PC-TRAVEL

Travel Time and Delay Analysis Software
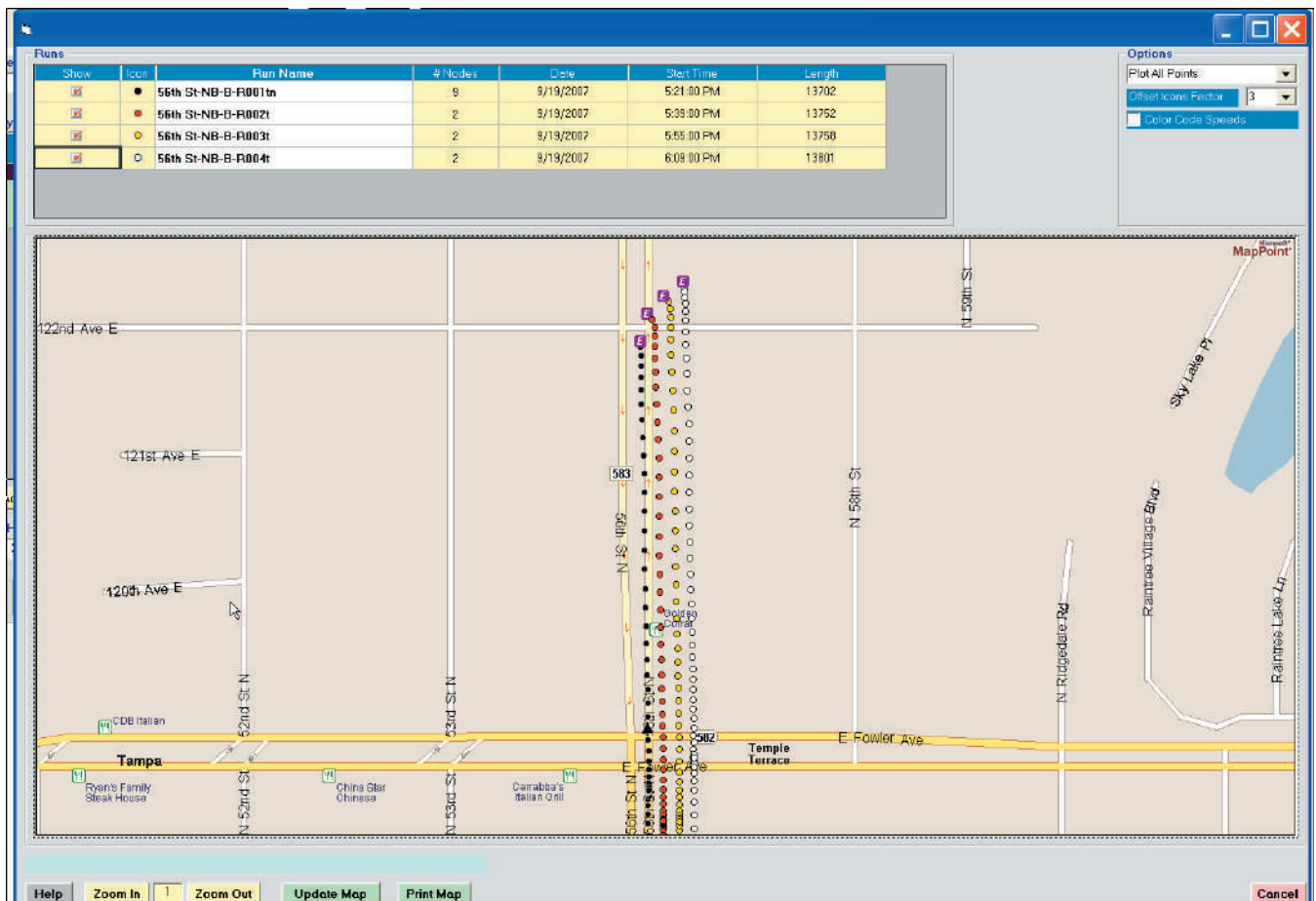
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Chapter 1

Introduction and Installation

Introduction to PC-Travel

Welcome to PC-Travel, a Ridge Engineering software program designed to process travel time and delay data. Travel time and delay analysis is a complicated subject and we have not tried to oversimplify it at the expense of the experienced user who wants to get as much from the analysis as possible; yet we have tried to make the software easy to use, even for the occasional user.

This manual is currently divided into four parts:

The first part is an introduction to PC-Travel, including a definition of terms used in collecting the data and running the software. This part also shows you how to install and run the software on your computer.

The second part covers the basics of collecting Travel Time data in the field with either a TDC unit or GPS interface software.

The third part is a series of tutorials that provide step-by-step instructions on how to use the software, providing detailed information about specific aspects.

The fourth and last part is a series of appendices that have reference-type information that you may find useful if you are interested in the technical details of the software.

Computer Requirements

- Windows 95, 98, NT, 2000, ME or XP.
- 64 Megabytes of RAM (although it probably will run in less).
- 10 Megabytes of free space on your hard disk.
- CD-ROM (to install the software only)
- Screen resolution of 800 x 600 or better.

This last requirement is the only non-standard one. Some users may still be using older computers limited to 640 x 480 pixels. If you find the software screens don't fit on the monitor, this may be the case for your computer. You should be able to change the screen resolution to 800 x 600. Worst case would be to add a new video card to your computer for $50 or so (if you are running Windows at 640 x 480 this is a great investment).

Software Updates

Updated versions of Ridge Engineering software are released periodically and are posted on the PC-Travel support site. Licensed owners of PC-Travel can download updates to the program to make sure they always have the latest version of the software. To download the latest version of PC-Travel, go to **www.pc-travel.com** and then select *Downloads* from the list of options.

Definitions

Before any discussion of travel time data collection and analysis can begin, you must have a careful under-standing of the terms we use and how we use them. This section defines the words used in the program that mean something more specific than the word itself might imply.

Run
A single collection of travel time data.
For example, when data is collected along an arterial, the user drives to the begin-ning of the arterial under study, starts data collection, proceeds along the arterial to the end of the study area, and then stops data collection. He has just completed one run. If he turns around and collects data in the other direction, it is another run. All runs are stored as separate entities in the program.

Study
A collection of runs.
When the user collects data, he is making data runs, and when he gets back to the office, he collects those runs into studies. The difference is important because runs can be collected into different studies. For example, a user may make a number of runs at an arterial during one or two days. Back in the office he may create a study with just the morning runs. He may also create a study with all of the runs, which of course use some of the morning runs.

There is one critical rule for studies:
All of the runs in a study must start at the same place, end at the same place, and follow the same route.

Only runs in the same direction can be part of the same study. Since you usually col-lect runs in two directions (up and back), you typically will create at least two studies for each data collection session.

Study Group
A folder where related runs and studies are stored.
This term is specific to the program. Since studies must be created from runs that start in the same place, end in the same place, and go in the same direction, it makes sense to store all runs that fit that criteria in one place on your computer, along with any studies that are created from those runs.

You typically create Study Groups when you first read the run data collected in the field. Since you usually collect at least two sets of runs, one in one direction and an-other in the opposite direction, you usually will create two Study Groups when you read the field data.

Fixed-Route
Data collection along a pre-determined route.
PC-Travel only supports Fixed-Route studies. Another type of study, called Chase Car studies, may be supported in the future, based on user interest.

When you do Fixed-route studies, you collect run data along the same route several times. One run is rarely sufficient to find the travel time characteristics of a route. You may be lucky and never hit a red light during your run, or you may be unlucky and hit several. If you collect several runs, the averages of the individual run data will be a better representative of the true traffic characteristics of the route. Fixed-route studies usually have segments defined at the time the runs are made.

The route is divided into geographic segments, using easily determined landmarks to separate the segments. For arterials, the segment boundaries may be signalized intersections. For freeways, the boundaries may be interchanges. You are free to define the segments any way you want.

Node
The boundary between two segments of a run.
Every run has a *starting node*, which is where you start collecting data on a fixed-route study, an *ending node*, which is where you stop collecting data, and several *segment nodes* in between. The user records the location of the nodes by pressing a buttons in the field as the user passes the nodes during a run.

Primary Run
A run where the user collected segment node data.
Most users, when doing a run, will collect segment node data by pressing a button as they pass by the pre-determined nodes in the route. There is a fairly high error associated with this process (more about this later) so the distances measured for a single run are not very accurate. The program uses the average of the node distances from each of the Primary runs in a study to find more accurate distances between nodes.

Secondary Run
A run where the user did not collect segment node data.
or
A primary run in which the user decides not to use the segment node data to find the node distances for the study.
You do not have to collect segment node data while doing a run. You may have done several runs in that direction and know you have sufficient data to find accurate node distances, or you may have made several mistakes marking the node on a particular run (which is annoyingly easy to do), or you simply don't need node by node statistics for this route. You can define a run as Secondary in the software and any node distance data in the run will be ignored in the analysis.

Before and After
A way to categorize a group of runs so that two different groups of runs can be compared.
The terms Before and After are used liberally in the program and these mean only that the data is summarized into two separate groups so the statistics of each group can be compared. If all of one set of runs are made under the same conditions, they may all be defined as *before* runs. Later, identical runs made under different conditions (after an arterial has been re-timed, for example) may be defined as *after* runs. The program lets you define runs as either before or after and then automatically calculates statistics for the before runs as a group, the after runs as a group, and changes in the various statistics from before to after.

Normal Speed
Ideal speed at which the traffic should travel on an arterial.
The Normal Speed is used in two places in the program. It is used to find Total Delay statistics for runs and studies *(see Total Delay, below)*. It also is plotted on the Time/Space Diagrams to show perfect progression. You set the Normal Speed on the Study Summary screen. As with most ideals, real traffic rarely measures up to the ideal, but it is useful as a guide.

Travel Time   *The elapsed time to travel between two points, in seconds.*
This is probably the most fundamental of the reported statistics. All run travel times are measured and reported to the nearest second. Study travel times, which are averages of the run travel times, are reported in tenths of second (technically speaking, the tenths of second are not significant in studies with less than about 5 runs, but that is rarely of concern in the vast majority of practical traffic evaluation situations).

Number of Stops   *A stop is defined as a one-second interval where the speed is less than X MPH for one second when the speed was greater than X MPH in the previous second.*
X is normally 5 MPH but can be set to any speed you want. This speed is called the Stop Speed and is set on the Study Summary screen. Each time the vehicle slows down and crosses the Stop Speed boundary, a stop is counted. The vehicle must speed up faster than the threshold before another stop can be counted.

Average Speed *The total distance covered divided by the elapsed time.*
The program calculates the average speed for each section *(node to node distance)* and also separately calculates a total average speed for the entire route.

Total Delay   *Difference between actual travel time and ideal travel time.*
Actual travel time is calculated from the data. The ideal travel time is based on the Normal Speed setting on the Study Summary screen.

Time <= X MPH   *Total time the vehicle spent at or below the given speed.*
The program gives you three speed categories, which you can set for different purposes. You can measure stopped delay (time vehicle is stopped) by setting Category 1 to 0 MPH. You can measure queue delay by setting Category 2 to 7 MPH. The third category might be set to 30 MPH to show how much time vehicles spent in car following mode rather than free flow (assuming free flow speed is 40 or 45 MPH). Many other uses for these three categories are possible, limited only by your imagination.

Chapter 1 — Introduction and Installation

How to Install & Run PC-Travel

Installation Procedure

Begin the installation by placing the PC-Travel CD into your CD drive. If your CD drive is configured for Autoplay, the Installation Options program will start after a few seconds. Otherwise, click on the **Start** button on your Windows desktop. Select **Run** from the list of options and type the command line **X:\setup.exe**, where X is the letter of your CD drive. Press **OK** and you will see the Installation Options for the program.

The Installation Options allow you to do a number of things in addition to installing PC-Travel. You can view a copy of this manual, register your copy of the software and check out other Ridge Engineering products. To begin installing PC-Travel, click on Install PC-Travel.

Note: If you downloaded the installation program from the PC-Travel.com support site, then unzip the file you downloaded to a convenient folder and run the Setup.exe file.
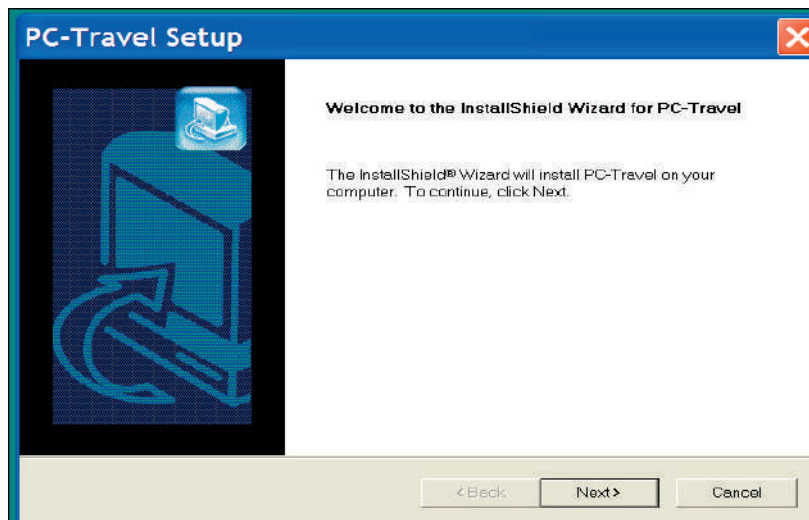

Figure 1.1 — Welcome Screen

The ***Welcome*** screen reminds you to be sure all other programs are closed before proceeding with the installation. During the installation, files used by the program will be copied to your computer, including some Windows system files. If other programs are open and using some of the files that need to be installed, an error can occur. Make sure you close any programs that obviously are running (especially virus checkers) before you install this or any Windows-based software.

The next screen contains the license information for the program. Please read this information. You must accept the provisions of the license in order to proceed and use the program. The program's license allows you to install the program on multiple computers provided they are in the same location and being used by employees of the entity that purchased the license. This is a very liberal license — many program licenses do not allow you to install the program on more than one computer. We ask that you respect the licensing policy and not abuse the use of this program. If you agree to the license, click Yes to continue.

Figure 1.2 — Customer Information

The next screen asks for the User Name, Company Name and Serial Number. The serial number can be found on the back of your CD case, or it may have been emailed to you when you ordered the software. When entering the numbers be sure to include the dashes. If the serial number is entered incorrectly, you will not be allowed to proceed with the installation. Once the information has been entered, click the Next button to continue.

Figure 1.3 — Program Destination

The Choose Destination Location screen is used to select the folder where PC-Travel will be installed. The default folder is C:\Program Files\PC-Travel, but you can change this if you like. Click the Browse button and navigate to the folder you want. Once the directory listed is correct, click Next to continue.
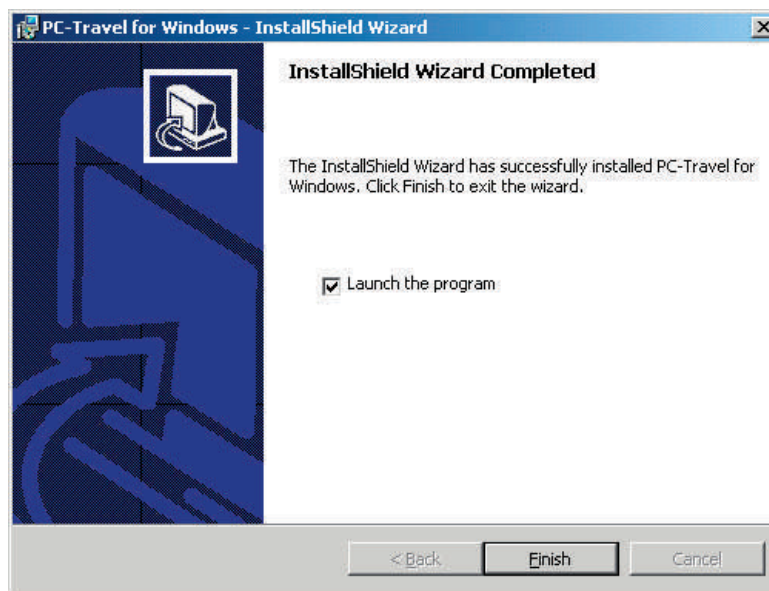
Figure 1.4 — Installation Finished

Once the installation program has enough information, the files will be copied from the CD to your computer. You'll then see a screen that tells you the installation has completed. You may be asked if you want to re-start your computer now. If you get this message, you should re-start your computer before you try to run the program. This will allow any of the System files that were copied during the installation to be loaded properly.

How to Run PC-Travel

Like most Windows programs, there are several ways you can run the software. Here are two:

1) Open an Explorer window (right click on My Computer and select Explore) and find the PC-Travel.exe file, which probably is in the *C:\Program Files\PC-Travel* folder. You will see a screen that looks something like figure 1.5 shown below. Double click on the file **PC-Travel.exe** and the program will run.
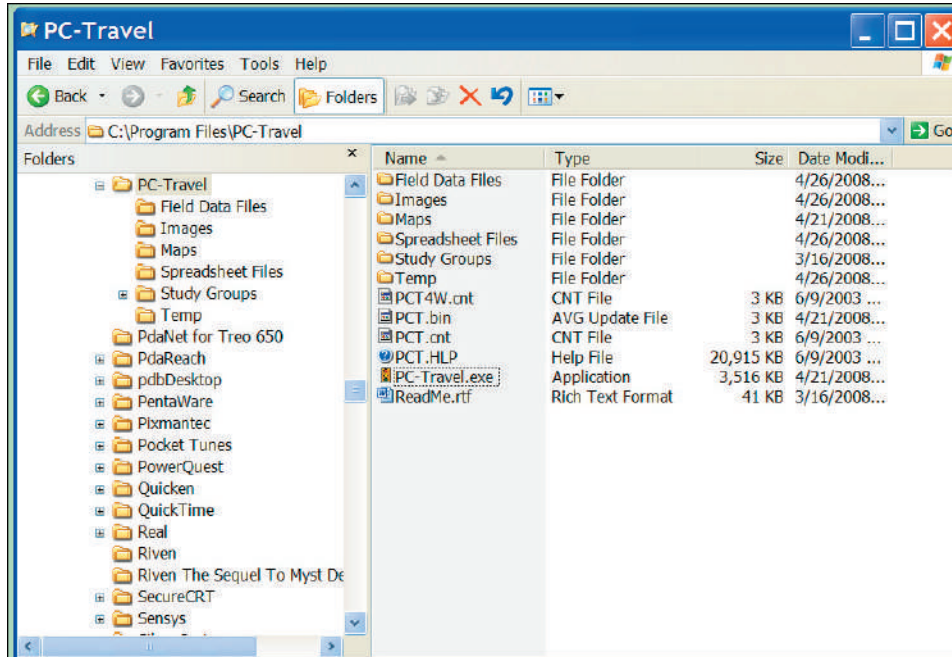

Figure 1.5 — Explorer View

2) Select **Start**, **Programs**, and then **PC-Travel** from the list of programs. There could be a long list, and they may not be in alphabetical order (don't you love Windows?). You will see a display similar to the one shown here. Select **PC-Travel** then click on the second **PC-Travel**. This will run the software.
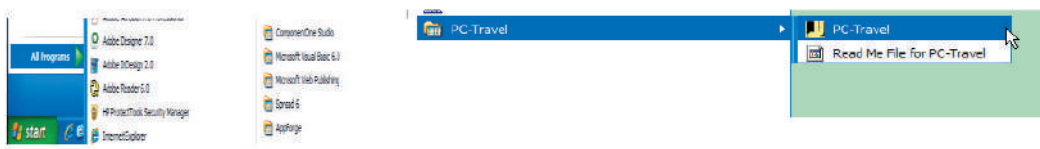

Figure 1.6 — Starting PC Travel

Chapter 1 — Introduction and Installation

Learning the Basics of PC-Travel

This tutorial will guide you through the basics of the software. To simplify things we will retrieve an existing study that was installed when the rest of the program was installed.

