~	~	~	U.S. 84	3
Clinch	442	Greyhound	Homerville	~	~	~	U.S. 84	3
Lanier	442	Greyhound	~	~	~	~	U.S. 84	3
Lowndes	442	Greyhound	Valdosta	~	~	~	U.S. 84	3
Brooks	442	Greyhound	Quitman	~	~	~	U.S. 84	3
Thomas	442	Greyhound	Boston	Thomasville	~	~	U.S. 84	3
Grady	442	Greyhound	Cairo		~	~	U.S. 84 / S.R. 93	3
Richmond	7505	Capital Trailways	Augusta	Fort Gordon	~	~	U.S. 1	3
Jefferson	7505	Capital Trailways	Wrens	Louisville	~	~	U.S. 1 / S.R. 24	3
Washington	7505	Capital Trailways	Sandersville	~	~	~	S.R. 24	3
Baldwin	7505	Capital Trailways	Milledgeville	~	~	~	S.R. 24	3
Jones	7505	Capital Trailways	Gray	~	~	~	S.R. 24/22	3
Bibb	7505	Capital Trailways	Macon	~	~	~	S.R.22 / Int. 75	3
Peach	7505	Capital Trailways	Byron	Fort Valley	~	~	Int. 75 / S.R. 96	3
Taylor	7505	Capital Trailways	Reynolds	Butler	~	~	S.R. 96	3
Talbot	7505	Capital Trailways	~	~	~	~	S.R. 96	3
Muscogee	7505	Capital Trailways	Columbus	~	~	~	U.S. 80	3
Richmond	7507	Capital Trailways	Augusta	Fort Gordon	~	~	U.S. 1	3
Jefferson	7507	Capital Trailways	Louisville	~	~	~	U.S. 1 / S.R. 24	3
Washington	7507	Capital Trailways	Sandersville	~	~	~	S.R. 24	3
Baldwin	7507	Capital Trailways	Milledgeville	~	~	~	S.R. 24	3
Jones	7507	Capital Trailways	~	~	~	~	S.R. 24 / 22	3
Bibb	7507	Capital Trailways	~	~	~	~	S.R. 22 / Int. 75	3
Peach	7507	Capital Trailways	Fort Valley	~	~	~	Int. 75 / S.R. 96	3
Taylor	7507	Capital Trailways	Butler	~	~	~	S.R. 96	3
Talbot	7507	Capital Trailways	~	~	~	~	S.R. 96	3
Muscogee	7507	Capital Trailways	Columbus	~	~	~	U.S. 80	3
Bibb	441	Greyhound Lines	Macon	~	~	~	Int. 16	3
Twiggs	441	Greyhound Lines	~	~	~	~	Int. 16 / U.S. 80	3
Lauren	441	Greyhound Lines	Dublin	~	~	~	U.S. 80	3
Emanuel	441	Greyhound Lines	Swainsboro	Twin City	~	~	U.S. 80	3
Statesboro	441	Greyhound Lines	Statesboro	~	~	~	U.S. 80	3
Chatham	441	Greyhound Lines	Savannah	~	~	~	U.S. 80	3
Bibb	7495	Georgia Trailways	Macon	~	~	~	S.R. 57	3
Wilkinson	7495	Georgia Trailways	Gordon	Irwinton	~	~	S.R. 57 / U.S. 441	3

Table A-3 (continued). Georgia Intercity Bus Plan
Potential New Service Needs and Abandonment Concerns

County	Bus Rte.	Operator	City 1	City 2	City 3	City 4	Hwy. Rte.	State Class
Laurens	7495	Georgia Trailways	Dublin	~	~	~	U.S. 441 / S.R. 29	3
Treutlen	7495	Georgia Trailways	Soperton	~	~	~	S.R. 29	3
Montgomery	7495	Georgia Trailways	~	~	~	~	S.R. 29	3
Toombs	7495	Georgia Trailways	Vidalia	Lyons	~	~	U.S. 280	3
Tattnall	7495	Georgia Trailways	Reidsville	~	~	~	U.S. 280	3
Evans	7495	Georgia Trailways	Claxton	~	~	~	U.S. 280	3
Bryan	7495	Georgia Trailways	Pembroke	~	~	~	U.S. 280	3
Chatham	7495	Georgia Trailways	Savannah	~	~	~	U.S. 280	3
Richmond	2792	Southeastern Stages	Augusta	~	~	~	U.S. 25	3
Burke	2792	Southeastern Stages	Waynesboro	~	~	~	U.S. 25 / S.R. 24	3
Jenkins	2792	Southeastern Stages	Millen	~	~	~	U.S. 25 / S.R. 21	3
Screven	2792	Southeastern Stages	Sylvania	~	~	~	S.R. 21 / 24	3
Effingham	2792	Southeastern Stages	Springfield	~	~	~	S.R. 21	3
Chatham	2792	Southeastern Stages	Savannah	~	~	~	S.R. 21	3

Database: county.mdb

State Case 1: Potential new service needed
State Case 3: Existing service potentially vulnerable to abandonment.