> *Note: The first time anyone runs PC-Travel after installing it, the software loads the Preferences screens so that the various settings can be checked and edited. From then on, the program starts with the Startup Options screen. This tutorial will start with the Preferences screen, assuming that you just installed the program. You may skip this section if it doesn't apply to you.*

Run the program (see the end of the Installation notes for two ways to start the software). The first screen you will see is a little message box that tells you that since this is the first time you have run the program, you need to check the settings. Click **OK.**

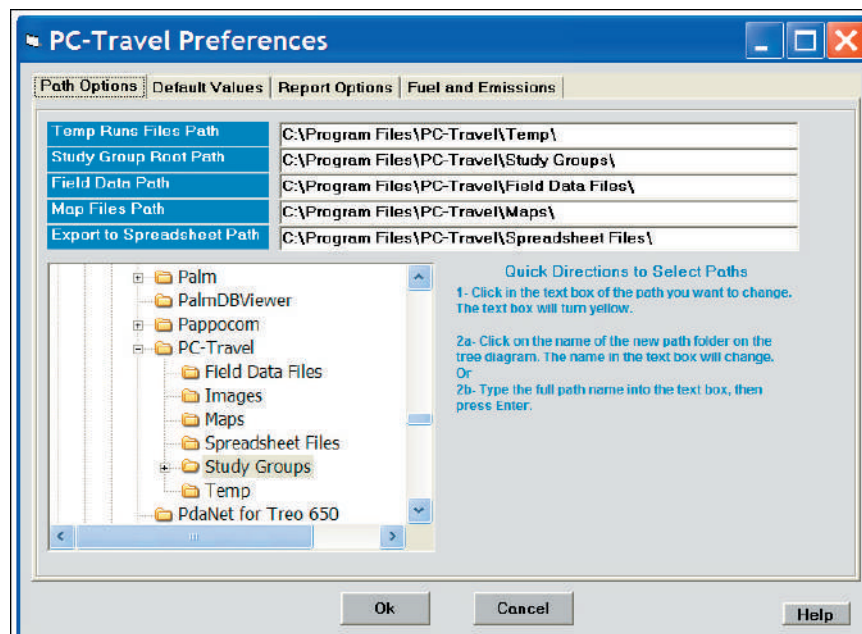You will then see the Preferences screen:

Figure 1.7 — Path Options

The Preferences screen has four tabs at the top of the window: **Path Options**, **Default Values**, **Report Options**, and **Fuel and Emissions**. The first tab, Path Options, is shown first.

If you selected the default installation directory, then you will see the same paths shown in the screen shot above. The program uses five basic directories:

1 – Temp
This directory holds the run files that you processed from the field data. These files are normally renamed and moved to a different directory.

2 – Study Group Root
This is the base directory where all of the travel time run and study data is stored. **A Study Group is a collection of related runs and studies that are stored together**. For the computer savvy, each Study Group is a directory under the Study Group Root directory.

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3 – Field Data Path
This is the directory where the data you collected in the field is stored before it is processed into runs.

4 – Map Path
This is the directory where you store your street map files to use with the software. Note: if you use MapPoint as your GIS engine, then this setting is irrelevant since MapPoint stores all of the map files in a separate folder.

5 – Export to Spreadsheet Path
This is the directory where files will be created if you use the Export to Spreadsheet function. Refer to page 3.27 *How to Export Statistics to a Spreadsheet* for more information.

If you want to change the paths, then follow the Quick Directions on the screen. You probably won't need to change them, however.

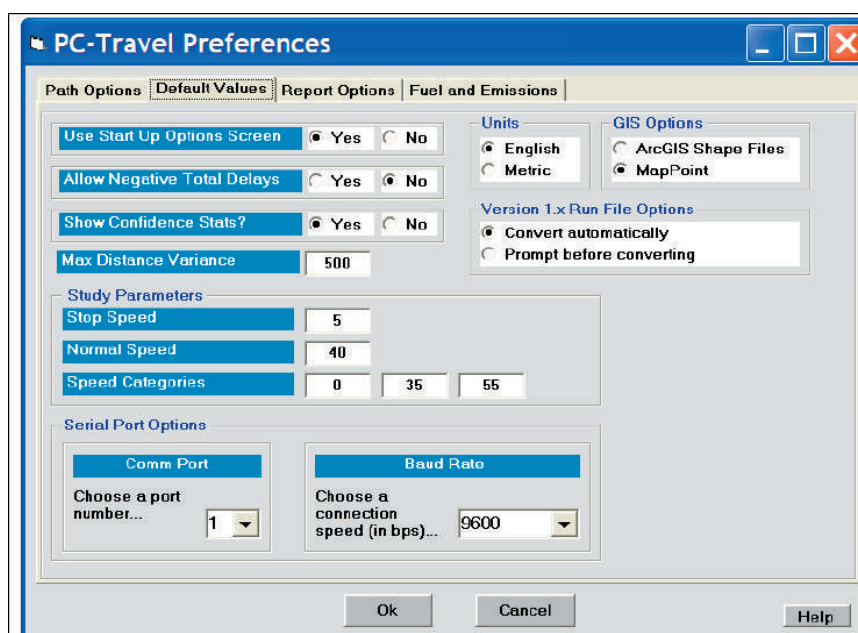Click on the second tab labeled **Default Values**.

Figure 1.8 — Default Values

The items on the screen are parameters that are used in the software. These values are the default values that are used when a study is first created; however, you can change many of them on the Study Summary screen if needed, and the changes will be stored with the other study data. Normally, you will set these values once and then not worry about them again.

Some of the parameters have an obvious meaning. Some don't. Don't worry what the various parameters mean for now. They will make more sense later after you have seen some more of the program. Just accept the default values for now.

You can check the settings in the other two tabs. They are fairly obvious from the descriptions, but again, don't worry if it isn't obvious what a particular setting is for right now.

You can play with the various options on the Report Option tab when you get to the Report section of the tutorial. Don't change any of the numbers in the Fuel and Emissions tab unless you are an expert in the models used.

Press **OK** to close the Preferences screen and go to the Startup Options.

Chapter 1 — Introduction and Installation

Startup Options

Figure 1.9 — Startup Options

This is the screen you will normally see when you first run the software. It helps to remind you what your options are when you first start the program. If you don't like this type of screen, you can turn it off so you won't see it in the future. All the options on this screen can also be access from the Menu commands of the program.

The options listed are fairly self-explanatory. However, they all will be discussed in more detail as we go along.

Click on the **Open an Existing Travel Time Study** button so we can start exploring PC-Travel.

Select Study
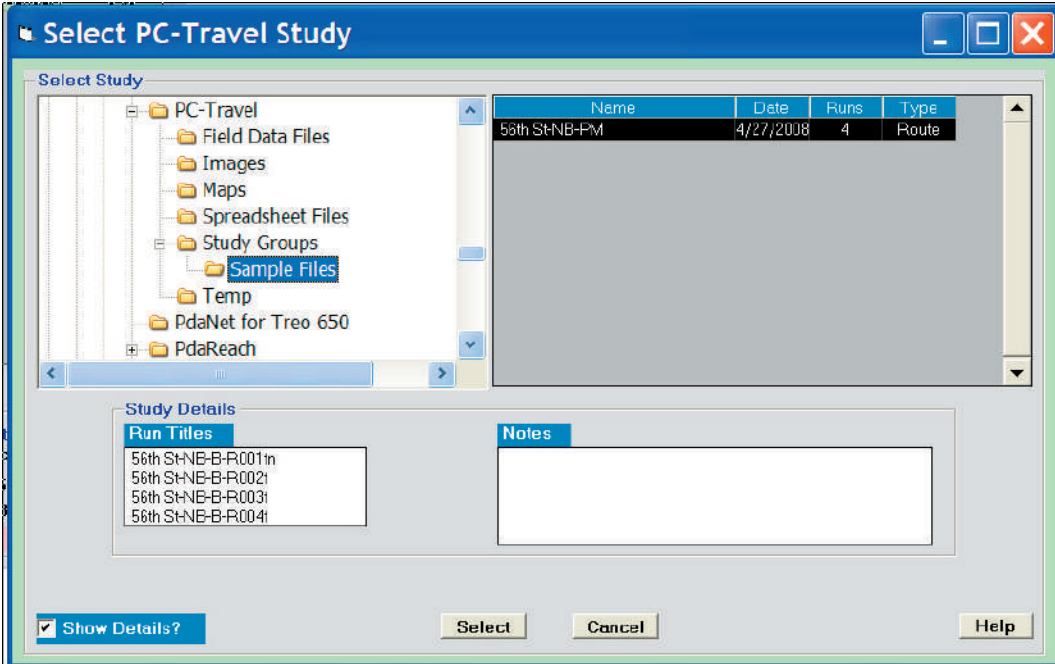
Figure 1.10 — Select Study

This is the screen you use to select a study that is stored on your computer. The upper left corner has a window that shows the directories *(or folders, if you prefer)* in the common tree format used in Windows. The Study Group folder is currently selected. Click on the **Samples** folder just below the **Study Group** folder. This is the state shown in figure 1.10 above.

The window to the right of the tree shows a list of the studies in that folder, with a little bit of information about the studies. In this case, there are three studies. The first study, **56th St NB-PM**, is highlighted.

The **Study Details** window shows some more information about the highlighted study. The titles of the runs that make up that study are shown, as well as any notes you entered when you saved the study.

We want to open the first study, which is highlighted, so click on **Select**.
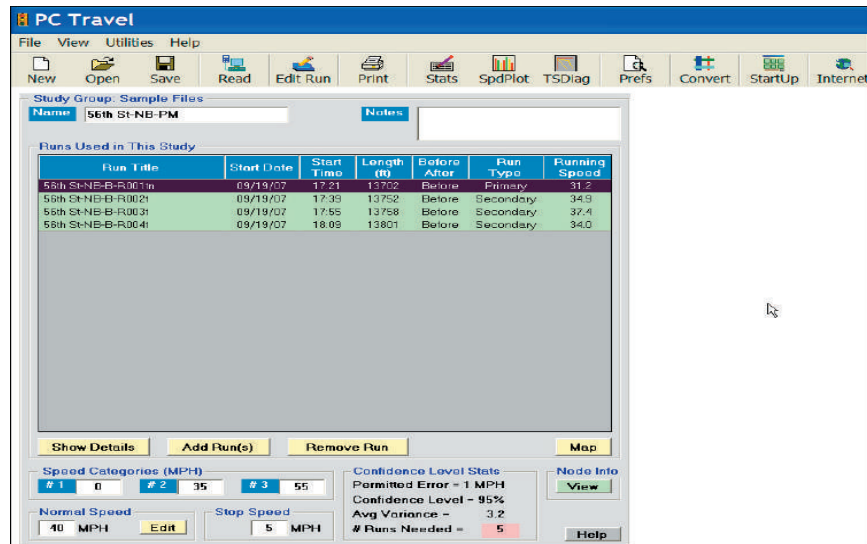
Study Summary

Figure 1.11 — Study Details

This is the core screen for the program; most of the operations involved in the software start and end here. There are several sections to this screen. At the top are the standard ***pull down menus*** that are part of every Windows program. Below that are a series of icons that make up the ***toolbar.*** These icons duplicate the most common options that are available in the menus.

The majority of the screen shows the details for the current study:

• The current **Study Group**. It is shown just below the toolbar. *(Sample Files, in this case)*.

• The **Name** of the study. To change the name you type in a new name and then hit the **Save** icon on the toolbar, or select **File:Save Now** from the drop down menus.

• **Notes** for this study. Just type anything you want.

• List of **Runs Used in This Study**. You can **Add Runs** or **Remove Runs** using the appropriate buttons. You can also **Show Details** of any run *(we'll do that in a minute)*. All three buttons operate the same way; select the run then click the appropriate button.

• **Speed Categories #1, 2 & 3, Normal Speed,** and **Stop Speed**. These are all parameters that are used in the study statistics. You'll see how they are used when you see the Study Statistics screens.

• **Confidence Level Statistics.** The software calculates whether you have enough runs for the results to be statistically significant. The logic used is based on the procedure detailed in the ITE Handbook.

• **Node Distances**. This will be explained in depth in a little bit.

First, click the **Show Details** button. This will allow you to see all of the information about the run that is highlighted.
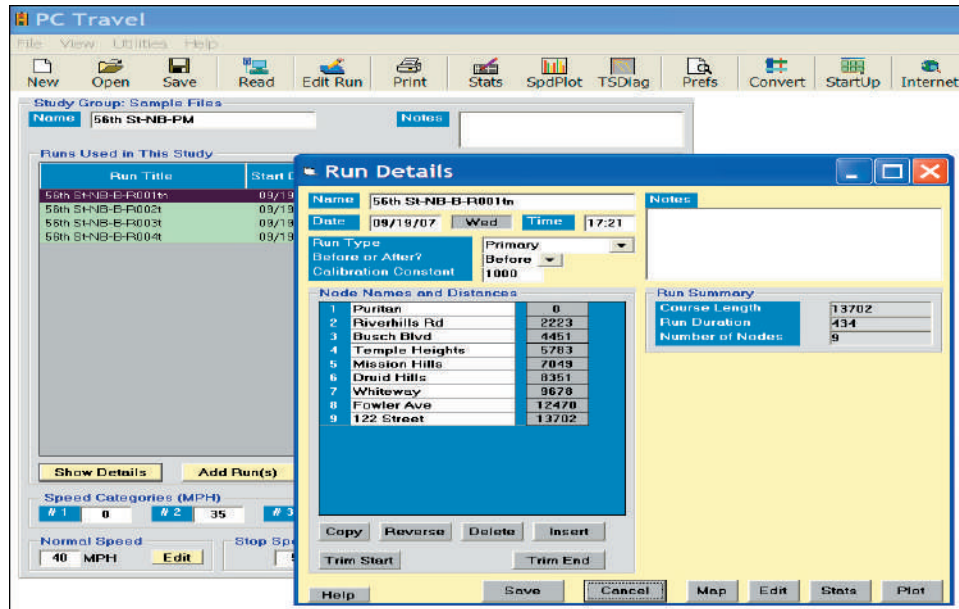
Run Details

Figure 1.12 — Run Details

The Run Details screen shows just about everything we know about this particular run, and most of it can be edited. In general, any fields with a white background are edit fields, and can be changed. Fields with a gray background are calculated from other things, and can't be edited directly.

Most of the fields are self-explanatory; each run has a **Name**, **Date**, and **Time**. A run can be either **Primary or Secondary**, and **Before or After** *(see page 1.4)*. The **Calibration Constant** normally should not be edited; it is the factor that converts the pulse data collected in the TDC to distances. You can also enter any **Notes** you want about this run. You might, for example, mention that it was raining during this run, or that there was a large truck in front of you during the run which might affect the data.

If the run is a Primary run you can edit the **Node Names and Distances**. The Node Names have a white background, which means you can edit the names simply by typing over the existing name. The distances are derived from the data collected in the field; these aren't as easy to edit so they have a gray background.

You can **Copy** names and distances from other runs. You can **Reverse** the list of names *(usually after copying from another run that went in the other direction)*, and you can even **Insert** and **Delete** actual node data points in the data to fix a run. *(Inserting and Deleting data points is beyond the scope of this introductory tutorial and will be covered in another tutorial.)*

The name of the run is shown in the upper left corner text box. You can change the name and then click **Save** to create a new run. The run file is stored in the current Study Group.

You can see more information about the run, if needed.

Click **Stats**

Figure 1.13— Detailed Run Statistics

This screen shows calculations of the standard statistics used in the program, for this run only. You can think of this as the results of a study with a single run. You can't edit anything on this screen. You can play with the check boxes and see what they do. If you are not familiar with all of the terms shown in the statistics, don't worry about it now. They will be explained later.

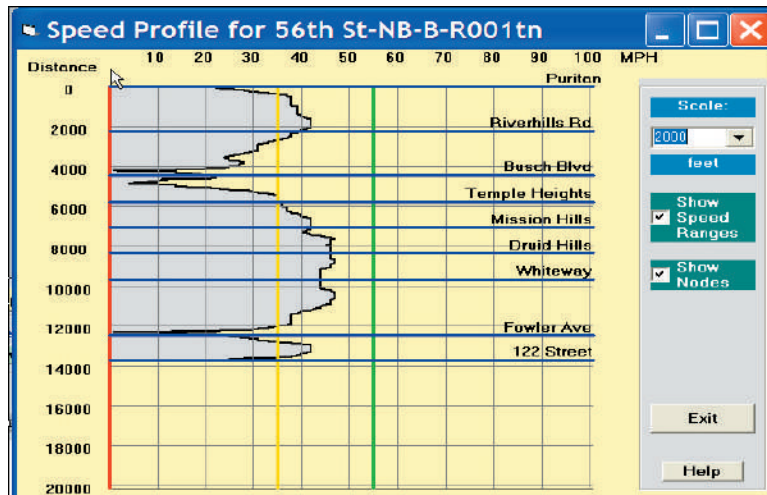Click **Exit** to go back to the Run Details screen and then click on **Plot.**

Figure 1.14— Speed Profile

You'll see the screen shown here. This is a plot of the Speed vs Distance for the data in the run. You can change the scale, and choose to show the nodes in the data, and to show the three speed category limits (the Red line is Speed 1, Yellow is Speed 2, and Green is Speed 3).

In this run, the car went through an intersection without any delay, then had to slow down to a stop at Busch Blvd *(probably a red light)*, and then accelerated back to about 45 mph for several nodes, then stopped again at Fowler Ave before ending the run.

When you are done playing with the plot, click on **Exit** to return to the Run Details, then click **Cancel** to go back to the Study Summary screen.

Node Distances

At this point, you should be back at the Study Summary screen. Notice that the **View** button in the Node Distances frame is red. This is telling you that you need to check the Node Distances because something *may* be wrong. Click on **View**.
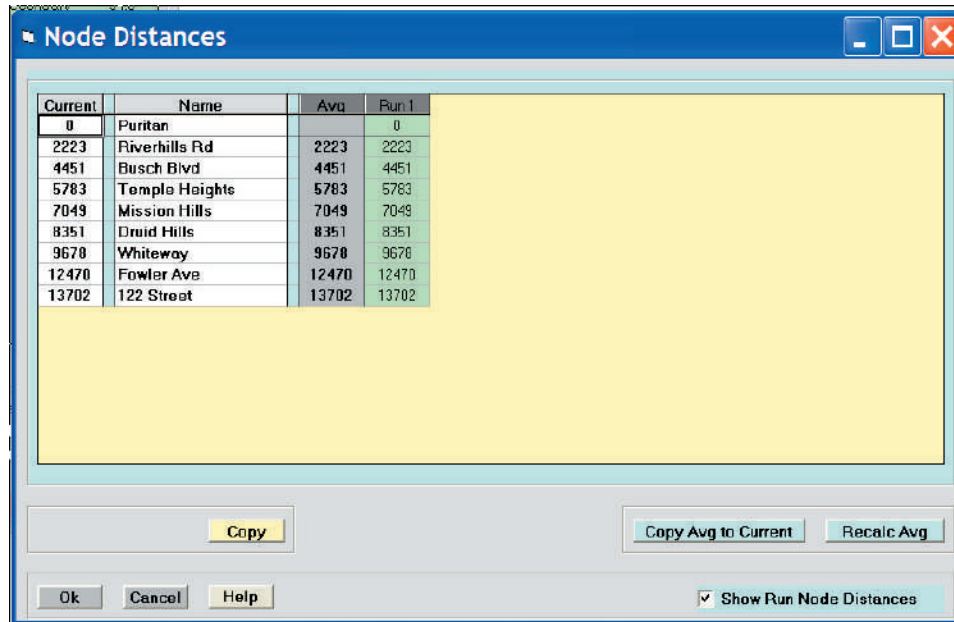

Figure 1.15 — Node Distances

Every study, like the runs that it is made from, starts at one well-defined point and ends at another, and usually has nodes in between. These nodes are usually cross streets, but can be anything that is easy to see while you are driving. The program needs to know the names of each of the nodes and the distance that each node is from the starting point. Various statistics are calculated, displayed, and printed in the reports not just on the entire route, but on a node to node basis as well.