Table A-4. Georgia Urbanized Counties
[Invalid for purposes of MTPT Transit Analysis]

Bibb	Floyd
Catoosa	Fulton
Chatham	Glynn
Clarke	Gwinnett
Clayton	Houston
Cobb	Muscogee
Dekalb	Richmond
Dougherty	

Database: transit.mdb, Table "Urban"

Table A-5. Georgia Section 5311 Provider Counties
[Invalid for purposes of MTPT Transit Analysis]

Baldwin	Habersham	Pulaski
Banks	Hall	Putnam
Bartow	Hancock	Quitman
Bleckley	Haralson	Rabun
Bryan	Hart	Sumter
Burke	Henry	Talbot
Chattahoochee	Jackson	Taliaferro
Cherokee	Jefferson	Telfair
Clay	Jenkins	Tift
Columbia	Laurens	Treutlen
Crawford	Lincoln	Troup
Dade	Long	Twiggs
Dodge	Lumpkin	Walker
Dooly	McDuffie	Walton
Elbert	Montgomery	Warren
Emanuel	Morgan	Wheeler
Fannin	Murray	Whitfield
Forsyth	Paulding	Wilcox
Gilmer	Peach	Wilkes
Glascock	Pickens	Wilkinson
Gordon	Pierce	
Greene	Polk	

Database: transit.mdb, Table "PRO5311"

Table A-6. Georgia Section 5310 Provider Counties

County	City	Provider
BACON	ALMA	BACON COUNTY MR SERVICE PROVIDER
BALDWIN	MILLEDGEVILLE	OCONEE CSB
BARROW	WINDER	TRANSBARROW, INC.
BARTOW	CARTERSVILLE	TALLATOONA EOA, INC
BEN HILL	FITZGERALD	BEN HILL MR SERVICE
BIBB	MACON	OLDER AMER. COUNCIL OF MIDDLE GA.
CALHOUN	ARLINGTON	ARLINGTON NUTRITION PROGRAM, INC.
CARROLL	CARROLLTON	CARROLL TRANSIT, INC.
CHEROKEE	CANTON	CHEROKEE COUNTY MH/MR SERV. CTR
CLARKE	ATHENS	NORTHEAST GEORGIA CSB
CLARKE	ATHENS	KELLEY DIVERSIFIED, INC.
CLINCH	HOMERVILLE	CLINCH COUNTY TRAINING CENTER
COLQUITT	MOULTRIE	SOUTHWEST GA. COMM. ACTION
COWETA	NEWNAN	COUNCIL ON AGING/NEWNAN-COWETA
DECATUR	BAINBRIDGE	DECATUR-SEMINOLE TRAINING CENTER
DECATUR	BAINBRIDGE	GA INDUSTRIES FOR THE BLIND
DOUGHERTY	ALBANY	EASTER SEAL ALBANY
DOUGHERTY	ALBANY	SOWEGA COUNCIL ON AGING, INC.
DOUGLAS	DOUGLASVILLE	DOUGLAS CO. COUNCIL ON AGING
EFFINGHAM	SRINGFIELD	EFFINGHAM SR. CITIZENS, INC.
FANNIN	BLUE RIDGE	MINERAL SPRINGS CENTER
FLOYD	ROME	NETWORK ASSOCIATES, INC.
GILMER	ELLIJAY	VOCATIONAL TRANSITIONS, INC.
GLYNN	BRUNSWICK	COASTAL GEORGIA CSB
GLYNN	BRUNSWICK	COASTAL GA. COMMUNITY ACTION
GRADY	CAIRO	GRADY COUNTY COUNCIL ON AGING
HALL	GAINSVILLE	GUEST HOUSE, INC.
HALL	GAINSVILLE	PEAK SERVICES, INC.
HALL	GAINSVILLE	REHAB. INDUSTRIES OF NORTHEAST GA.
HALL	GAINSVILLE	GEORGIA MOUNTAINS CSB
HANCOCK	SPARTA	HANCOCK COUNTY SERVICE CENTER
HARALSON	BREMEN	HARALSON PROGRESSIVE INDUSTRIES
HEARD	FRANKLIN	CHATTAHOOCHEE-FLINT RDC
HEARD	FRANKLIN	HEARD CO. REDEVELOPMENT CORP.
IRWIN	OCILLA	SUNNY DALE TRAINING CENTER, INC.
JACKSON	JEFFERSON	JACKSON ADVISORY COA, INC.
LAURENS	DUBLIN	EASTER SEAL DUBLIN
LINCOLN	LINCOLNTON	LINCOLN COUNTY COMMISSIONERS
LOWNDES	VALDOSTA	SOUTH GEORGIA COA
LOWNDES	VALDOSTA	SOUTH GEORGIA CSB
LOWNDES	VALDOSTA	COASTAL PLAIN AREA EOA, INC.
MADISON	DANIELSVILLE	MADISON COUNTY COUNCIL ON AGING
MERIWETHER	WARM SPRINGS	OUTDOOR THERAPEUTIC PROGRAM, WM
MURRAY	CHATSWORTH	MURRAY COUNTY MR SERVICES CENTE
MUSCOGEE	COLUMBUS	DIRECT SERVICE CORPORATION
NEWTON	COVINGTON	NEWTON COUNTY DFCS