The Node Distances screen shown above shows the **Names** of the nodes and the **Current** distances assigned to each node. ***Ultimately, the only thing that matters is that the Current column has the best possible distances.*** The distances default to the values of the first Primary run, which often is close enough to use. However, these rarely are the *best possible* distances. There are several ways to get these better distances. They will all be explained very carefully in another tutorial.

As you saw in the Run Detail screen, each Primary run has node names and distances that you entered when you entered the data for that run. The program uses the averages of the node distances in all of the Primary runs to calculate the best possible node distances for the study.

The Node Distance screen shows the node distances for each of the Primary runs in the study. This is shown in the upper right section of the screen. The **Avg** column is the average of all of the run distances in that row. In this case, there is only one primary run so only one run is shown. This is typical with version 2 of PC-Travel since you can accurately mark the node locations on a map of your streets. If you don't use GPS to collect your data or don't enable the mapping feature then this screen is more important, but this is beyond the scope of this introductory tutorial.

Once you have reviewed this screen and verified that the nodes have names and distances that make sense, click on the **Ok** button. The software assigns the node names for the study from the Name column and the node distances from the Current column.

> **Note: It is very important to understand that PC-Travel uses the values from the Node Distances screen for the *study* node names and distances. Only these values are used in the rest of the software. All statistics are calculated from the study node distances and the individual run node distance information is ignored. The node distance information in the runs is only used to find the study node distances. If you have a way to assign the node distances in the study, such as using the mapping feature in PC-Travel, then you don't have to collect the node information when you do your travel time runs.**

You should be back at the Study Summary screen now.

Confidence Level Statistics

Fig 1.16 Confidence Level Stats

At the bottom of the Study Summary screen is a section labeled Confidence Level Stats. The software calculates whether you have enough runs for the results to be statistically significant. The logic used is based on the procedure detailed in the ITE Manual of Transportation Engineering Studies (Chapter 4, page 55 in the 2000 edition).

The procedure is based on measuring the average range of **Running Speed** in the runs in the study. **Running Speed** is defined as the distance traveled divided by the **Running Time.**

Running Time is the time the vehicle is actually in motion (moving faster than a predesignated speed). This is easy for PC-Travel to calculate since the basic data for each run is the speed of the vehicle each second. The software counts the number of seconds that the vehicle is moving at or faster than the Stop Speed setting (which is shown at the bottom left of the Study Summary screen); this is the running time. The software then calculates the running speed by dividing the distance of the run by the running time.

The **Running Speed**, converted to MPH, is shown on the screen in the last column. The software calculates the **Average Variance** of the Running Speeds, which is the difference in Running Speed between successive runs, and uses a look up table to calculate the Number of Runs needed. The ITE procedure suggests that 95% **Confidence Level** be used with a **Permitted Error** of 1 -3 MPH for before and after Studies. These two values are currently hard-wired in the software, but a future version of PC-Travel may make these settings variable.

In this case the **Average Variance** is 3.2 MPH, which calculates to a **# of Runs Needed** of 5. Since we have only four runs in this study we might want to consider adding more runs if they are available, or collecting more if they are not.

Study Statistics

Click on the icon labeled **Stats** in the toolbar at the top of the Study Summary screen.
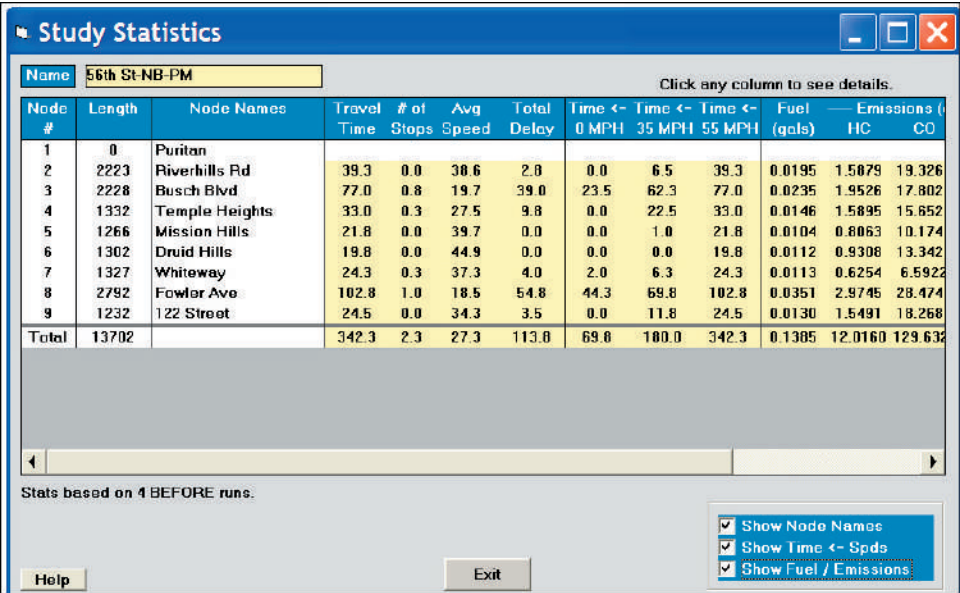

Figure 1.17 Study Stats

This screen lets you see a summary of the statistics for your study. All of the stats shown are averages of the data contained in the runs. Runs labeled as Before Runs are treated separately from After Runs.

Since there is too much information to show everything on one screen, you need to scroll around to see all of the stats. The three checkboxes let you choose what groups of data to show. You can play with them for a minute to see what they do.

At the bottom of the list, after the last node, you will find a set of total statistics for the entire route.

If your study has both Before and After runs then the screen looks a little different. There are separate rows for the Before and After runs and a separate row labeled Change that shows the difference between the Before and After values for each node. The background colors in the Change cells are coded to show if the change is good or bad. Since you want lower Travel Times *(I assume)*, a negative change in Travel Time is good, so it is green. A lower Average Speed is bad, so a negative change in Average Speed is red, and so on.

If you want to see where these numbers came from, you can see the Study Details screen for each statistic. For example, to see the details for Travel Time, click the mouse on any cell in the Travel Time column. You will see a screen like figure 1.17 below.

Figure 1.18 — Travel Time by Section

The travel times of each run, for each node, is shown. The Before runs are shown with a yellow background, the After runs with a blue background.

The data on the Study Stats screen *(the previous screen)* are averages of these values. For example the Travel Times for the Before runs from the Puritan to Riverhills Rd are 41, 36, 34, and 40 seconds. If you check the Study Stats screen you will see that the average shown is 39.3.

You can check the other stats in the same way. Click anywhere in the column of the stat you want to see to bring up a similar screen.

You can also get to these screens from the **View** menu on the Study Summary screen.

Normally, you probably would never check these screens. However you may see a statistic on the Study Stats screen *(or a report)* that seems odd. You can check to see where the data came from by examining the Study Details screens. You may find a run with bad data, or one where the node distances were incorrect.

Click **Exit** to return to the ***Study Details*** screen, then click **Exit** again to return to the ***Study Summary*** screen.

Study Plots

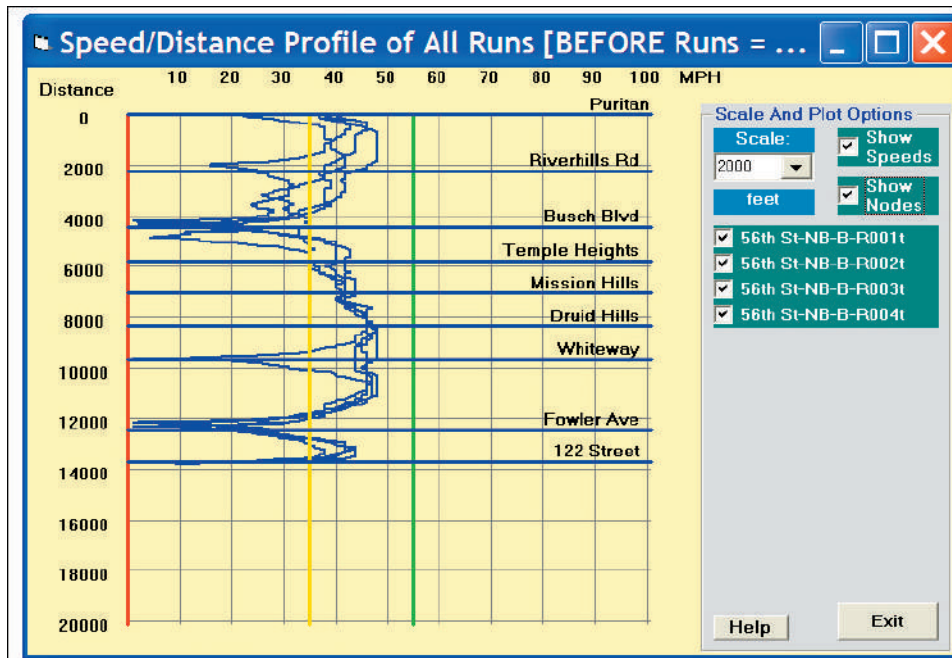Click the toolbar icon labeled **SpdPlt**.

Figure 1.19 — Speed Plot

This screen shows Speed Profile plots of all of the runs in the study. You can select which runs to show, the scale for the graph, and whether to show the node distances and names and/or the speed categories. This will give you a quick look at the data before you print it. You might find a problem with one of the runs when you see them all plotted on the same graph. Click **Exit** to return to the Study Summary screen.
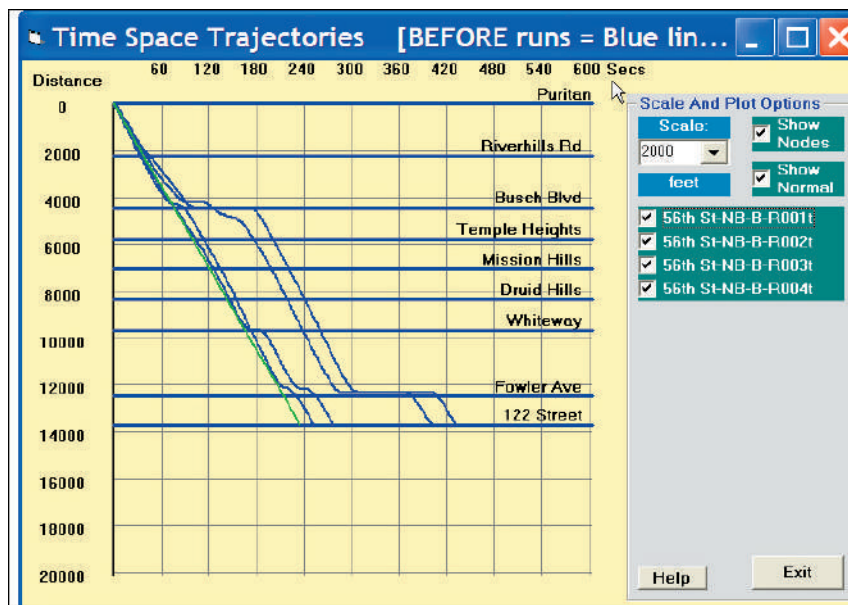
Figure 1.20 — Time Space Trajectory Plot

Click the toolbar icon labeled **TSDiag.** This screen shows a Time/Space Trajectory plot of each of the runs in the study. As in the Speed Profile plot, you can control various aspects of the plot. The straight green line shows the Normal Speed as set on the Study Summary screen. This plot is another way of seeing the data for all of the runs at one time. Click **Exit** to return to the Study Summary screen.

By now you should have a pretty good idea if your study is set up properly and has good analysis results. It is time to print the reports.

Reports

The end results of almost all Travel Time studies are the reports, and special attention has been given to the design of the reports in this program.

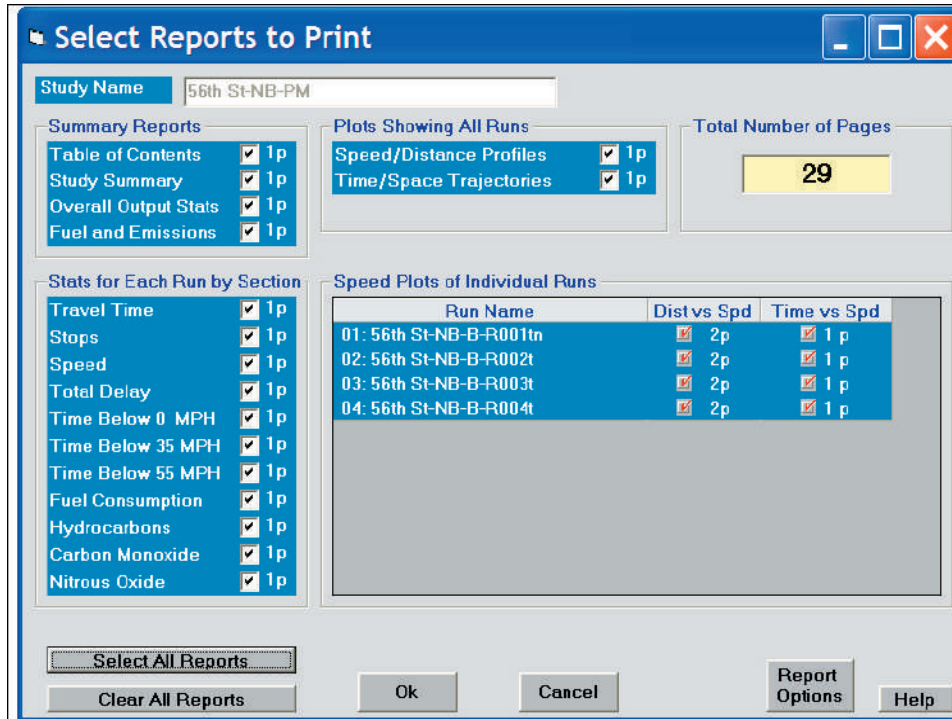Click the toolbar icon labeled **Print**, or select **Print** from the **File** menu.

Figure 1.21 — Select Reports to Print

The screen you see is a list of all of the reports you can print with the current study. There are 17 standard reports that are always available, and then there are two types of plots that you can print for each run in the study. The screen shows the name of each run with check boxes for each of the two types of run plots you can print.

The idea is simple, just *click the reports you want to print*. All reports with a check in the checkbox next to the report will be included in the report.

There are two buttons in the lower left corner. One **Selects All** of the reports and the other **Clears All** of the reports. Their meaning should be obvious.

In the upper right hand corner is a little window that shows the total number of pages for the reports you have selected. The number changes automatically as you select or de-select different reports.

Most of the reports are only one page. They are shown with a small **1p** next to the check box. The **Speed Profiles of Runs** plots are often more than one page. The number of pages in each of these reports is also shown next to the checkbox.

Once you have selected the reports you want to print, click **OK**. If you change your mind and decide not to print any reports at this time, click **Cancel**.

Report Options

You can select different options before you print the reports. To select the options you want, click the button labeled **Report Options**.
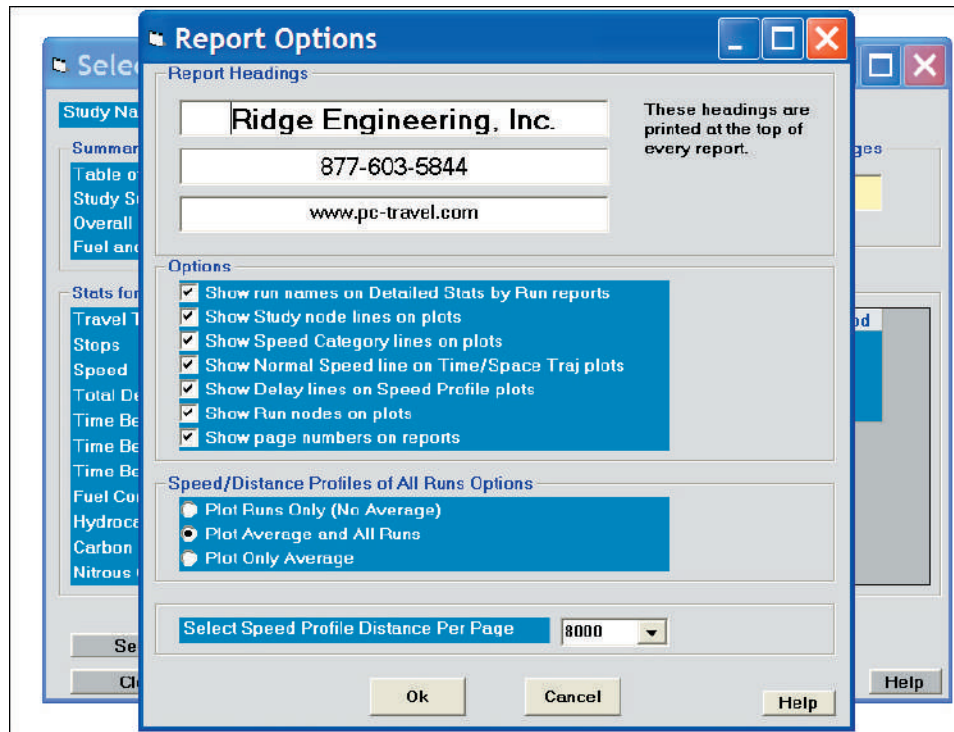

Figure 1.22 — Report Options

The top section shows the three titles that are printed on the top of every report. Normally you would fill this out once and never edit it again. However, some users like to change the titles often, especially consultants who will put the name of the customer, rather than their own name, on each report. It's up to you.

The top line usually is the name of your organization. It is printed in larger type, in bold, and centered on the top of every report. The next two lines are smaller, but still centered under the top title. You don't have to use all three lines, you can leave the second or third lines blank if you want.

The bottom section shows other options you can set before you print the reports. Your choices for these options may vary from study to study, although you may just set all of the options on and forget about it. The options may not make much sense right now. That's not important for now. Just accept the defaults.

All of the settings on this screen are duplicated in the Report Option tab on the Preferences screen. *See Appendix 1 for a complete description of each of these options.* That is where you would set the default value for each title and option. You use the screen shown here only to change any of the default values. If you know that you don't need to change any of the default values *(which is the usual case)* then you don't need to go to this screen at all.

Click **OK** when all of the options are set the way you want them. This will bring you back to the **Select Reports to Print** screen.

Once you have selected the reports you want to print, and have selected the options for the reports, you are ready to preview the reports. Click **OK**.
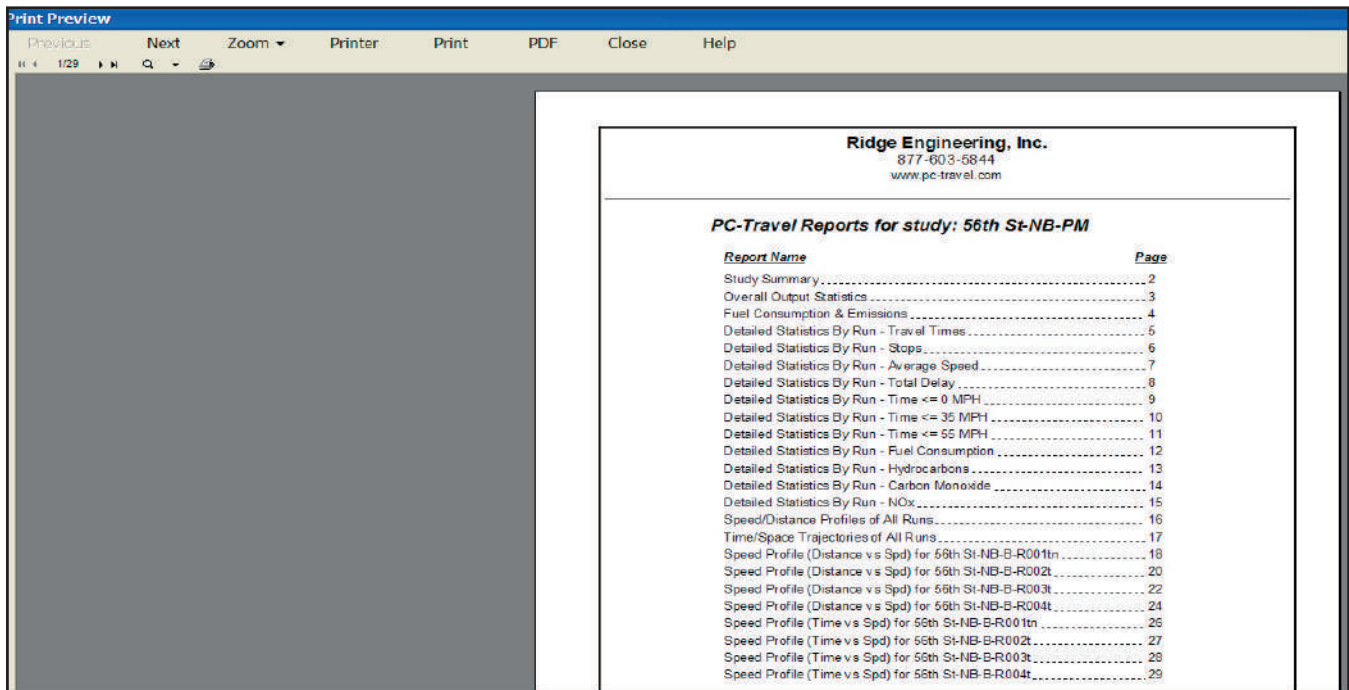

Figure 1.23 — Report Preview

Above is an example of the screen you might see. In this case I selected all of the reports on the previous screen. This is the Table of Contents page that lists all of the reports and the page number for each report.

At the top of the screen are the navigation buttons to control the preview of the reports, select the printer, print the reports, and exit the preview.

Click the **Next** and **Previous** buttons to move from page to page to see what each of the reports look like.

Click the **Zoom** button to select different views. Select the Thumbnail view *(my favorite)* from the drop down list, then double click on any of the reports to quickly go to that page.

Click the **Printer** button to display the standard Windows printer select dialog box. If you have multiple printers available to you, you can choose the printer here.

Click the **Print** button to print the reports.

Click the **PDF** button to create a PDF file of the report. This file is stored in the current Study Group folder and is called <study name>.pdf, where <study name> is the name of the study.

Click the **Close** button to return to the Study Summary screen.

Feel free to play with all of the options available on these screens. You also might try changing some of the Report Options to see the effect on the reports. Remember, you don't have to print out the actual reports to see the different options, you can just preview the report pages on the screen.

Summary

If you made it all of the way through this tutorial, congratulations.

In this tutorial we retrieved an existing study, displayed the run details of the runs in the study, viewed the node distances of the runs to set the node distances and names for the study, displayed the study details in both tabular and graphical form, and finally previewed and then printed a complete set of reports for the study.

Hopefully you now have a pretty good idea of how the core features of the software work.

Several areas of the software were not discussed at all, and a few others were just briefly discussed. Other Tutorials and Appendices in this Reference Manual explain these areas in more detail.

Chapter 2

Collecting
Travel Time Data
in the Field

How to Do a Travel Time Study

This chapter is a step-by-step guide on how to do a fixed route travel time study on an arterial street, using a Jamar TDC unit or a GPS receiver.
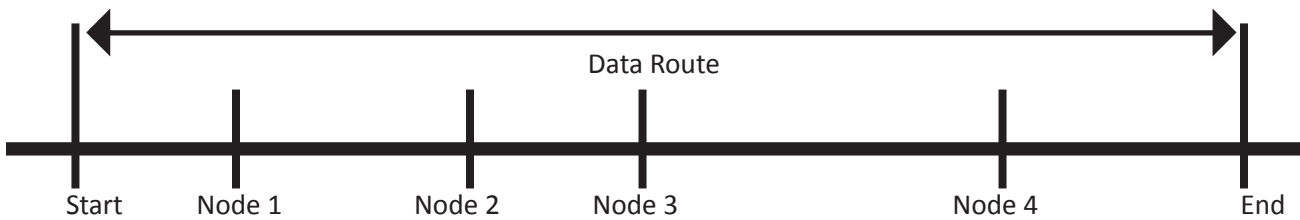

Figure 2.1 — Data Route

Step 1 — Define the Route

This step may seem obvious, but it is easy to forget some important points. You need to define a starting point, an ending point, and the intermediate nodes. Normally the starting, ending, and intermediate nodes are intersections, but they can be other landmarks such as bridge abutments, mile post markers, or other fixed landmarks. Pick points that can be easily identified now and when future *after* runs may be collected. The drawing above shows a simplified diagram of a typical study route. There is a starting node, which could be an intersection, four nodes, which could be signalized intersections, and an ending node.

Make a rough sketch of the route, clearly showing the starting and ending points and list the intermediate nodes you want to use *(see step 2)*. You don't have to make every intersection a node. It is important to understand the type of information you want the data to give you before you define the route and nodes. Don't use more nodes than you really need; it just needlessly complicates the analysis.

Figure 2.2 — Field Worksheet

Step 2 — Prepare the Field Worksheet

You should always keep field notes when you do travel time studies. The field notes help you keep track of the runs when you get back to the office. The Appendix has a master copy of a sample field worksheet to help you store all of the information about the runs you make. You should make copies of this form, or use it as a guide to develop your own field sheet. Also included is a sample of a worksheet that has been filled out *(shown here in reduced form)* to give you an idea of how the form is used.

Before you start the data collection, fill in the general information about the session at the top of the sheet. List the starting point, ending point, and any intermediate nodes.

Step 3 — Collect Your Data

There are several ways to collect your data in the field — using a GPS receiver, using an OBD Interface, or using a TDC unit from Jamar. However most users of PC-Travel will want the option to use the mapping features of the software, and this is only possible when using GPS receivers to collect the data. This section of the manual will only discuss how to collect data with GPS receivers. Other Appendices in the manual discuss the other options.

This section details the procedures for collecting travel time data using a TDC. If you are using the GPS software,

Collecting Data with GPS Travel Time Software

The GPS Travel Time software allows you to collect travel time data using a GPS receiver and either a laptop computer or PDA. You do not need to use this software if you are collecting data with a TDC unit.

The basic idea is simple. The GPS receiver outputs data every second. Some of this data includes the speed of the vehicle, which is measured to a surprisingly high degree of accuracy (better than 1 MPH). The laptop or PDA reads the data from the GPS receiver and stores the speed information, plus other information that you input. The PC-Travel software then can read and process these files into travel time studies.

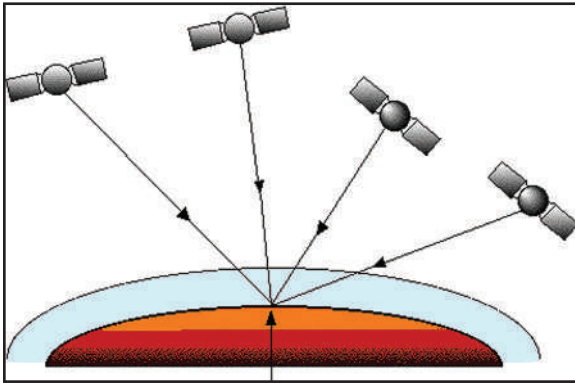## GPS Technology and Receivers

Figure 2.6 - How GPS Works

In case you are new to GPS technology, what follows is a brief introduction to the subject. Each GPS receiver is a glorified radio antenna that picks up signals put out by the network of dedicated GPS satellites. Once the receiver gets a signal from three or four satellites, it can compute your position *(latitude and longitude)* anywhere on the planet. Using a little calculus, the receiver can figure out how fast you are moving by monitoring your changes in position.

There are dozens of GPS receivers available, in many different price ranges and with many different features. In general, the best GPS receivers to use with GPS Travel Time do not have dedicated display screens. For our purposes, they just aren't necessary. Since the laptop or PDA you are running GPS Travel Time on acts as your display, you don't need one on your GPS unit. If you've already got a GPS receiver with a display and it's supported by GPS Travel Time, that's fine. However, if you're shopping for a GPS unit for the specific purpose of taking travel time data, save yourself some money and opt for something like the simple black receiver shown here. Visit **www.pc-travel.com** for more information on GPS receivers.

The most important part of the GPS Travel Time set up is the placement of the GPS antenna. In order for the GPS receiver to function properly, it must have a fairly clear view of the sky. This makes GPS reception more difficult in places with numerous tall buildings or dense foliage, and nearly impossible in tunnels.

Since the inside of your car doesn't provide an ideal view of the sky, it is best to have a GPS receiver with an external antenna. This antenna may be the entire receiver, as in the case of the Garmin 35, or it may plug into the GPS device which would then feed the data to your laptop. Either way, you don't want to be driving around holding your GPS receiver out the window so you don't lose your signal. Most of the external antennas are magnetic, which is very handy when popping it on and off of a car's roof, but a suction cup anchor or fixed mounting bracket would also do the job. Route the cable through a window into your car.
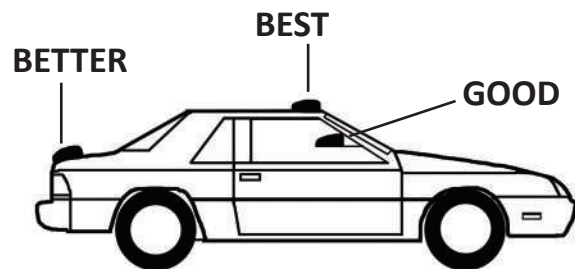

Figure 2.7 - Antenna Placement

To physically connect with GPS Travel Time, your GPS receiver must have some means to send data to your laptop or PDA. Usually the easiest means to achieve this connection is through a serial port. Most GPS receivers are equipped with a female 9-pin serial connector and most laptops have the male equivalent. A fairly standard cable is used to connect the two. *Note: Some new laptops don't have serial ports, they only have USB ports. There are USB to Serial adapters that are available at any computer store that solve this problem For this tutorial we'll assume you have a GPS receiver and a laptop that each have serial ports.* PDAs require a serial adapter, which can be acquired from the PDA's manufacturer.

The specific information output by GPS receivers will vary from unit to unit. However, there is one standard output format that is supported by nearly every receiver. This format is called NMEA. NMEA outputs are divided into sentences and these sentences are transmitted as ASCII text characters. Often, there are ways to adjust which sentences your receiver transmits. A GPS receiver may default to output its sentences every second, every two seconds, or sometimes every 5 seconds. This time interval may also be changed on most units. PC-Travel requires that your receiver output sentences at one second intervals. **If you aren't sure if your receiver outputs data in the proper format, visit www.pc-travel.com or give us a call.**

Many GPS receivers are battery powered and any such unit with a reasonable battery life would be fine for use with PC-Travel. Since you will be in the car, the best option is to power your GPS unit with a cigarette lighter plug. Some receivers, like the Garmin 35, come with a cigarette lighter plug already included. Otherwise, you can usually find a cigarette lighter adapter to add to your GPS unit through the GPS manufacturer.

Once you have your GPS receiver installed and ready to go, you will have it connected to either a laptop computer or PDA. The following sections detail how to use the GPS Travel Time software with either a laptop or PDA.

Recommended GPS Receiver Features
• External antenna that mounts on roof of car

• Serial port for standard connection to laptop or PDA

• NMEA format output at 1 second intervals

Working with GPS to Laptop (GPS2LT)

This section details the procedures for collecting GPS travel time data using a laptop computer. If you are using a PDA, skip to the next section.

This tutorial will guide you through the basic use of the GPS to Laptop (GPS2LT) software. Read through the tutorial once to get familiar with the basic ideas and to learn how the two primary screens work. The tutorial works best if you actually follow the directions and collect real data in the field with a GPS receiver and laptop, but we tried to write the tutorial to make sense even if you are sitting comfortably in your recliner in your office. *(What? You don't have a recliner?)*

This tutorial assumes you are familiar with PC-Travel and the basics of travel time studies. If not, then you should read Chapter 1 of this manual. It will make this tutorial easier to follow.

Installation

To install GPS2LT onto your laptop PC, place the Ridge PC-Travel CD into your CD drive. The Installation Options program will start after a few seconds. Otherwise, click on the **Start** button on your Windows desktop. Select **Run** from the list of options and type the command line **X:\setup.exe**, where X is the letter of your CD drive. Press **OK** and you will see the Installation Options for the program. Click *Install GPS to Laptop* to start the installation.

At the Welcome Screen, click **Next** to start the wizard. You will then be asked whether or not you want to accept the licensing agreement. Click the **Yes** button to accept the agreement and continue with installation.

Fill in the appropriate boxes with your name, and your company's name, and serial number. The serial number will be on the back of your CD case. Be sure to include the hyphens (-). Click **Next** to proceed. The install program checks the serial number you entered and if there is a problem (usually just a mistake typing the number) you will see an error message and get a chance to enter the number again. When the software is happy with the number, you will see the next screen.

The setup program needs a location in which to install your GPS2LT software. The default location will install GPS2LT in the same folder with other PC-Travel software you might have. Whether or not you have any other PC-Travel software, the default location will work just fine. If you do have some reason to change you installation location, click the **Browse** button and select any existing directory for installation.

The fifth screen asks you to choose a folder for GPS2LT's icon. Again, the default shown will almost certainly be okay. It may make the most sense to you to pick the folder that matches the directory from the previous screen, but you're free to choose any folder you like. Click the **Next** button to continue.

Now, you are able to review any and all of the information that you've entered into the setup wizard. Click the **Back** button should you want to change anything. If everything looks correct, click **Next** to install all of the GPS2LT's files.

Once your GPS2LT software is installed, click the button labeled **Finish** to exit the wizard. Start the GPS2LT program and the first screen you will see is the **Preferences**.

Setting the Preferences

The purpose of this screen is to allow you to set all of GPS2LT's options before you start recording data. Your interaction with this screen will determine the name of your study, the folder in which your study will be saved, the communication port number that will be active, what type of GPS receiver you'll be using, and whether or not you'll be using the VersaPoint remote control.
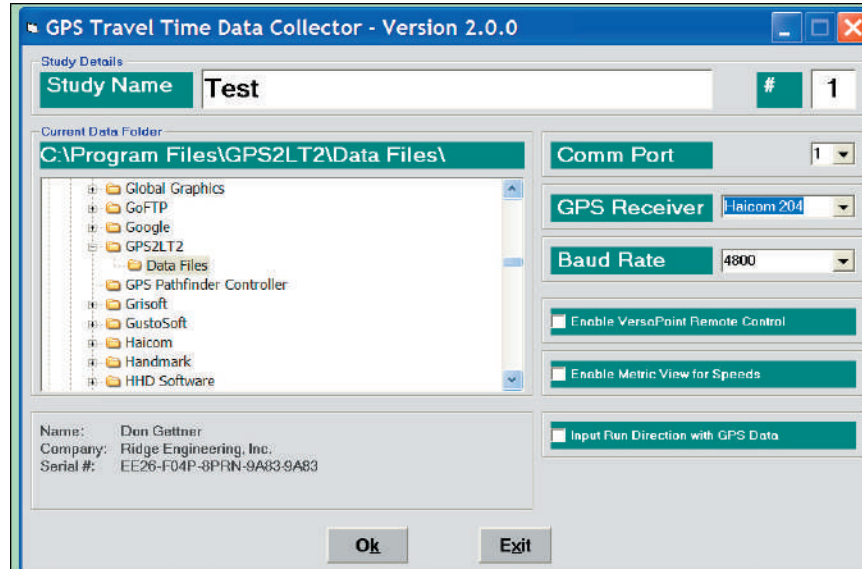

Figure 2.8 - GPS to Laptop Preferences

The lower left corner of the screen shows the **license information**, including your serial number. You may need this number if you are talking to Tech Support at Ridge Engineering.

The boxes labeled 'Study' and '#' in the **Study Details** field allow you to enter a unique name for your upcoming study. GPS2LT will save every file with a .gdf file extension. This is not optional, as PC-Travel will be looking for your GPS data in this particular format. For the purposes of this tutorial, leave the study name and number as their default values.

Use the tree viewer in the **Current Data Folder** field to select the folder in which your study will be saved. If your selection is invalid, you will see an error message asking you to pick another folder. For now, you can just have GPS2LT save your data in the default Data Files folder.

To the right of the tree viewer is the **Comm Port** drop-down box that allows you to select the number of the Comm (serial) port with which your GPS receiver will be communicating. If you are unsure of your Comm port number, just leave it set to Comm port number one and GPS2LT will let you know whether or not it was able to open that particular port.

Use the **GPS Receiver** box to select the type of GPS receiver you are using with GPS2LT. This entry will allow the software to better process the information output by your GPS receiver. If the receiver you are using isn't on the list then you may need to experiment to see if any of the listed receivers work the same way as yours. You will be able to tell on the Main screen, before you start collecting any data, if the software can read the data coming from your receiver.

Figure 2.9 - VersaPoint Remote Control

Use the **Enable VersaPoint Remote Control** box to tell the software whether you are using the remote control that is available as an option with GPS2LT. This remote control (shown in the picture) allows you to control the software without looking at the keyboard. One button is used to mark the beginning and end of runs and one button is used to mark nodes if needed. This low cost remote simplifies the data collection since the person running the software can watch the road instead of glancing back and forth between the road and the keyboard.

You can select to **Enable Metric View for Speeds** mode, which records and shows speeds in KPH, if desired.

You also can select to **Input Run Direction** before each run. This will be explained in more detail a little later in this tutorial.

When all of your information is correct, click the **OK** button to proceed to the Main Screen.
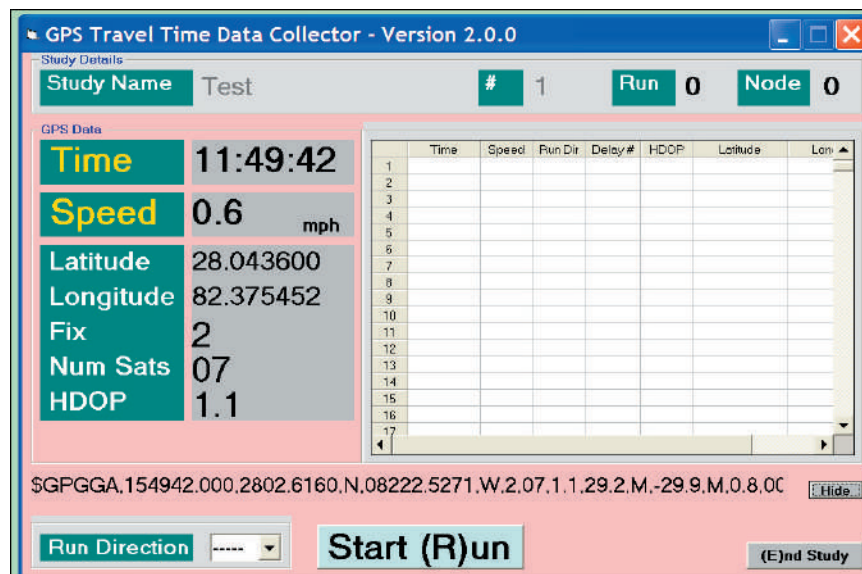
Data Collection Screen

Figure 2.10 - GPS to Laptop Main Screen

The **Study Details** field at the top portion of the screen is dedicated to displaying important information about your current study. The **Study Name** and **#** labels will show whatever you typed into the boxes on the *Preferences* screen. The **Run** indicator shows the current run number. The **Node** indicator shows the current node number in the run.