Table A-6 (continued). Georgia Section 5310 Provider Counties

County	City	Provider
OCONEE	BISHOP	OCONEE C O A
OGLETHORPE	CRAWFORD	OGLETHORPE COUNTY SR. CITIZENS
PEACH	FORT VALLEY	KAY COMMUNITY CENTER FOR M. R.
PUTNAM	EATONTON	PUTNAM-JASPER MR SERVICE CENTER
PUTNAM	EATONTON	PUTNAM COUNTY SENIOR CENTER
RABUN	CLAYTON	WOODLANDS FOUNDATION, INC.
RICHMOND	AUGUSTA	EASTER SEAL AUGUSTA
RICHMOND	AUGUSTA	LYNNDALE, INC
RICHMOND	AUGUSTA	SR. CITIZENS COUNCIL OF GREATER AU
SPAULDING	GRIFFIN	GRIFFIN AREA RESOURCES CENTER
SPAULDING	GRIFFIN	GRIFFIN COMMUNITY WORKSHOP
SPAULDING	GRIFFIN	COUNCIL ON AGING/MCINTOSH TRAIL
SUMTER	AMERICUS	MID FLINT AREA COUNCIL ON AGING
TELFAIR	MCRAE	HEART OF GA. AREA AGENCY ON AGING
THOMAS	THOMASVILLE	THOMASVILLE-THOMAS CO. COA
TIFT	TIFTON	TIFT COUNTY MR/MH CENTER
TROUP	LAGRANGE	NEW VENTURES, INC.
UPSON	THOMASTON	GILMORE CENTER
WALKER	LAFAYETTE	LOOKOUT MOUNTAINS CSB
WALTON	MONROE	WALTON COUNTY SR. CITIZENS COU
WARE	WAYCROSS	SATILLA CSB
WARE	WAYCROSS	SOUTHEAST GEORGIA RDC
WARE	WAYCROSS	WARE COUNTY MR SERVICE CENTER
WARE	WAYCROSS	CONCRETED SERVICES, INC.
WASHINGTON	SANDERSVILLE	WASHINGTON COUNTY COA
WHITFIELD	DALTON	GEORGIA HIGHLANDS CSB
WILKES	WASHINGTON	GA TASC. WILKES LINCOLN S/C
WILKINSON	GORDON	WILKINSON COUNTY SERVICE CENTER