If any information shown under *Study Details* or *GPS Data* is incorrect, go ahead and click the **End Study** button *(or the 'e' key).* The program will take you back to the *Preferences* screen where any mistakes can be corrected.

Once your GPS device is properly connected, the GPS information is processed and parsed to fill in the *Time*, *Speed*, *Latitude*, *Longitude*, *Fix*, *Num Sats*, and *HDOP* labels found in the **GPS Data** field.

Most of these labels are obvious, but the last three may need some explanation:

Fix: This shows the type of data detected by the GPS receiver. If it equals zero, then the receiver is not getting sufficient information to accurately determine the position. If it equals one, then the receiver is getting information only from the satellites. If it equals two, then the receiver is getting data from the satellites and a source of *differential correction*, which gives more accurate position information but doesn't improve the speed measurement significantly. For GPS2LT, the Fix should equal 1 or 2.

Num Sats: This shows the number of satellites used to calculate the current location. In general, the more satellites the receiver can see the better the data will be. This is included primarily to help you determine if the data you are collecting might have problems. The number of satellites can vary from 3 to 8 or more.

HDOP: This stands for Horizontal Dilution of Precision. It is a fancy term for the theoretical quality of the data based on the current location of the satellites in the sky used by the receiver to calculate the position and other statistics. If the satellites, by chance, happen to all be in the same general portion of the sky then the calculations made by the receiver are not as accurate as if the satellites are spread out. The HDOP ranges from less than 1, which is very good, to 5 or more. Data collected with the HDOP consistently over 4 or so may not be as accurate as the data collected on the same route at another time.

To the right of the GPS Data display is the **Data Grid**. This section is filled in when you are doing a run. Each line is one second of data. This is the data that is stored in the data file and used by PC-Travel to create the run files.

The unprocessed **GPS transmission sentences** are shown on the Status Line, below the GPS Data. This is the data that is displayed in the GPS Data section. Normally you don't pay much attention to this data; it is there as an indication that the communication with the GPS receiver is working.

It is possible that the GPS information displayed will not be correct. If the GPS receiver hasn't been used in a while, it may take some time to get a proper satellite fix. If you've given your GPS unit a few minutes to adequately determine its position and its transmissions are still erroneous, try moving to a new location that has a less obstructed view of the sky.

If you don't want to see these sentences *(they can be distracting)*, then click on the **Hide** button to the right of the Status Line. You can turn the display of the sentences back on by clicking the same button *(now labeled* **Show***)* at any time.

Once you start a run, GPS2LT will begin to fill in the Data Grid with the information supplied by the receiver.

At the bottom of the screen are the **Command Buttons** you use to control the software. There are three buttons, *(R)un*, *(N)ode*, and *(E)nd Study*. Only the buttons that are active at a given time are shown. Each command can be entered in two ways, either click on the button with the mouse or enter the letter in parenthesis on the keyboard. For example, to start a new run, press the **r** key. *(If the Remote Control option is used, then you can also control the software using the remote).*

Preparing to Start Run

When you first get to the **Main** screen, the software tries to communicate with the GPS receiver. If there is a problem, the screen will not show any GPS data. *(See below for notes on what to do)*. If the software successfully connects to the receiver, the GPS data is shown on the left side of the screen. You should check the **Time** and **Speed** in particular to make sure they seem correct. You should also check the **Fix**, **Num Sats**, and **HDOP** to see the quality of the data. No information is shown in the GPS Grid section yet; that only happens once you start a run. The **Start (R)un** button is now visible, but the run hasn't started yet.
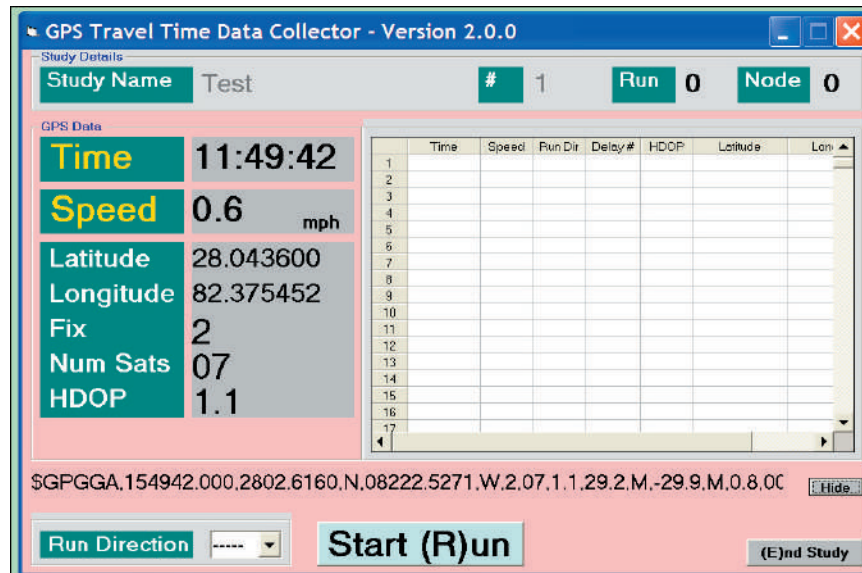

Figure 2.11 - Initial Data Collection Screen

Once all of the information you've entered is satisfactory and the GPS unit is properly connected, you're ready to start collecting data. Drive to the start of the route. Check the **Time** and **Speed** shown on the screen. They should be correct, and the speed should be close to the speed shown on the speedometer.

If you enabled **Set Run Direction** on the previous *Preferences* screen, you will have an drop down box in the lower left corner of the screen. Select the direction for the run you are about to start. The software will add the direction information to the run data; when PC-Travel processes this run data it will read the direction information and add that to the name of the run file. This greatly helps to identify runs when you are creating and editing the runs later in the process.

No GPS Data?

If you have everything set up and you're not getting any data, check the following:

• Make sure the GPS receiver is getting power. Some cigarette lighter adapters only work when the car is moving or a key is in the ignition.

• Make sure the Comm port setting is correct in the *Preferences* screen. Laptops almost always use Com1 for the serial port, but check it anyway. Also check that some other application isn't monitoring the serial port.

• Make sure the antenna has a good view of the sky. Some receivers don't output data until the data is above a certain quality level. If the receiver is new or has been moved more than a few hundred miles since it's last use, it may take up to 10 minutes to figure out where it is and start outputting data.

Collecting Data

To start the first run, click the **Start** (**R)un** button or press the **R** key. Note that the background changes its color to green once the run has started. At this point, you will also notice that the GPS data has begun to fill in the grid and your screen will look similar to the one pictured here. Also, the (**N)ode** button has appeared while the **(E)nd Study** button has disappeared. This ensures that you aren't counting nodes in between runs or mistakenly ending a study while taking data during a run. The **Start (R)un** button now reads **Stop (R)un**.
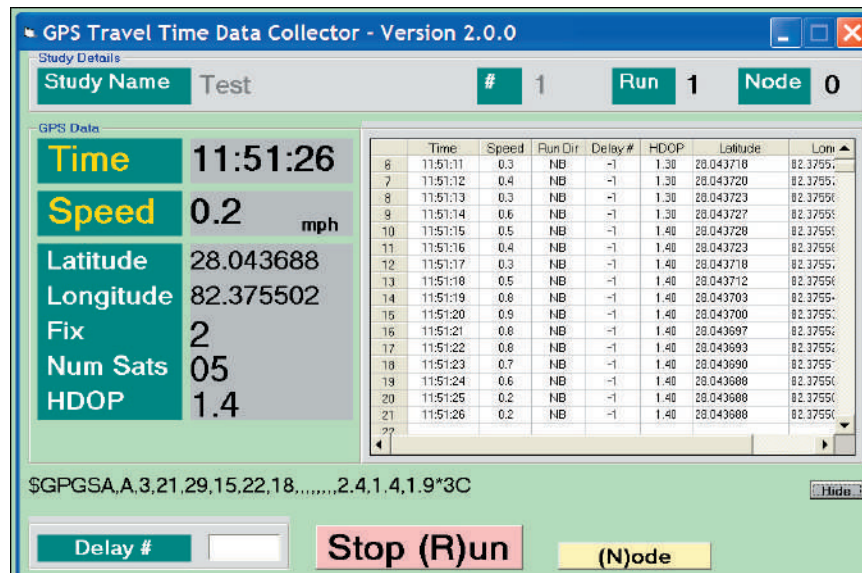

Figure 2.12 - Data Collection Screen

To record a node during your run, click the **Node** button, press the **Spacebar**, or the **N** key. Any one of these actions will cause the node number in the top right corner of the screen to increment by one. You can have as many, or as few (even zero), nodes as you like marked on a given run; your GPS data is recorded either way.

In the lower left corner is an input box where you can input **Reasons For Delay**. This is an optional feature that was added to PC-Travel with version 2. To use it you create a list of codes for different reasons for delay in PC-Travel. For example, 1 might be congestion, 2 might be pedestrians, etc. You can enter these codes while you are collecting your data. The codes you enter in the field will show up on the detail plots of the run data when you print the reports. **_Note: Since this requires typing on the keyboard, you should only use this feature if you have two people in the car._**

When you come to the end of your run, click the **Stop** (**R)un** button or **R** key again to end data collection for that particular run. Once you stop the run, the background becomes red and data entry ceases in the grid. Now you're ready to start another run that will be added to the current study. Drive to the beginning of the second run and click the (**R)un** button or **R** key again. You can have as many runs as you like in any particular study.

When you've collected as many runs as you need, click **(E)nd Study** or the **E** key. Your data is automatically saved, and the program ends.

The data for the study is stored in a file using the names you entered into the **_Preferences_** screen and shown at the top of the **_Main_** screen, in this case Test-1. The next step is to process the data you collected in PC-Travel.

Using GPS2LT Data with PC-Travel

After you've collected all of the necessary travel time data, it's time to use PC-Travel for data analysis and report generation. There is a sample data file installed with the GPS2LT software. This tutorial will use that file to show you the basic procedure; then you can duplicate the process with any data you collect.

Run your PC-Travel software.

Figure 2.13 - Startup Options

At the **Startup Options** screen, click the **Process GPS2LT Data** button. The program takes you to a screen which allows you to browse for the particular GPS2LT study that you want to process, as shown in Figure 2.14 below.
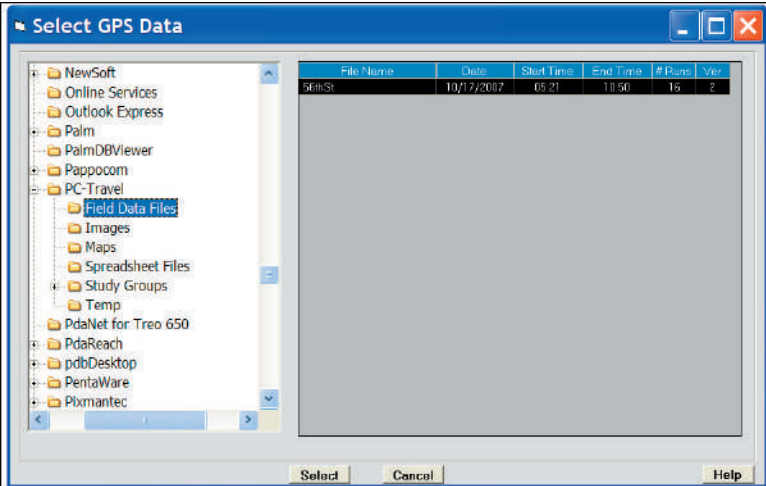
Figure 2.14 - Select GPS Data

The left side of the screen shows the familiar folder tree. The folder highlighted is the folder selected in the **Field Data** folder setting in the **Preferences** screen, which typically is called **Field Data Files**. The software looks for files with an extension of .gd2, which are the files produced by GPS2LT2. The grid on the right side of the screen shows some information about each GPS2LT2 data file so that it is easier for you to locate the one you want. The example shown above only has one data file called **56thSt**, which is already highlighted. Click the **Select** button.

Figure 2.15 - GPS Data Screen

At this point, you see a window entitled *GPS Data*. The purpose of this screen is to check your data for missing speeds. If you lost your GPS fix at any point during your travel time study *(which is not uncommon)*, there will be missing data points. The grid on this screen shows all of the GPS data for the study that you've selected *(this includes every run in that study)*. If the **OK** button is red then the software has found missing data points and you should go through your data and fix the missing speeds.

Figure 2.16 - Fix GPS Data Screen

Fixing Missing Speeds
Click the **Find Next Missing Speed** button to find the first place where you data needs to be fixed.

The grid will jump to the line with first missing speed. To have the software calculate a reasonable speed for the missing data point, click **Fix Missing Speed** and the software will fill in a speed value based on the recorded speeds before and after the missing point *(it will linearly interpolate between the two, if you like fancy words)*. If you don't like the speed calculated by the software you can edit the speed manually. Click on the speed data point and type in the speed.

You may have sections where several seconds of data are missing. The process just described does not need to be repeated for every point. As soon as you click **Fix Missing Speed**, the program will fill in speeds for the entire group of missing data points. When the **OK** button turns green, there are no more missing speeds.

You should not try to fix a large amount of data. The software can only do so much. If there are large blocks of missing data then any attempt to estimate the missing speeds is likely to give bad results. In all likelihood the people collecting the data will have noticed the data was not collected properly during one or more runs. You may need to ignore these runs because the data isn't complete. In this case you should let the software fill in the missing speeds so that the runs will be created, but simply ignore those runs when you create your studies.

In this case there is just one missing point, so the software fixes this one point and the Ok button is turned to Green signifying that all of the data has been checked and it is ok.

Creating Run Files
If the **OK** button is green, you can click it to continue. The software takes the data in the grid and creates individual run files, names the runs, and copies them to the *Temp* folder.

Figure 2.17 - Process Runs in Temp Folder Screen

You will see a screen similar to that shown here in Figure 2.17. Notice that the names of the run files have direction information (NB, SB) in them.

Chapter 3 details how to convert your Temp files to into run data files, how to edit the run data, and how to produce reports from the data.

Summary
If you followed this tutorial then you should have a pretty good idea how to collect travel time data using a GPS receiver and a laptop, and how to process that data in PC-Travel. Now you can go out and try it yourself.

Working with GPS To PDA (GPS2PDA)

This section details the procedures for collecting GPS travel time data using a PDA. If you are using a laptop, refer to the previous section.

This tutorial will guide you through the basic use of the GPS to PDA (GPS2PDA) software. Read through the tutorial once to get familiar with the basic ideas and to learn how the two primary screens work. The tutorial works best if you actually follow the directions and collect real data in the field with a GPS receiver and your PDA, but we tried to write the tutorial to make sense even if you are sitting comfortably in your recliner in your office. *(What? You don't have a recliner?)*

This tutorial assumes you are familiar with PC-Travel and the basics of travel time studies. If not, then you should read Chapter 1 of this manual. It will make this tutorial easier to follow.

Installation

The installation procedures for GPS2PDA vary depending on whether you are using the Pocket PC operating system or Palm operating system. Refer to Appendix 3, Pocket PC Supplement, and Appendix 4, Palm Supplement, for more details on installing the software and entering your serial number for the program.

Navigating GPS2PDA

Figure 2.20 - PDA Programs

GPS2PDA has been designed for easy navigation on any PDA. The figures in this tutorial show GPS2PDA running on a Pocket-PC operating system and an iPAQ variety PDA. However, the software will also run on the Palm Operating System and the screens will be much the same.

Once you've installed your GPS2PDA software (refer to Appendix 3 & 4 for details), you'll notice a couple of new icons on your *Applications Screen*. The first one you'll see is a program called **Booster**. The **Booster** program is the middle man that allows Ridge Engineering software to run on your PDA. Should you delete **Booster**, GPS2PDA will no longer run. The icon for GPS2PDA has also been added to your list of applications, as would be expected.

Tap on the **GPS2PDA** icon to run your new software.

Figure 2.21 is the first screen that you will see. Its main purpose is to look pretty and entertain you while the program is loading. If you're an experienced PDA user, you know that load times can be somewhat lengthy. This screen also has four buttons.

Click the **Serial #** button to go to the *Enter New Serial Number* screen. You normally only need to do this if you get a new serial number from Ridge Engineering.

Click the **Prefs** button to navigate to the *Preferences Screen* should any of the program defaults need to be changed.

Click the **Exit** button to end the program.

Figure 2.21 - Splash Screen

Click the **Start** button to proceed to the data collection screen.

Preferences

Once you've clicked the **Prefs** button on the Splash Screen, you will arrive at the **Preferences Screen** shown in Figure 2.22. At this point, you'll be able to adjust some of the major parameters of GPS2PDA. You should notice that you have a **?** button in the upper right hand corner of the screen. This button will take you to the **Help Screen** should you need any more tips on navigating the **Preferences Screen**.

The uppermost box, labeled **GPS Receiver**, allows you to pick out you particular GPS unit from the list of those that GPS2PDA supports. Click the downward pointing arrow to open up the box and show all of the options in the list. Don't worry if you don't see your receiver on the list. It is very likely that its output structure is identical to one of the units already on the list. Contact Ridge Engineering and we'll find out what is needed to support your GPS receiver. You can also check the support web site at **www.pc-travel.com** to find more information about GPS receivers we have tested.

Figure 2.22 - Preferences

The **Data Screen Format** option allows you to choose between data collection screens. The **Small Buttons** settings shows more GPS information on the screen, but all of the elements are a little smaller than the **Large Button** setting, which doesn't show all of the GPS info but makes the buttons larger and easier to tap. Try each one and decide which one you prefer.

NOTE: The **Preferences Screen** on the Pocket PC will have one additional setting labeled **Comm Port**. If you are connecting to your GPS unit through the cradle port of your PPC, then **Comm Port** should be set to 1. If you are using another connection method, such as a Compact Flash card or Bluetooth , then **CommPort** should be set to whatever value is appropriate for your device.

You also can select to **Input Run Direction** before each run. This will be explained in more detail a little later in this tutorial.

If you tap the **Adv. Settings** button you will see the screen shown in Figure 2.23. The top button labeled **Check GPS Data** is used to see if the communications with the GPS receiver is working properly and also to see which sentences are output by your GPS receiver. This can be helpful if you have an older, slower PDA since the number of sentences affects the ability of the software to process the data. Normally you can ignore this test.

The **Enable Metric Units** tells the software to store and show speeds in Kilometers per Hour (KPH).

The **Baud Rate** setting is used to match the setting on your GPS receiver. Most receivers use 4800 baud, but some newer ones have faster baud rates. If you are having trouble connecting to a receiver, this might be the problem.

The **Timer Delay** option is used by the software to synchronize the data coming from the GPS receiver to the code running in the PDA. Don't adjust this setting unless we tell you to do so.

Figure 2.23 - Advanced Prefs

Once both Preferences screens are set properly you can tap **Ok** to return to the Splash screen. Tap the **Start** button to proceed to the data collection screen.

Data File options
GPS2PDA stores the travel time data in one database file in the PDA. The data in this file is not deleted or erased when you transfer the data to your computer for processing. Typically, when you start a new study, the database file has the data from the last study still in it. This screen gives you the option to delete the data in the file before you start the new study, or to leave the data and add the new data to the end of the existing data.

There are two common scenarios that make the use of this screen more understandable.

First is the case where you do a travel time study and then bring the PDA back to the office and process the data in PC-Travel. The data in the PDA is no longer needed. The next time you do a study, you select **Delete** to remove the data from the database file before you start the new study.
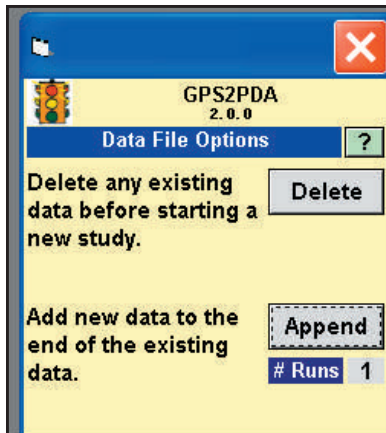
Figure 2.24 - Data Options

The second scenario is where you do a travel time study in the morning and collect data during the AM peak. You go back to the office, but don't process the data. You then return to the site at noon and possibly at the PM peak to collect more travel time data. Since you haven't processed the data in the PDA yet, you don't want to delete it. Instead you select Append. The software checks the existing data, determines the run number of the last run you did, and then starts the data at the next run number. If you did 10 runs in the morning and 10 more in the afternoon then when you processed the data you would see 20 runs, numbered 1 to 20.

In the screen shown in Figure 2.24, there is currently 1 run in memory. The next run stored would be stored as run number 2.

If you choose to delete the data, the data is permanently removed from the database, so be careful before you tap that button. When you tap either of these buttons, the software brings you to the ***Main Screen.***

Main Screen
This screen is where all of the good stuff happens. Your PDA will begin communication with your GPS unit and all of your data will be taken while looking at this screen. The title bar atop the screen includes the version number of your GPS2PDA software in the middle and the help button in the right corner. Just below the title bar is the status label. In the illustration, the status label reads "Synched..." which means the software is connected to your GPS unit. Otherwise, the status label will give you any error messages that may be associated with any communication errors. Information taken from your GPS unit will be placed into the **Time**, **Speed**, **Latitude**, etc. labels as it is received.
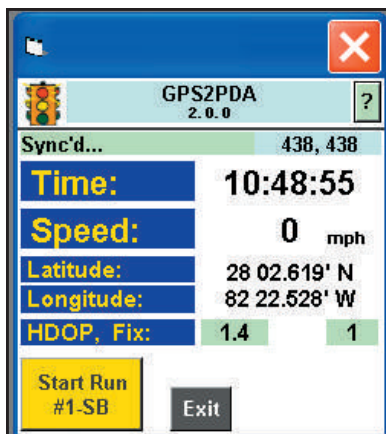
Figure 2.25 - Main Screen

The **Time**, **Speed**, **Latitude**, and **Longitude** labels are fairly self-explanatory.

HDOP stands for Horizontal Dilution of Precision and it is a number that describes how well your GPS unit is currently able to calculate your position. The lower the value the better. An HDOP value of 5 or higher would be high enough to make any travel time data suspect.

Fix is an integer value that applies to the method that is being used by your GPS unit to find your position. If it equals zero, then the receiver is not getting sufficient information to accurately determine the position. If it equals one, then the receiver is getting information only from the satellites. If it equals two, then the receiver is getting data from the satellites and a source of *differential correction*, which gives more accurate position information but doesn't improve the speed measurement significantly. For GPS2PDA, the Fix should equal 1 or 2.

The **Start Run 1** button will begin GPS2PDA's data collection, however the button is disabled if there is not a GPS unit already connected.

The **Exit** button exits GPS2PDA and returns your PDA to its normal functioning.

Collecting Data with GPS2PDA

Now that you've seen the screens that make up GPS2PDA, and you know how the controls are laid out, it's time to start collecting data out in the field. Plug your GPS receiver into the cigarette lighter *(or just turn it on if it uses batteries)* and connect it to your PDA. Run GPS2PDA and navigate to the *Main Screen*.

Prepare for Start of Run

If everything is connected properly, your screen will look like the one shown in Figure 2.25. It is often a good idea to do a quick visual check to make sure you're getting good GPS data. Make sure that the **Time** is increasing by one second intervals and check to see if the **Speed** value is close to what you read on your car's speedometer. At this point you can proceed to the starting point of your travel time run. When you reach your desired starting point, tap the **Start Run** button.
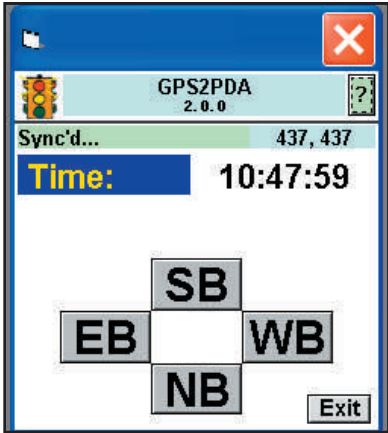
Figure 2.26 - Select Direction

If you enabled the Select Input Direction option in the Preferences screen, then you will see a screen similar to Figure 2.26. You can select the direction for the run by tapping the appropriate button. GPS2PDA then goes to the data collection screen.
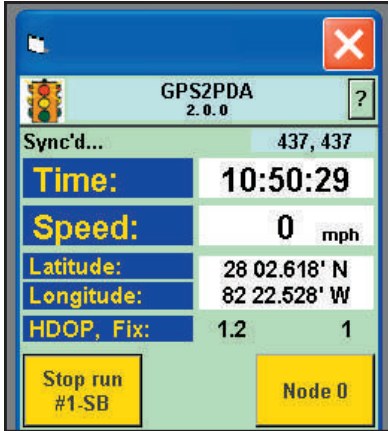
Figure 2.27 - Collecting Data

Recording Data During a Run
Once you click the **Start Run** button, GPS2PDA begins to record your travel time data. The background changes to green and the status line shows *Storing GPS Data*. At this point, the **Node** button is visible. Tap this button to record a node during you run. You may record as many nodes as you like or none at all. The number on the right side of the **Node** button tells you how many nodes have been recorded. At the end of your run, tap the **Stop Run 1** button *(it formerly read **Start Run 1**)* to halt data collection. The background will turn red and you will be able to begin another run *(the button will read **Start Run 2**)* or end your study by tapping the **Exit** button.

Chapter 2 — Collecting Travel Time Data in the Field
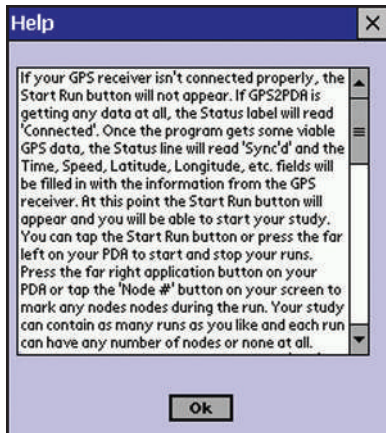
Help Screen

Figure 2.28 - Help Screen

Should you need any extra information while running GPS2PDA, just click the button with the question mark caption in the upper right hand corner of the screen. This will open up a help screen that provides extra information about what you're currently doing in GPS2PDA.

Tap **Ok** to close the Help screen.

Transferring Data from GPS2PDA to Your Computer

After you've collected all of the necessary travel time data on your PDA, the next step is to upload the data from your PDA onto your computer.

Pocket PC

PC-Travel has code to automatically copy the database file in the PDA to the proper folder on your computer. This code uses the ActiveSync software that came with your PDA. If for some reason that doesn't work, then you can always manually copy the files from your PDA to the computer using the Explore option in ActiveSync. To do this, run Active Sync, and select Explore from the options. Find the GPSData.pdb file on your PDA and copy it to the Field Data folder under PC-Travel. This is usually located at C:\Program Files\PC-Travel\Field Data\. PC-Travel will take care of the rest.

Palm

Palm PDAs use a special bit of software called a conduit to copy the data from your PDA to your computer. You have to setup the conduit once when you first install PC-Travel and then you don't have to worry about it again. Upon each HotSync, GPS2PDA's custom conduit transfers all of your travel time data in your PDA to the appropriate database on your computer. All that's left for you to do is run PC-Travel and create travel time studies with your new data. Installing the conduit is explained in detail in the Palm Supplement in the Appendix.

Processing GPS2PDA Data with PC-Travel

After you've collected all of the necessary travel time data, it's time to use PC-Travel for data analysis and report generation. There is a sample data file installed with the PC-Travel software. This tutorial will use that file to show you the basic procedure; then you can duplicate the process with any data you collect.

Run your PC-Travel software. One way to do this is to click on the **Start** button, select **Programs**, then the **PC-Travel** folder, and click on **PC-Travel** to start the software.

Figure 2.29 - Startup Options

At the **Startup Options** screen, click the **Process GPS2PDA Data** button. The program takes you to a screen which asks if you want to have the software automatically copy the database data from your Pocket-PC PDA. You can answer yes, and the software will automatically copy the data, or you can say no and the software will go to the file selection screen shown in Figure 2.32 on the next page.
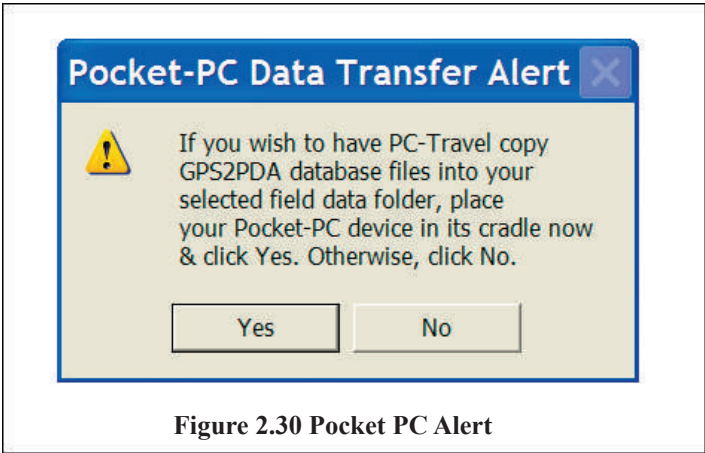
Figure 2.30 Pocket PC Alert

Note: This option only applies to Pocket-PC type PDAs. If you have a Palm PDA, then always click on No.
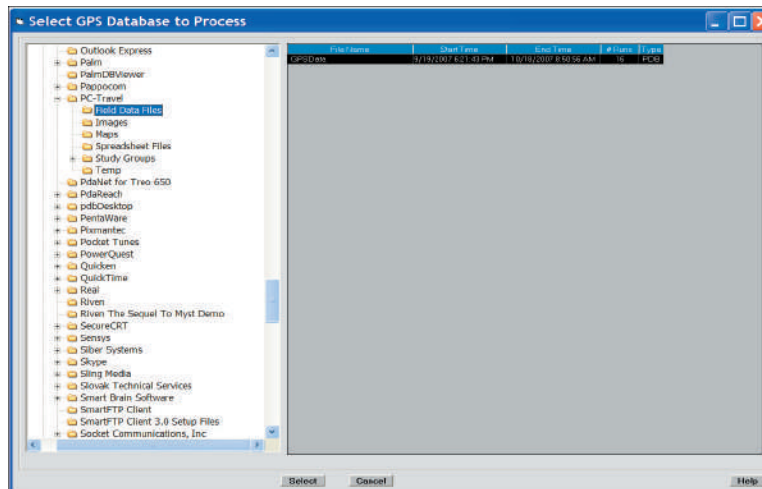
Figure 2.31 - Select GPS Database

The left side of the screen shows the familiar folder tree. The folder highlighted is the folder selected in the **Field Data** folder setting in the **Preferences** screen, which typically is called **Field Data Files**. The software looks in the highlighted folder for files produced by GPS2PDA. The grid on the right side of the screen shows some information about each GPS2PDA data file so that it is easier for you to locate the one you want. The example shown above only has one data file called **GPS2PDA**, which is already highlighted. Click the **Select** button.

Figure 2.32 - GPS Data Screen

At this point, you see a window entitled **GPS Data**. The purpose of this screen is to check your data for missing speeds. If you lost your GPS fix at any point during your travel time study *(which is not uncommon)*, there will be missing data points. The grid on this screen shows all of the GPS data for the study that you've selected *(this includes every run in that study)*. If the **OK** button is red then the software has found missing data points and you should go through your data and fix the missing speeds.

Fixing Missing Speeds

Click the **Find Next Missing Speed** button to find the first place where you data needs to be fixed.

Figure 2.33 - Fix GPS Data Screen

The grid will jump to the line with first missing speed. To have the software calculate a reasonable speed for the missing data point, click **Fix Missing Speed** and the software will fill in a speed value based on the recorded speeds before and after the missing point *(it will linearly interpolate between the two, if you like fancy words)*. If you don't like the speed calculated by the software you can edit the speed manually. Click on the speed data point and type in the speed.

You may have sections where several seconds of data are missing. The process just described does not need to be repeated for every point. As soon as you click **Fix Missing Speed**, the program will fill in speeds for the entire group of missing data points. When the **OK** button turns green, there are no more missing speeds.

You should not try to fix a large amount of data. The software can only do so much. If there are large blocks of missing data then any attempt to estimate the missing speeds is likely to give bad results. In all likelihood the people collecting the data will have noticed the data was not collected properly during one or more runs. You may need to ignore these runs because the data isn't complete. In this case you should let the software fill in the missing speeds so that the runs will be created, but simply ignore those runs when you create your studies.

In this case there is just one missing point, so the software fixes this one point and the **Ok** button is turned to Green signifying that all of the data has been checked and it is ok.

Creating Run Files

If the **OK** button is green, you can click it to continue. The software takes the data in the grid and creates individual run files, names the runs, and copies them to the ***Temp*** folder. You will see a screen similar to that shown here in Figure 2.35. Notice that the names of the run files have direction information (NB, SB) in them. This i
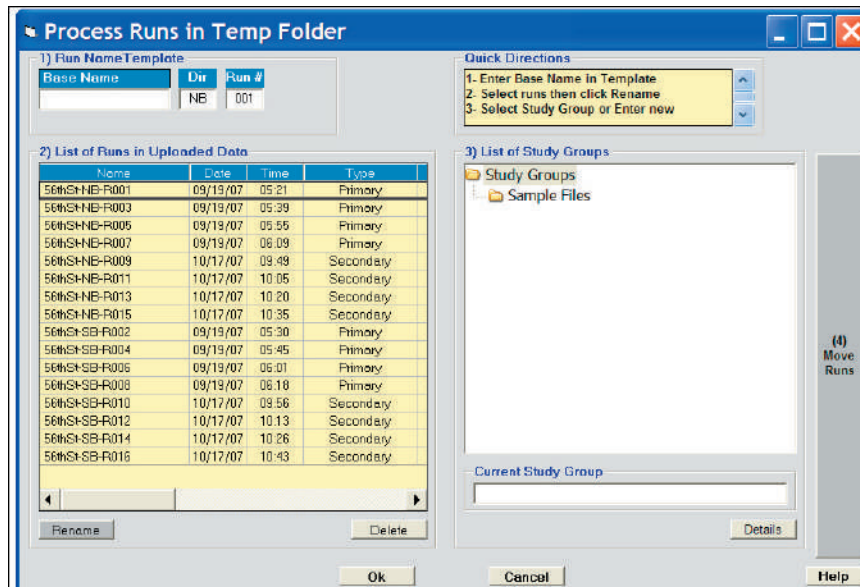
Figure 2.34 - Process Runs in Temp Folder

The next chapter details how to convert your Temp files to into data files, and how to produce reports and graphs from the data.

Summary
If you followed this tutorial then you should have a pretty good idea how to collect travel time data using a GPS receiver and/or a PDA, and how to process that data in PC-Travel. Now you can go out and try it yourself.

Collecting Data with a Jamar TDC
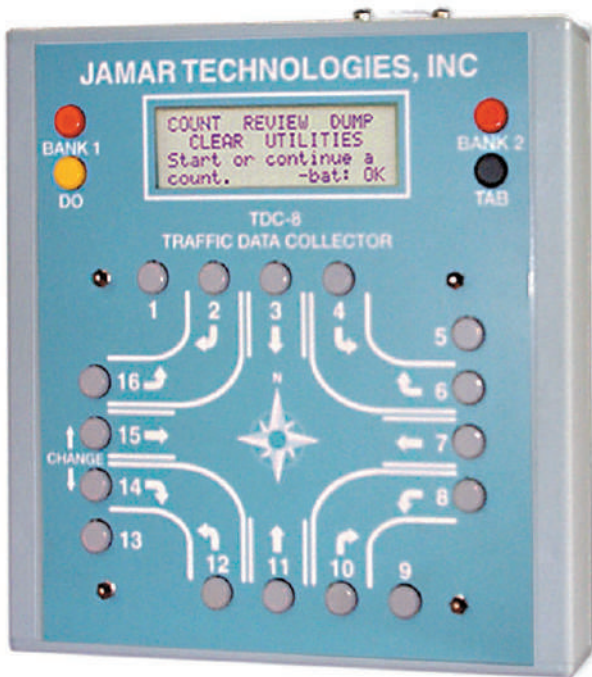
Figure 2.35 — TDC-8

Figure 2.36 — TDC Travel Time Template

This section details the procedures for collecting travel time data using a TDC.

Step 1 — Connect the TDC to the Test Vehicle

This tutorial assumes you have installed and tested a transmission sensor in the test car. Refer to the instructions that came with the sensor, or to Appendix 2, for installation information.

Connect the transmission sensor to the TDC using the Sensor Interface Cable. The five pin DIN connector goes to the transmission sensor cable. The other end plugs into the serial connector jack on the TDC. Make sure you tighten the lock-down screws on this connector to assure a good connection.

Also connect the pushbutton switch to the TDC. You don't have to use the pushbutton switch; you can use the BANK 2 button on the TDC. However, if you are doing a study by yourself, the pushbutton switch is much easier and safer to use.

Note: Plug the pushbutton switch into the jack labeled Bank 1 on the side of the TDC. This is actually connected to the Bank 2 switch in the counter. The labels for the two jacks are reversed on the side of the TDC.

The diagram to the left shows the Travel Time overlay that comes with the TDC. It has a set of brief directions printed on the middle of the overlay to help you remember how to do a Travel Time study. It also defines the buttons that you can use when you do a study.

Actually, you only need to use two buttons to do a typical study; the DO button to start and stop runs, and the BANK 2 button *(via the pushbutton switch)* to define node distances.

However, PC-Travel lets you use other buttons to define other events that you can monitor when you do a study. These other events can be sources of delay during a run, such as a signal, stop sign, congestion, etc. You can also assign your own *(for example, a construction zone delay could be assigned to button 12)*. These delay buttons are grouped on the left side of the overlay and have a red background. You can also use the buttons to define *movements* made by the vehicle during a run, in case the route isn't along a single arterial. These movement options are shown in green on the overlay.

If you use the delay buttons, you can have the software show where the delays occurred on several of the plots supported in the program. If you want to use the delay buttons, you should have another person in the car collecting the data while you drive; it isn't safe to try to collect delay data while you drive.