Table A-7. Georgia State Provider Counties

County	City	Provider
ATKINSON	PEARSON	ATKINSON COUNTY MR SERVICE CENTER
BALDWIN	MILLEDGEVILLE	BALDWIN COUNTY SERVICE CENTER
BALDWIN	MILLEDGEVILLE	OVERVIEW, INC.
BARROW	WINDER	BARROW COUNTY MR SERVICE CENTER
BARTOW	CARTERSVILLE	GEORGIA DIVERSIFIED INDUSTRIES
BARTOW	CARTERSVILLE	WOODRIGHT INDUSTRIES
BIBB	MACON	RIVER BEHAVIORAL HEALTH CTR.
BLECKLEY	COCHRAN	BLECKLEY COUNTY MR SERVICE CENTE
BULLOCH	STATESBORO	BULLOCH CO. HEALTH DEPARTMENT
BULLOCH	STATESBORO	PINELAND AREA CSB
CARROLL	CARROLLTON	CARROLL COUNTY TRAINING CENTER
CHARLTON	FOLKSTON	CHARLTON-BRANTLEY CO. MRSC
CHARLTON	FOLKSTON	CHARLTON-BRANTLEY CO. MRSC
CHATHAM	SAVANNAH	COASTAL CENTER FOR DEV. SERVICE
CHATHAM	SAVANNAH	TIDELANDS CSB
CLARKE	ATHENS	NORTHEAST GEORGIA AAA
COFFEE	DOUGLAS	COFFEE COUNTY MR SERVICE CENTER
COLQUITT	MOULTRIE	GREEN OAKS MR SERVICE CENTER
COLUMBIA	EVANS	SR. CITIZENS COLUMBIA COUNTY
COLUMBIA	THOMPSON	GA TASC: COLUMBIA MCDUFFIE S/C
COWETA	NEWNAN	RUTLEDGE, INC.
DEKALB	ATLANTA	GEORGIA MENTAL HEALTH INSTITUTE
DODGE	EASTMAN	DODGE COUNTY SERVICE CENTER
DOUGHERTY	ALBANY	ALBANY AREA CSB
DOUGHERTY	ALBANY	ALBANY ASSOC. FOR RETARDED CITIZE
DOUGHERTY	ALBANY	PRIMUS INDUSTRIES/DOUGHERTY CO.
DOUGHERTY	ALBANY	SOUTH GA RESIDENTIAL SERVICES
DOUGLAS	DOUGLASVILLE	DOUGLAS COUNTY RETARDATION ASS.
EARLY	BLAKELY	EARLY-MILLER COUNTY SERVICE CENT
ELBERT	ELBERTON	ELBERT COUNTY MR SERVICES CENTER
EMANUEL	SWAINSBORO	OGEECHEE MH/MR CSB
GORDON	CALHOUN	GORDON COUNTY TRAINING CENTER
GREENE	GREENSBORO	GREENE-OGLETHORPE MR SERVICE CEN
HARALSON	BREMEN	HARALSON COUNTY CENTER FOR MH
HOUSTON	WARNER ROBINS	PHOENIX CENTER CSB
JACKSON	COMMERCE	JACKSON COUNTY SERVICE CENTER
JOHNSON	WRIGHTSVILLE	JOHNSON COUNTY SUPPORTS & SERVIC
LAMAR	BARNESVILLE	LAMAR ASSOC. FOR RETATRDED CITIZEN
LAURENS	DUBLIN	LAURENS BOARD OF HEALTH
LAURENS	DUBLIN	LAURENS COUNTY SERVICE CENTER
LAURENS	DUBLIN	MIDDLE GEORGIA CSB
LOWNDES	VALDOSTA	LARC, INC.
LUMPKIN	DAHLONEGA	LUMPKIN INDEPENDANT LIVING
MACON	MONTEZUMA	WEST CENTRAL GA COMM ACTION
MADISON	DANIELSVILLE	MADISON COUNTY SERVICE CENTER

Table A-7 (continued). Georgia State Provider Counties

County	City	Provider
MADISON	DANIELSVILLE	RESOURCE MANAGEMENT ASSOC. UNL.
MITCHELL	CAMILLA	MITCHELL-BAKER COUNTY SERVICE
MONTGOMERY	MOUNT VERNON	MONTGOMERY-WHEELER PROD. & SERV
MUSCOGEE	COLUMBUS	ENRICHMENT SERVICES PROGRAM, I
MUSCOGEE	COLUMBUS	NEW HORIZONS CSB
PAULDING	DALLAS	PAULDING ENTERPRISES
PICKENS	JASPER	BURNT MOUNTAIN CENTER, INC.
POLK	CEDARTOWN	COOSA VALLEY CSB
PULASKI	HAWKINSVILLE	PUALASKI COUNTY MR SERV. CENTER
SPAULDING	GRIFFIN	MCINTOSH TRAIL CSB
STEPHENS	TOCCOA	TOCCOA REHABILITATION INDUSTRIES
SUMTER	AMERICUS	MIDDLE FLINT CSB
TELFAIR	MCRAE	TELFAIR PRODUCTS AND SERVICES
TERRELL	DAWSON	TERRELL-LEE MR SERVICE CENTER
THOMAS	THOMASVILLE	GEORGIA PINES CSB
THOMAS	THOMASVILLE	THOMAS-GRADY MR SERVICE CENTER
TREUTLEN	SOPERTON	TREULTLEN COUNTY SERVICE CENTER
TROUP	LAGRANGE	CHATT-FLINT CSB
WALKER	LAFAYETTE	LOOKOUT MOUNTAINS CSB
WALKER	LAFAYETTE	WALKER COUNTY DFCS
WALTON	MONROE	WALTON-MORGAN MR SERVICE CENTE
WARE	WAYCROSS	SOUTHEAST HEALTH UNIT
WARE	WAYCROSS	WARE COUNTY BOARD OF HEALTH
WHITE	CLEVELAND	OUTDOOR THERAPEUTIC PROG, CLEVEL
WHITFIELD	DALTON	CHEERHAVEN INC.
WHITFIELD	DALTON	GEORGIA HIGHLANDS CSB
WHITFIELD	DALTON	VALUABLE INDUSTRIAL PRODUCERS
WHITFIELD	DALTON	WHITFIELD COUNTY HEALTH DEPT
WILCOX	ROCHELLE	WILCOX COUNTY MR SERVICE CENTER