Step 2 — Calibrate the TDC

```
TRAVEL   CALIBRATE
                    EXIT
  Edit or Measure the
  Calibration Constant
```

```
EDIT   MEASURE   EXIT

  Measure a new
  Calibration Constant
```

```
Enter calibration
distance (ft):  2000
BANK1-TAB = cancel
DO = done
```

```
Drive to beginning
of calibration run..

Press DO to start..
```

```
Counting pulses:
     0473
Press DO at end of
calibration distance
```

```
Calibration Constant
     0882
Press DO to return
to Travel Time menu
```

If you have already calibrated your test car *(possibly with a Ridge Engineering Distance Measuring Instrument)*, you can skip this step, unless you have made a change in your vehicle which affects the calibration, such as getting new tires or changing their inflation pressure.

The calibration constant used should be between **0500 and 1200**. If not, you must adjust the rotary dial on the Modular Distance Sensor.

The TDC will remember the last calibration constant used. If you have several test vehicles you can enter the calibration constant using the edit feature of the TDC's calibration routine. If you use multiple vehicles, you will help yourself by posting the calibration constant in the vehicle.

Calibration requires a little advanced preparation. Find a location in your area where a straight and flat section of sparsely traveled road can be used. Have a section of the road surveyed so that the distance between two fixed landmarks is accurately measured. The distance should be between 1000-3000 feet, though lengths up to 9999 feet can be used.

Invoke the TDC's calibration procedure by selecting a new TT count and then tabbing to the CALIBRATE option and pressing the DO button. Select MEASURE and then press the DO button. Next, enter the calibration distance, which is the distance resulting from your survey. Remember, the "10" button on the TDC gives you a zero.

Drive to the first marker and stop *(that's why a sparsely traveled road is desirable)* so that the test car is immediately adjacent to the marker. You should always come to a complete stop for several seconds before starting the calibration run. This stop will ensure that no distance error results from the reaction time of pressing the button.

Once in position, press the DO button again, then start driving to the second marker at the end of the calibration course. The TDC will show you how many pulses are being received from the transmission sensor as you traverse the calibration distance. (**If your TDC does not show pulses being recorded during the calibration procedure, refer to Appendix 2 for troubleshooting.)** Once you reach the marker at the end of the calibration course, again come to a complete stop immediately adjacent to the marker. Press the DO button again, and the calibration constant will be displayed. The constant is the same value used in PC-Travel, and you should write it down on your field notes.

IMPORTANT: The calibration constant used should be between **0500 and 1200**. If your calibration constant is outside this range, you will need to adjust the rotary dial on the Modular Distance Sensor, then re-calibrate. Refer to the documentation that came with the sensor, or Appendix 2, for information on how to do this. **If you use a calibration constant outside the 0500 to 1200 range you may not receive accurate data.**

That's all there is to calibration. The TDC will store the constant until you change it.

Step 3 — Prepare the TDC

```
 TRAVEL     CALIBRATE
                    EXIT
  Start a new Travel
  Time Study
```

Go through the preparation of the TDC for a travel time (TT) study: From the Main Menu, select COUNT, then NEW, then TT. That will bring you to the point shown in the first screen shown here.

```
 Site Code: 12345678
 Enter up to 8 digits
 Press DO to accept
 BANK1-TAB to cancel
```

Select TRAVEL and press DO. Enter a numeric site code *(there isn't much reason to go through the hassle of entering an alpha-numeric site code; pick a numeric one and write it in your field notes in case you need it later)*, and press DO *(the second screen)* and proceed until the TDC says to press DO to start the study *(the third screen)*.

```
  Travel Time Study
  Count:001      Run:001
  Press DO to Start...
  07:12:43          Speed = 27
```

The screen now shows the Count number, Run number, time, and speed if the car is moving.

Note: Step 3 can be done in the office or, more commonly, in a parking lot near the start of the route.

Step 4 — Start a Run

```
  Travel Time Study
  Run:001         Link:01
  Dist = 0843     Speed = 27
  07:12:43        L Key = 12
```

Drive to the starting point so that when you pass the starting point you are traveling at the proper speed with the rest of the traffic. Press the DO button as accurately as you can as you pass the starting point; this begins data collection.

The display shows the run number, link number *(how many times you have pressed the New Link button this run)*, time, distance traveled so far this run, speed, as well as the last delay button pushed *(the L Key = value)*. As you proceed along the route, press the New Link button as you pass each new section.

Note: Check the speed reading on the TDC and make sure it is close to the speed on the speedometer. If they are not reasonably close (within a few MPHs), it may indicate a problem with the sensor or an incorrect Calibration Constant. Don't collect data if the speed isn't right; the data almost certainly won't be correct.

Note: If you have chosen intersections as your nodes, wait until you exit the intersection to press the New Link button. This will ensure that any delay associated with stops at the intersection will be reported in the correct section.

If you forget to press the New Link button at a location, continue the run to its stopping point as normal. You can add a node to the run later when you process the data. Make a note on the field sheet at the end of the run about the missing data.

If you hit the New Link button or a delay button by mistake, continue the run. You can edit the run data in the office if needed. Make a note on the field sheet at the end of the run about the extra data.

If you have an additional person in the car to push buttons, they may press the delay buttons as appropriate during the run. You can use the Travel Time overlay that came with the TDC to describe the delays you encounter during the run, or you can assign your own definitions to the buttons; the software lets you define the delay buttons any way you want.

Step 5 — Stop the Run

Press the DO button on the TDC when you have reached the end of the route. If the end is the last intersection, remember to press the button as you *depart* the intersection. This ends the run and the TDC stops collecting data until you press the DO button again, signifying the start of a new run.

You may turn around and collect data in the other direction. In this case you press the DO key when you go by the first intersection *(the END node of the previous run)*, press the New Link button as you go through each of the nodes, and press the DO button to end the run when you get to the last node *(the START node of the previous run)*.

It is important to understand that the various runs in the two different directions are not going to be combined in any way in the software. Travel times and other statistics have no meaning unless they represent travel along the same route, *in the same direction*. However, it is usually useful to collect data in both directions, and if you use the same nodes for both directions, you will not have to enter the names of the nodes twice later in the office. The software lets you enter the node names once, and then copy and reverse the order for the runs in the other direction. For this reason, we always suggest that you collect data in both directions, and use the same nodes for both directions.

Note: Remember that you press the DO button to start and stop a run. You press the New Link button for nodes in between.

Step 6 — Make More Runs

Repeat Steps 4 & 5 until you have completed the session, then just turn the TDC off. There is considerable debate on how many runs you should do to have statistically significant data, but the general consensus is that at least 3-5 runs in each direction are necessary, with the more runs the better.

Step 7 - Download and Store Data

Once you have collected enough data, you can return to the office to process it. To download a TDC you will need to have a Jamar universal cable and an open serial (COM) port on your computer.

Note that only a Jamar Universal Cable (or cable with matching pin configuration) should be used for downloading data. The TDC and universal cable use just three pins (2, 3 & 5) for the data transfer. However, some of the other pins on the TDC's serial port are left open for other functions. The universal cable blocks these other pins so no extraneous voltage can be sent from the computer to the TDC. If you use a generic serial cable (which has all nine pins connected) it is possible that the computer could send out incompatible voltage to the TDC that could damage it or cause your data to be lost or corrupted.

Turn the TDC on. (If you are still in data collection mode, turn the unit off, then back on. Turning the unit off ends the study and stores it in memory. You cannot download data while you are in data collection mode.) Connect the universal cable to a serial port on your computer. The ports are often labeled on the computer. If you are not sure what port you are plugging into, consult your computer manual.

All Jamar equipment currently downloads to a computer's serial (COM) port. If your computer does not have a serial port, or if you have a conflict on a serial port, an alternative is to use a USB to Serial Adapter. These devices allow you to download data using a USB port as if it were a COM port. A wide variety of these devices are available, usually for less than $30. A link to one of these devices can be found on our web site at **www.jamartech.com/hardwaresupport.htm**.
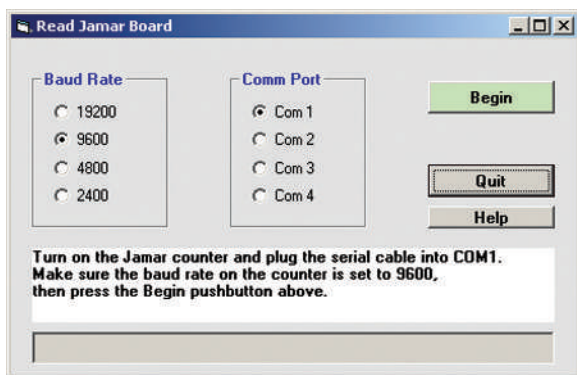
Figure 2.5 - Read Jamar TDC Board

Once the cable is plugged into the computer, plug the other end into the port on the TDC then click on the **Read TDC** button in the Startup Options and the **Read Jamar Board** window will appear. You can also access this window by going to the File menu and selecting Read TDC Counter.

The baud rate setting determines how fast the data will be transferred into the program and it must match the baud rate set on the TDC. Click the Setup button and set the baud rate to 9600. Once this is set, select the com port into which you have connected the universal cable.

After making these adjustments, click on the Begin button and you will see a message prompting you to begin downloading the TDC. To do this, press the Tab key on the TDC until Dump is flashing, then press the DO key. Local should then be flashing. Check the bottom two lines of the display to check the settings. If it matches the 9600 we set in the software, hit DO. If it does not match, tab to Baud and set it accordingly, then go back to Local and hit DO. You should then see Begin flashing. Press DO and the download will begin.

When the download is occurring you should see a status bar moving across the bottom of the Read Jamar Counter screen. Once the download is complete, the Process Runs in Temp Folder window should appear. Refer to Chapter 3 for information on how to process your data from this point.

Chapter 2 — Collecting Travel Time Data in the Field

Chapter 3

Tutorials:
Working with PC-Travel

Tutorial 1 - How to Process Field Data Into Runs

This tutorial is about how you get field data into edited runs.

As you saw in the last chapter, there are several ways to collect data in the field with PC-Travel. The most common method now is to use GPS receivers with laptops or PDAs. The great advantage of GPS is it allows you to view and edit the data on street maps. You will see later in this chapter how useful this is.

However, there are other ways to collect the field data, such as using a Jamar TDC board or using an OBD-II Interface with a laptop or PDA. You can't map this data, but you still can do travel time studies.

Whatever method you use, the end result is to have raw run files stored in the Temp folder of your computer that we can process into run files that can be used in studies.

Since you may not have any field data ready to go at this point, we'll fake it a bit by processing data that was previously collected with a TDC unit.

Select Process TDC Data from the Startup Options. The **Select TDC Data** screen is displayed, as shown in figure T1.1 below.
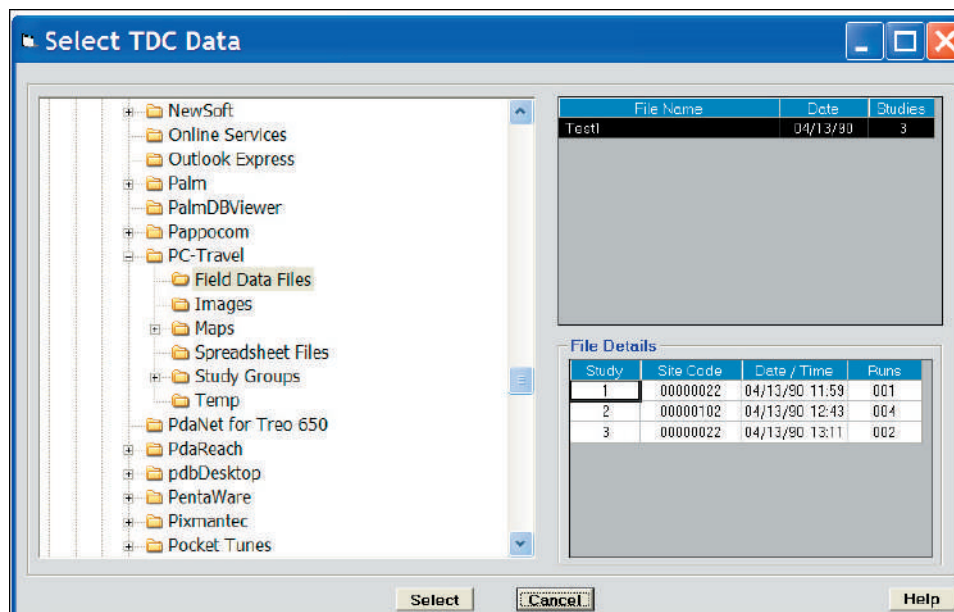
Figure T1.1 — Select TDC Data

This screen shows any files with a .tdc extension, which has the data downloaded from a TDC count board. The install routine created a folder called **Field Data Files** and copied a file called Test1.tdc to that folder.

The left side of the screen shows the familiar tree layout of your computer, with the **Field Data Files** folder selected. The upper right window shows that there is only one file in it now, called **Test1**. The file was created on 4/13/90 and has 3 studies in it.

The **File Details** window shows more info about the three studies, such as the Site Code, Date and Time, and the number of Runs in each study. The file details help you pick the correct File Name to process. Since there is only one file, that decision is easy. Click **Select** to select the Test1 file.

The next screen you see is the same screen you would have seen if you had read a TDC unit with this data in it. This is also the screen you will encounter when you are processing your field data collected using the GPS Travel Time software.
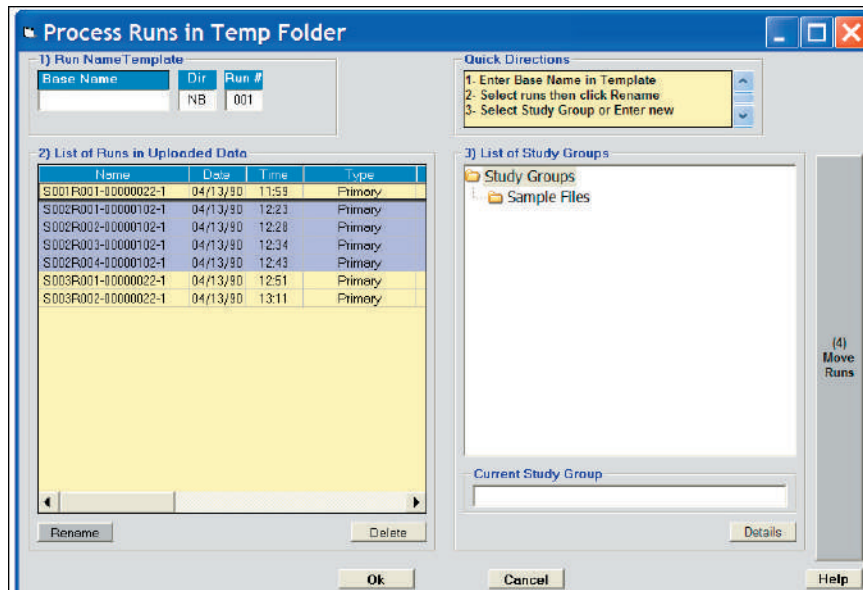
Figure T1.2 — Process Runs in Temp Folder

At this point, the field data you collected has no real resemblance to the run file format the software needs. This screen attempts to solve the following problem:

> *What is the simplest procedure for an experienced user to take field data and end up with proper PC-Travel runs that can be built into studies?*

When you process field data, it is converted into individual run, which are stored in the **Temp** folder *(as specified in the Preferences screen)*. Each run is given a unique name using the following naming logic: SxxxRyyy-CCCCCCCC-N, where xxx is the study number, yyy is the run number, CC... is the site code from the data, and N is a number that is used to break ties in case two runs have the same other specs.

The program then displays the screen shown in Figure T1.2 above. The large window on the left side of the screen shows the runs from the field data, named using the convention just described. The background color alternates to separate runs from different studies.

You can see in this example that the first study just has one run, the second has four, and the third has two. Let's pretend the field notes show that the first run was just for practice. The next four runs were good runs. Runs 1 & 3 were northbound, 2 & 4 southbound. The last two runs were done at a different location, first westbound, then eastbound.

This is the starting point. The ending point will be when all of the temporary runs have been renamed and moved into a new or old Study Group. This is a four step process. While it isn't necessary to do the operations strictly in the order shown, it is probably a good idea to do it that way for a while until you feel comfortable with the process.

1 — Enter Base Name in Template

The **Base Name** is just a name that helps you identify a run as belonging to a group of similarly named runs. From the field notes *(continuing the example from the last page)*, we know the first five runs were done on Fowler Ave., so we'll name all of these runs with a Base Name of Fowler Ave. Enter Fowler Ave. in the **Base Name** text box. Leave the Dir set to NB *(northbound)* and the Run # to 001.

2 — Select Runs then Click Rename

Study 1, Run 1 was just for practice, according to our notes. Runs 1 and 3 of Study 2 are northbound runs. We want to select them. Click on S002R001... and S002R003... then click on **Rename**. The names change to match the new name convention.

3 — Select Study Group

We want to move these two runs into a Study Group, but there isn't a Study Group we want to use. We need to create a new Study Group for these runs *(and later for any studies built from them)*. In the **Current Study Group** text box, type Fowler Ave NB then press **Enter**. This creates a new Study Group, which is shown in the **List of Study Groups**. Click on the new Study Group to select it *(you can see it is selected because the folder is "open")*.
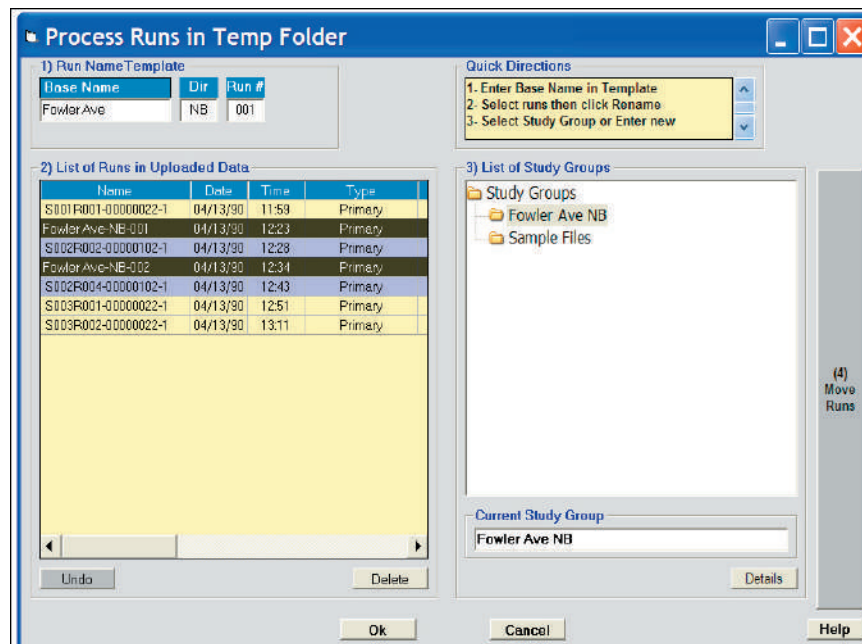
Figure T1.3 — Select Study Group

Your screen should now look like the one shown above. The runs with the new names are selected and the destination Study Group is shown in the **Current Study Group** text box.

4 — Click Move Runs

You are ready to move the runs to the new Study Group. Click the button on the far right labeled **(4) Move Runs**. The two runs disappear from the *List of Runs*, showing that they have been moved.

That takes care of the northbound runs. Now you have to do the same thing for the southbound runs. Since we already went through it once, I'll just outline the procedure.

1 – Edit the **Dir** field in the *Run Name Template* to SB, for southbound.
2 – Select the two runs from the list (S002R002... & S002R004).
3 – Click **Rename**.
4 – Create a new Study Group called Fowler Ave SB.
5 – Select the new Study Group.
6 – Click **Move Runs** to move the runs.

This will reduce the List of Runs to three.