Table A-8. Relative Terrain Conditions for Georgia

County	Terrain	County	Terrain	County	Terrain	County	Terrain
Appling	Level	Dade	Rolling	Jefferson	Rolling	Richmond	Level
Atkinson	Level	Dawson	Rolling	Jenkins	Level	Rockdale	Level
Bacon	Rolling	Decatur	Level	Johnson	Rolling	Schley	Level
Baker	Level	Dekalb	Level	Jones	Rolling	Screven	Level
Baldwin	Rolling	Dodge	Level	Lamar	Rolling	Seminole	Rolling
Banks	Rolling	Dooly	Level	Lanier	Level	Spalding	Rolling
Barrow	Rolling	Dougherty	Level	Laurens	Rolling	Stephens	Rolling
Bartow	Rolling	Douglas	Level	Lee	Level	Stewart	Rolling
Ben Hill	Rolling	Early	Level	Liberty	Level	Sumter	Rolling
Berrien	Level	Echols	Level	Lincoln	Level	Talbot	Rolling
Bibb	Rolling	Effingham	Level	Long	Level	Taliaferro	Level
Bleckley	Level	Elbert	Level	Lowndes	Level	Tattnall	Level
Brantley	Level	Emanuel	Level	Lumpkin	Rolling	Taylor	Rolling
Brooks	Level	Evans	Level	Macon	Level	Telfair	Level
Bryan	Rolling	Fannin	Rolling	Madison	Rolling	Terrell	Level
Bulloch	Level	Fayette	Rolling	Marion	Level	Thomas	Level
Burke	Level	Floyd	Rolling	McDuffie	Level	Tift	Level
Butts	Level	Forsyth	Rolling	McIntosh	Level	Toombs	Level
Calhoun	Level	Franklin	Rolling	Meriwether	Rolling	Towns	Mount.
Camden	Level	Fulton	Level	Miller	Level	Treutlen	Rolling
Candler	Level	Gilmer	Rolling	Mitchell	Level	Troup	Rolling
Carroll	Level	Glascock	Rolling	Monroe	Rolling	Turner	Level
Catoosa	Rolling	Glynn	Level	Montgomery	Level	Twiggs	Rolling
Charlton	Level	Gordon	Rolling	Morgan	Rolling	Union	Mount.
Chatham	Level	Grady	Level	Murray	Rolling	Upson	Rolling
Chattahoochee	Level	Greene	Rolling	Muscogee	Level	Walker	Rolling
Chattooga	Rolling	Gwinnett	Rolling	Newton	Rolling	Walloon	Rolling
Cherokee	Rolling	Habersham	Rolling	Oconee	Rolling	Ware	Level
Clarke	Rolling	Hall	Rolling	Oglethorpe	Rolling	Warren	Level
Clay	Level	Hancock	Rolling	Paulding	Rolling	Washington	Rolling
Clayton	Level	Haralson	Rolling	Peach	Level	Wayne	Level
Clinch	Level	Harris	Level	Pickens	Rolling	Webster	Rolling
Cobb	Level	Hart	Level	Pierce	Level	Wheeler	Level
Coffee	Level	Heard	Level	Pike	Level	White	Mount.
Colquitt	Level	Henry	Rolling	Polk	Rolling	Whitfield	Rolling
Columbia	Level	Houston	Rolling	Pulaski	Level	Wilcox	Level
Cook	Level	Irwin	Level	Putnam	Rolling	Wilkes	Level
Coweta	Rolling	Jackson	Rolling	Quitman	Rolling	Wilkinson	Rolling
Crawford	Rolling	Jasper	Rolling	Rabun	Mount.	Worth	Level
Crisp	Level	Jeff Davis	Level	Randolph	Level		

Table A-9. Multilane Highway Study Site Characteristics

Site	Road	Direction	County	Access Points per km [mi]	Grade (%)	Horizontal Curvature C = Curve T = Tangent
1	SR 2, 515	SB	Union	0.93 [1.50]	+ 2.0	C
2	SR 300	NB	Worth	1.09 [1.75]	+ 2.3	T
3	SR 38	EB	Seminole	4.19 [6.75]	+ 1.4	T
4	SR 38	EB	Brooks	1.71 [2.75]	- 0.2	T
5	SR 520	EB	Ware	1.86 [3.00]	+ 0.3	C
6	SR 53	EB	Floyd	1.55 [2.50]	- 0.2	T
7	SR 365	SB	Habersham	0.97 [1.56]	- 0.5	T
8	SR 15	NB	Habersham	0.93 [1.50]	+ 3.3	C
9	SR 35	SB	Grady	1.16 [1.87]	+ 0.7	T
10	SR 6	WB	Paulding	3.26 [5.25]	+ 3.1	T
11	SR 5, 515	SB	Gilmer	0.78 [1.25]	+ 2.5	C
12	SR 2, 5, 515	NB	Gilmer	2.17 [3.50]	- 0.9	C

Table A-10. Multilane Highway Site Speed Summaries

Posted Speed	Site	Mean Speed km/hr [mi/hr]	85th-percentile km/hr [mi/hr]	Standard Error km/hr [mi/hr]	Percent > 88.5 km/hr [55 mi/hr] %	Percent > 104.6 km/hr [65 mi/hr] %
88.5 km/hr [55 mi/hr]	1	99.4 [61.8]	110.2 [68.5]	10.93 [6.79]	83.7	28.3
	2	95.1 [59.1]	103.5 [64.3]	9.41 [5.85]	76.5	9.7
	3	94.9 [59.0]	103.7 [64.5]	9.88 [6.14]	72.9	10.8
	4	99.4 [61.8]	110.0 [68.3]	11.99 [7.45]	87.7	27.6
	5	104.7 [65.0]	112.5 [69.9]	9.69 [6.02]	95.2	45.6
	6	101.2 [62.9]	111.2 [69.1]	10.57 [6.57]	87.4	33.8
	7	100.5 [62.4]	110.4 [68.6]	9.77 [6.07]	87.6	29.9
	8	101.4 [63.0]	111.0 [69.0]	9.88 [6.14]	89.5	33.6
	9	98.2 [61.0]	108.0 [67.1]	9.17 [5.70]	83.4	19.7
	10	94.2 [58.5]	103.6 [64.4]	9.78 [6.08]	69.7	10.5
	11	98.0 [60.9]	108.1 [67.2]	9.83 [6.11]	83.0	19.9
	12	100.3 [62.3]	110.0 [68.3]	9.17 [5.70]	89.3	28.1
	Avg.	98.9 [61.5]	108.5 [67.4]	10.01 [6.22]	84.4	25.5
104.6 km/hr [65 mi/hr]	1	99.0 [61.5]	109.6 [68.1]	10.28 [6.39]	82.3	26.0
	2	101.1 [62.8]	110.3 [68.6]	9.72 [6.04]	89.1	32.0
	3	102.1 [63.5]	111.2 [69.1]	10.72 [6.66]	90.0	39.6
	4	105.8 [65.7]	117.7 [73.1]	15.31 [9.51]	92.2	63.1
	5	105.8 [65.8]	112.3 [69.8]	8.77 [5.45]	96.1	57.8
	6	103.3 [64.2]	112.1 [69.7]	10.09 [6.27]	90.5	45.8
	7	109.3 [67.9]	118.8 [73.8]	9.98 [6.20]	96.9	70.7
	8	104.9 [65.2]	115.1 [71.5]	10.01 [6.22]	94.0	48.1
	9	108.2 [67.2]	117.6 [73.1]	10.17 [6.32]	96.5	68.8
	10	99.9 [62.1]	109.9 [68.3]	10.07 [6.26]	86.0	28.3
	11	103.7 [64.5]	111.9 [69.6]	9.48 [5.89]	93.7	43.1
	12	106.7 [66.3]	117.3 [72.9]	10.85 [6.74]	94.3	58.3
	Avg.	104.2 [64.7]	113.7 [70.6]	10.46 [6.50]	92.5	51.0

Note: Data shown is based on 24-hour data sets for all vehicles observed

Table A-11. Volumes and Percentage of Heavy Vehicles Observed for Multilane Highway Sites

Site	Posted 88.5 km/hr [55 mi/hr]			Posted 104.6 km/hr [65 mi/hr]		
	Volume (vpd)	Adjusted Volume* (pcpd)	Percent Heavy Vehicles	Volume (vpd)	Adjusted Volume* (pcpd)	Percent Heavy Vehicles
1	2099	2174	7.2	2646	2734	6.6
2	2468	2804	27.2	3214	3622	25.4
3	2496	2844	27.9	2865	3273	28.5
4	3795	4154	18.9	4041	4353	15.4
5	1889	2174	30.2	1967	2254	29.1
6	6948	7513	16.3	6670	7045	11.2
7	7343	8857	10.3	9085	11781	14.8
8	2429	2935	10.4	5809	6497	5.9
9	2782	3498	12.9	3667	4533	11.8
10	4071	4875	9.9	4538	5064	5.8
11	4345	5091	8.6	4991	5925	9.4
12	6224	7178	7.7	6238	7352	8.9

* Adjusted volume is a volume corrected for the presence of heavy vehicles per HCM adjustment factors.

Table A-12. Two-Lane Analysis Road Summary Data Sets

County	Road	Miles
District 1:		
Dawson	SR 9	9.88
Forsyth	SR 9	21.33
Lumpkin	SR 9	23.84
Gwinnett	SR 20	25.77
Banhs	SR51	18.26
Franklin	SR51	23.18
Hart	SR51	19.24
Walton	SR 83	8.99
Hall	SR 332	10.42
Jackson	SR 332	12.63
White	SR 348	5.97
Hall	SR 369	7.36
Total District 1 Data:		**186.87**
District 2:		
Emanuel	SR 4	38.15
Jefferson	SR 4	35.23
Newton	SR 11	12.49
Jenkins	SR 17	20.62
Screven	SR 17	23.36
Laurens	SR 19	40.07
Wilkison	SR 19	1.52
Morgan	SR 24	20.52
Jefferson	SR 47	6.36
Baldwin	SR 49	11.44
Johnson	SR 78	13.17
Baldwin	SR 112	8.44
Jasper	SR 142	13.85
Newton	SR 142	16.21
Putnam	SR 142	5.82
Morgan	SR 186	0.48
Bleckley	SR 257	5.57
Dodge	SR 257	12.11
Laurens	SR 257	16.75
Washington	SR 272	15.35
Bleckley	SR 278	7.81
Laurens	SR 278	2.89
Total District 2 Data:		**328.21**

County	Road	Miles
District 5:		
Dooly	SR 7	19.76
Houston	SR 7	18.11
Peach	SR 7	11.43
Harris	SR 18	11.61
Lamar	SR 18	15.70
Meriwether	SR 18	26.39
Pike	SR 18	21.93
Wilkinson	SR 18	11.79
Dooly	SR27	25.22
Pulashi	SR27	22.50
Sumter	SR27	28.73
Butts	SR 36	17.93
Lamar	SR 36	18.54
Talbot	SR 36	21.94
Upson	SR 36	16.99
Marion	SR 41	27.50
Talbot	SR 41	24.72
Webster	SR 41	18.64
Total District 3 Data:		**359.43**
District 4:		
Clay	SR 39	22.83
Early	SR 39	29.07
Miller	SR 39	14.35
Quitman	SR 39	15.82
Calhoun	SR 45	20.21
Early	SR 45	13.09
Miller	SR 45	13.82
Seminole	SR 45	4.56
Baker	SR 91	25.96
Dougherty	SR 91	5.88
Miller	SR 91	23.81
Seminole	SR 91	11.61
Turner	SR 107	10.35
Brooks	SR 122	16.19
Lowdes	SR 122	17.25
Thomas	SR 122	12.96
Ben Hill	SR 182	8.61
Colquitt	SR 202	5.98
Thomas	SR 202	9.38
Seminole	SR 285	13.66
Total District 4 Data:		**295.39**

County	Road	Miles
Candler	SR23	18.46
Appling	SR27	12.15
Bacon	SR 32	17.46
Brantley	SR 32	16.69
Pierce	SR 32	18.13
Glynn	SR 32	10.13
McIntash	SR 57	8.17
Candler	SR 57	8.65
Candler	SR 121	18.90
Bryan	SR 144	28.12
Liberty	SR 144	19.91
Long	SR 144	8.23
Total District 5 Data:		**185.00**
District 6:		
Chattooga	SR 1	18.52
Floyd	SR 1	26.46
Polk	SR 1	14.84
Polk	SR 6	21.58
Murray	SR 24	32.61
Gilmer	SR 29	14.01
Polk	SR 100	17.98
Floyd	SR 100	18.39
Chattaooga	SR 100	14.05
Paulding	SR 120	6.70
Gilmer	SR 136	5.21
Gordon	SR 136	22.63
Murray	SR 136	2.82
Walker	SR 136	36.23
Paulding	SR 360	3.93
Gilmer	SR 523	13.36
Total District 6 Data:		**269.32**

Total Data Reduced:	
District 1	186.87
District 2	328.21
District 3	359.43
District 4	295.39
District 5	185.00
District 6	269.32
Total	**1624.22**

Table A-13. Percentage of Two-Lane Highway No-Passing Zones in Study Districts

District	Direction		Average
	Traveling Direction	Opposing Direction	
1	69.5%	68.8%	69.2%
2	47.1%	46.5%	46.8%
3	58.8%	58.2%	58.5%
4	41.2%	40.8%	41.0%
5	27.8%	27.6%	27.7%
6	60.2%	60.1%	60.2%

Table A-14. Percent No-Passing Per Terrain Type for Two-Lane Highways

District	General Terrain (≤ 3%)			Specific Terrain (> 3%)		
	Traveling	Opposing	Average	Traveling	Opposing	Average
1	59.9%	62.1%	61.0%	97.0%	88.3%	92.7%
2	36.7%	39.0%	37.8%	71.6%	55.3%	63.5%
3	54.0%	54.9%	54.5%	88.0%	77.9%	83.0%
4	38.6%	39.3%	38.9%	78.8%	63.9%	71.3%
5	27.1%	27.5%	27.3%	75.3%	53.9%	64.6%
6	54.7%	55.6%	55.1%	81.8%	77.8%	79.8%
Average	45.2%	46.4%	45.8%	82.1%	69.5%	75.8%

Table A-15. Percent of Horizontal Road Curvature per District for Two-Lane Highway Analysis

District	Non-Curve	Curve
1	26.5%	73.5%
2	55.2%	44.8%
3	35.5%	64.5%
4	59.3%	40.7%
5	77.7%	22.3%
6	33.1%	66.9%
Average	47.9%	52.1%

Table A-16. Percentage of No-Passing Zones Based on Road Curvature for Two-Lane Highway Analysis

District	Non-Curve			Curve		
	Traveling Direction	Opposing Direction	Average	Traveling Direction	Opposing Direction	Average
1	21.8%	22.3%	22.1%	86.6%	85.6%	86.1%
2	27.1%	27.9%	27.5%	71.4%	69.5%	70.5%
3	45.6%	42.7%	44.1%	66.1%	66.7%	66.4%
4	24.6%	24.5%	24.6%	65.7%	64.9%	65.3%
5	15.9%	15.3%	15.6%	71.5%	72.8%	72.1%
6	14.0%	13.5%	13.8%	83.0%	83.2%	83.1%
Average	24.8%	24.4%	24.6%	74.1%	73.8%	73.9%

Table A-17. Signalized Intersection Data Collection Sites

District	Intersections	District	Intersections
1	SR 316 and SR 53 SR 316 and SR 11 SR 316 and SR 81 US 441 and SR 17 US 441 and SR 17 alt. US 441 and Industrial	4	SR 7 and 13th Street SR 7 and 14th Street SR 32 and Lee Street SR 32 and Graves Street
2	US 1/4 and Main Street US 1/4 and Pine Street Bellevue and Jackson Bellevue and S. Calahon	5	SR 26 and Johnny Street SR 26 and Bryanwoods SR 67 and SR 301
3	SR 3 and Cherie Street SR 3 and Jeff Davis SR 54 and Banks Road	6	SR 92 and SR 360 SR 92 and US 278 SR 3 and Firetower SR 3 and McJohnson

Table A-18. Delay Comparisons for Signalized Intersection Data

Measured Delay	Estimated Delay (seconds)		
	HCM Planning	HCM Observed	Expected Delay
10.05	6.2	6.6	9.8
6.37	6.3	6.4	6.75
7.0	4.0	4.2	6.13
3.28	4.2	4.3	2.75
7.06	4.0	4.2	6.35
4.21	4.2	4.3	3.72
6.43	3.9	4.0	4.66
4.17	4.2	4.3	3.52
4.96	4.20	5.00	4.09
7.10	5.70	6.30	7.39
7.50	4.60	5.30	7.67
3.23	5.40	6.20	3.70
7.58	4.40	4.50	7.77
3.23	5.40	6.20	3.70
6.2	3.3	3.5	5.61
4.57	3.0	3.2	3.74
6.23	3.3	3.5	5.67
8.27	2.8	5.2	6.77
5.42	3.2	3.5	4.02
8.4	2.8	5.3	7.04
2.91	2.7	0.1	1.83
5.43	2.6	2.7	4.5

Table A-19. Bicycle Route Summary

Route Number	Bicycle Route Name
5	Chattahoochee Trace
10	Southern Crossing
15	Central
20	Wiregrass
35	March To The Sea
40	TransGeorgia
45	Little White House
50	Augusta Link
55	Appalachian Gateway
60	Athens Link
70	Northern Crescent
85	Savannah River Run
90	Mountain Crossing
95	Coastal

APPENDIX B

DATA COLLECTION FORMS

Figure 1

Page #:	
Tape #:	
Date:	
County:	
Road #:	
Direction:	

Access Point Descriptors:
I - intersection
D - driveway
M - median-cut

Note: For intersection inputs - I in both L and R for a full intersection, I in either L or R for T-intersection

		Access Point (I,D, or M)				Access Point (I,D, or M)	
Mile Post	Grade (%)	Left Side ?	Right Side ?	Mile Post	Grade (%)	Left Side ?	Right Side ?

Access Point Data Collection

Figure 1

Two-Lane Highway Log Sheet

Date:__/__/__ County:_____ Tape No.:_____ District: _____ Road Name:_____ Direction:__B

Mileage														
Terrain														
Grade														
Passing Zone														
Road Characteristic (Curvature, driveway, intersections, including unsignalized and signalized)														