You can repeat the procedure for the two runs in Study 3, if you want. Since our hypothetical notes say they were done at a different location, you should create a new Study Group for them. Just make up any name. Put both of the runs in the new Study Group.

This leaves the single run. Since our notes say this was a practice run, then it isn't needed. Click on **Delete** to delete the run. The *List of Runs* is now empty. This is where you want to end up, with all of the runs from the counter renamed and moved to study groups.

Click on the **OK** button to close the *Process Run* screen and return to the main screen.

Note: The procedure outlined up to this point may seem confusing at first glance. Once you get the hang of it though, you will be able to process run files very quickly.

At this point you have all of the runs from the counter renamed and moved to new study groups. The run data is not complete, however. You need to add the node names, assuming you collected node data during the runs, and you also can add notes to the run details to help you explain the data when you do analyze the data as part of a study.

There are two different procedures you can follow to finish editing the run data details:

1 – Create a new study, and then edit the run details for the runs in that study. This is the most common procedure, since most users immediately create studies and print out the analysis reports after reading the data from the counter. This process is described in *Tutorial 2 — How to Create a New Study* and then *Tutorial 3 — How to Edit Nodes in Individual Runs*.

2 – Edit all of the runs you just read before you create any studies. This is a good option if you plan to create the studies at a later date. You probably have the information you need to edit the runs at hand, since you brought the field sheets with you. You can edit the runs as needed, get them in really good shape, and then when you want to create the studies you won't have to worry about the runs at all. Some users prefer this method even if they plan to create the studies and print the analysis reports in the same session.

The next part of this tutorial shows you how to easily select a run to edit even if that run isn't part of a study yet.

How to Select a Run to Edit

Assume that you have read your field data and processed the runs as described in this tutorial. You now have several runs in one or more study groups. The runs are not complete yet; they still need some information added to them *(primarily the node names, but other stuff as well)*.

Figure 3.4 — Edit Run Icon

From the Main Menu, click on the **Edit Run** icon in the toolbar, as shown in the figure here. This will bring up the **Select One Run** screen as shown below.
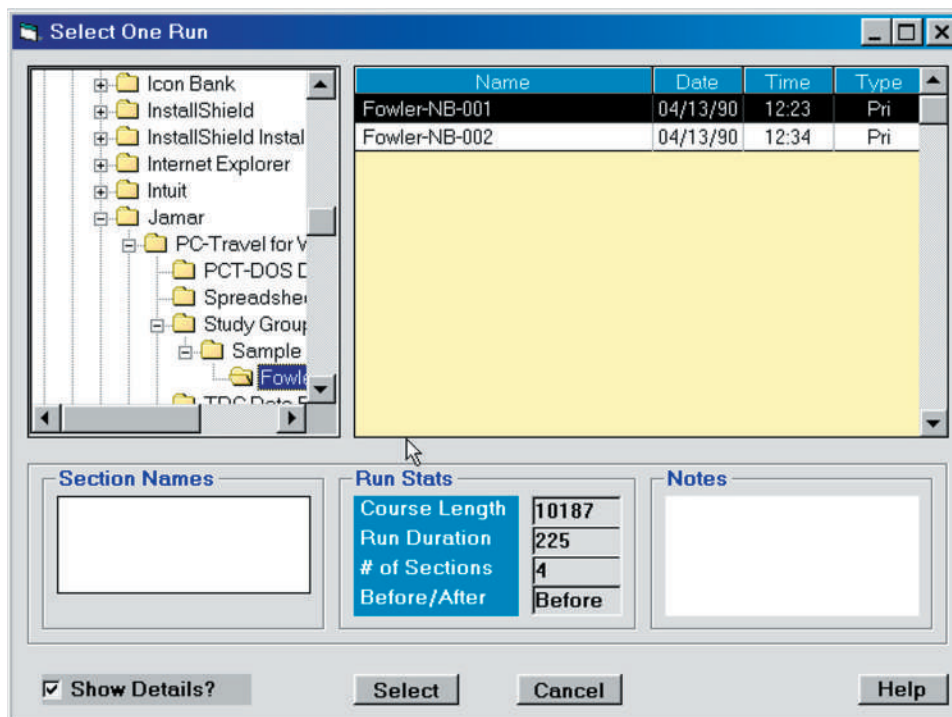
Figure 3.5 — Select One Run

There are three primary parts to this screen. The upper left window shows the familiar tree diagram of your Study Groups with the current Study group highlighted. The upper right window shows the runs that are in the highlighted Study Group. The name, date, time, and type of run are shown for each run. The bottom window shows additional information about the run that is highlighted in the upper right window.

The highlighted Study Group probably isn't the correct Study Group; you probably want to navigate to one of the new Study Groups you created when you processed the runs in your counter. If you followed the tutorial then you should have a folder under the Samples folder called Fowler NB. Click on that folder and you should see the screen shown in Figure 3.5.

There are the two runs you created earlier. The first run, **Fowler - NB - 001** is highlighted. There are no Node Names or Notes, so those sections are blank in the lower window. This is the run you want to edit, so click on the **Select** button at the bottom of the screen.

This brings up the Run Details screen shown in Figure 3.6.

Figure 3.6 — Run Details Screen

Tutorial 3 explains in great length how you can edit the Node Names on this screen, so that information won't be repeated here. Once you are through editing the run, you click on the **Save** button. This will bring you back to the *Select One Run* screen shown in Figure 3.5, where you can select another run to edit.

You can systematically edit each of the runs in the Study Group, and then go to another Study Group *(Fowler SB in this case)* and edit each of the runs in that Study Group. When you are done you will have all of the runs completely edited and ready to be added to studies.

Tutorial 2 - How to Use Maps to Edit Runs

This tutorial shows you how to use the new mapping features in PC-Travel to edit run data that you have collected with GPS2LT or GPS2PDA.

Note: This tutorial uses sample files collected in the Tampa, FL area. You must have maps of that area in order to duplicate the steps shown. If you are using MapPoint as your GIS engine in PC-Travel then this is not a problem since MapPoint includes maps of all of North America, including Tampa, FL. If you are using the ArcGIS Shape File engine then this isn't quite as simple. The installation program installed a folder called Tutorial Maps under the PC-Travel folder on your computer. ***You need to copy all of the files in the Tutorial Maps folder to the Maps folder, which also is under the PC-Travel folder***. Once you do this you will be able to duplicate the steps shown in this tutorial.

Data Collection Considerations:

One of the primary advantages of the mapping feature is that it simplifies the way you collect data in the field. Previously you had to mark the start and stop points for each run and also you would typically mark each node during each of the runs as well. You don't have to do this now since you can edit the runs on the map, which you will see in just a minute. Here is the typical scenario for collecting data:

> 1- Set up the GPS equipment and laptop or PDA in the car as usual.
> 2- Drive to a parking lot or side street near the start of the route you want to study.
> 3- Run GPS2LT or GPS2PDA and make sure the GPS receiver is working properly.
> 4- Select the Direction of Travel (NB or SB or whatever) and start the run.
> 5- Merge onto the main arterial and drive to the end of the route. Don't mark any nodes.
> 6- After passing the last intersection or node of interest pull into a convenient parking lot or side street and end the run.
> 7- Drive to the beginning of the next route (typically this means you do a U-Turn and get onto the other side of the arterial you are studying).
> 8- Repeat steps 4-6.
> 9- Continue until you have done as many runs as you need.

Note that you don't mark any nodes and you never have to take your hands off the wheel once you are driving the car. This is safer as well as more efficient.

If you are familiar with PC-Travel for Windows version 1.x, then you will immediately see how much simpler this process is than what you have done in the past. If you are new to PC-Travel version 2.x then the advantages won't be quite as obvious, but you will just have take our word for it...this is better!

Sample Files Used in the Tutorial

In the PC-Travel\Study Groups\Sample Files are runs that are used in this tutorial. There are the basic runs that were collected in the field using the procedure described above; they started and ended off the main arterial and there were no nodes collected. An example of a run file name is 56th St-NB-B-R001.

There also are run files that are edited versions of these basic runs. These edited runs have a -t at the end of them to signify that they have been trimmed (this will be explained in a minute). One of the runs has a -tn at the end to signify that it has been trimmed and nodes have been added to it. Make sure you select the proper runs that are specified in the tutorial as you follow along; it is easy to miss the -t or -tn if you aren't careful.

Ok, we are ready to start the tutorial.

Select Run To Edit

The first task is to select a run to load to a map so we can edit it.

Run PC-Travel and click on the Edit Runs button on the Startup Options screen. The **Edit Run** screen is displayed, as shown in figure T2.1 below.
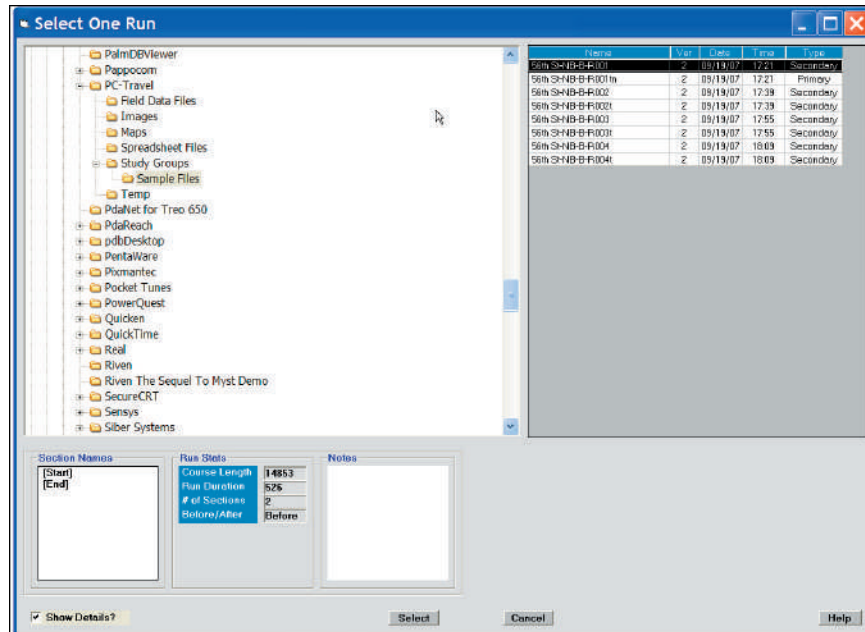
Figure T2.1 — Select Run To Edit

The tree on the left side of the screen should point to the Sample Files folder under the Study Groups folder. If it doesn't then find that folder in the tree and click on it to select it.

The runs in that folder are shown in the list on the right. We want to edit the 56th St-NB-B-R001 run, which probably is highlighted. Click on **Select**. This brings up the Run Details screen, shown here in Figure T2.2.
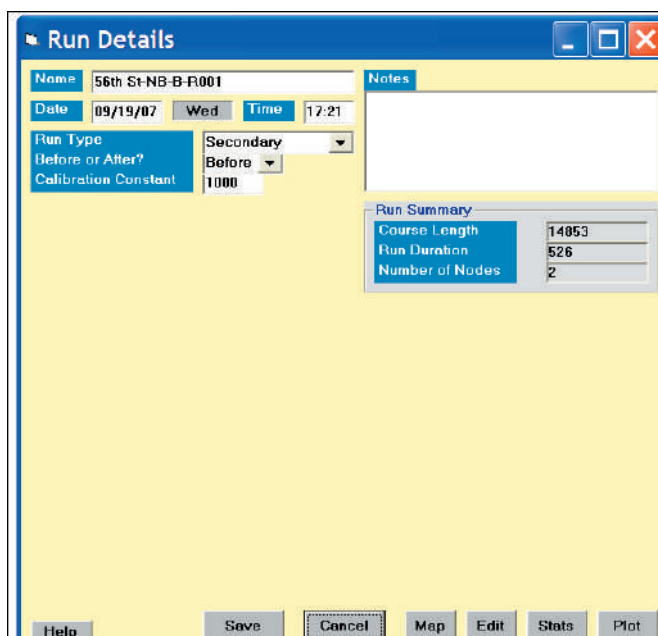
Figure T2.2 — Run Details

Notice that this run is a Secondary run, which means it doesn't have any node information in it (yet). We will edit this run on the map and add nodes to it, which will make it a Primary run.

We want to edit this run on a map, so click on the **Map** button at the bottom of the screen.

Note: If you are using MapPoint for your GIS engine then there isn't a Map button visible on this screen. You need to Start a new study, Add the 56th St-NB-B-R001 run listed here (select the Sample Files folder if it isn't already selected), then click on the Map button on the Study Summary screen. This will bring you to the same point in this tutorial.

PC-Travel Reference Manual
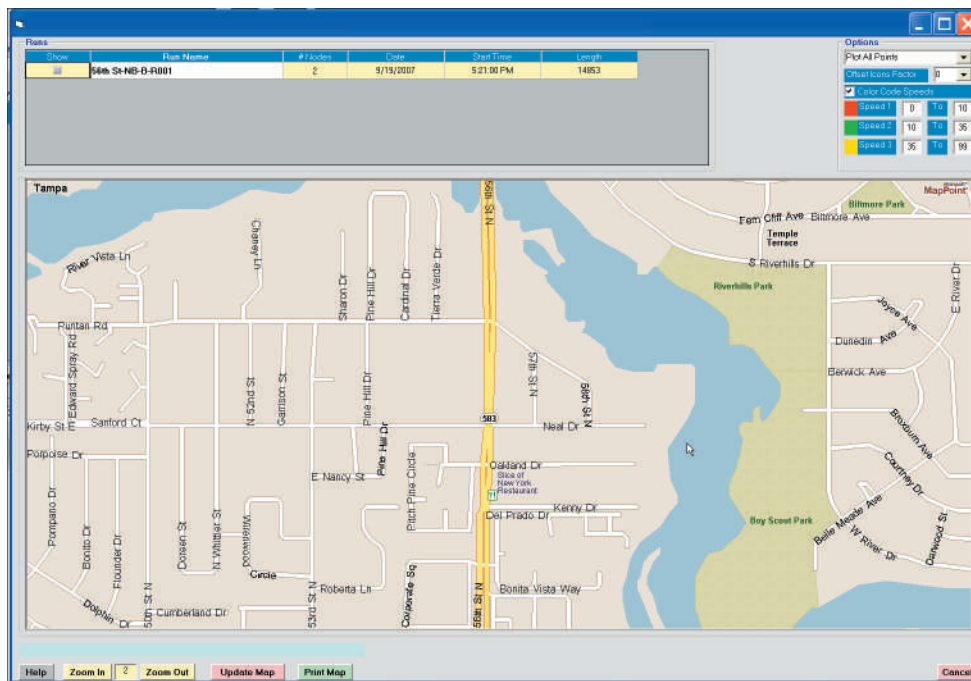
Figure T2.3 Initial Map Screen

This is the map screen. It has several parts.

List of Runs

At the top is the list of runs in the current study. In this case there is no study yet so it just shows the run that was selected. Along with the **Run Name** you can see some basic information about that run. You can select which runs you want to map by checking the **Show** checkbox on the left side of the row.

Map Options

On the top right of the screen are the Map Options as shown in Figure T2.3.
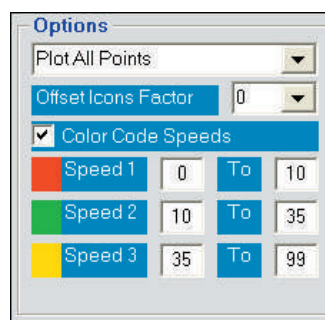
Fig T2.4 Map Options

Plot Points

The first option is a drop down box to select how many points in each run to plot. You can select between **Plot All Points** (the default) to **Plot Every 10th Point**. This is useful if you just want a rough idea of how the data looks and don't need to see every data point in the run. Normally you will choose **Plot All Points** when you want to edit any of the data in a run.

Offset Icons Factor

If you plot several runs at once then the data points tend to overlap each other and it is hard to separate the runs. The **Offset Icons Factor** lets you pick a value from 0 to 5, where 0 is no offset and 5 is the maximum offset. The software plots each point and then moves it a little to the right based on the value of the offset factor. The first run is always plotted with no offset. The second run is offset a little to the right, the third run a little more to the right of that run. The points won't be exactly on top of the road but they will be easier to see. If this is a little confusing it will make more sense when you play with the software and try different settings.

Color Code Speeds

You have the option to assign three speed ranges to the data, each with a different color. This mode is enabled

by checking the checkbox. You then can edit the speed ranges. PC-Travel remembers the settings for the three speed ranges so you normally only have to set the ranges once. Of course for special circumstances you can change the speed ranges but the new values will be stored unless you set them back. You should set the ranges so that there are no holes in the speed ranges. For example, if you set the first range from 0 to 10 you should normally set the second range to start at 10.

The software checks this setting before plotting the data on the map. If the **Color Code Speeds** is enabled, then the software uses different colored solid circles to plot all of the points, and the colors are based on the speed of the vehicle and the speed ranges selected.

If the **Color Code Speeds** is not enabled then the software uses different shapes of icons, and if needed, different colors, to distinguish between the runs.

Map
In the center of the screen is the map. What you see on your screen may look a little different from the screen-shot shown here, which was done on a fairly large monitor using MapPoint mode for the GIS engine. The software looks at the first data point of the first run and centers that on the map, so you should see the general area where the data was collected.

Navigating around the Map
There are several ways to change the view on the map. The procedures vary depending on the GIS mode you are using, MapPoint or ArcGIS Shapefile. In either mode you can use the **Zoom In** and **Zoom Out** buttons at the bottom of the screen.

MapPoint Mode
Important: All commands are done with the Alt key pressed!
You can select a specific region by pressing the Alt key and drawing a bounding box with your mouse. This is done by pressing the left mouse button at the upper left corner of the area you want to see and dragging the mouse to the lower right corner. When you let go of the left mouse button you will see a little message to "click to Zoom". Click the mouse and the map will zoom to the bounding box you set.

You can scroll around the map by pressing the Alt key and moving the mouse to one of the borders. The cursor will change to an arrow symbol. Click the mouse and the screen will scroll in that direction. This takes a little practice, but it is a good way to follow the route.

ArcGIS Shape File Mode

Figure T2.5 shows the navigation toolbar that is displayed in the upper left corner.

The first icon (looks like an earth) is the **Full Extent**. Clicking this shows the entire map of your area.

The second icon is a magnifying glass. Click this to set **Zoom Mode**. Press the left mouse button at the upper left corner of the area you want to see and drag the mouse to the lower right corner. When you let go of the left mouse button the map will zoom to the bounding box you set.

The third icon is a hand. Click this to set **Scroll Mode**. Click and hold the left mouse button and then drag the map around to show the view you want.

Fig T2.5 Navigation Toolbar

Status Line and Control Buttons

At the bottom of the screen is a status line which will show you messages occasionally as you use the software.

Below the status line are a series of buttons.

Help

Click this to show the Help screen for the mapping feature. If you forget how to navigate around the map or what an option is for you can find out here.

Zoom In and Zoom Out

This were discussed before and are fairly obvious. The number between the two buttons roughly represents the altitude when in MapPoint mode and a zoom factor when in ArcGIS Shape File mode.

Update Map

This is used to tell the software to go ahead and draw the map using the options currently selected. If the button is red then you need to select one or more runs to map.

Print Map

At any time you can print the current view shown on the map.

Cancel

Click this to return to the Main Screen in PC-Travel.

Now that you have some understanding of the screen and know how to move around the map it is time to plot some points. Click the Show checkbox on the first run to select it. Set the **Map Options** to *Plot All Points*, **Offset Icon Factor** = 0, **Color Code Speeds** checkbox selected. Click the **Update Map** button, which is now green. The software plots all of the data from the first run onto the map. Use your new navigation skills to zoom out and
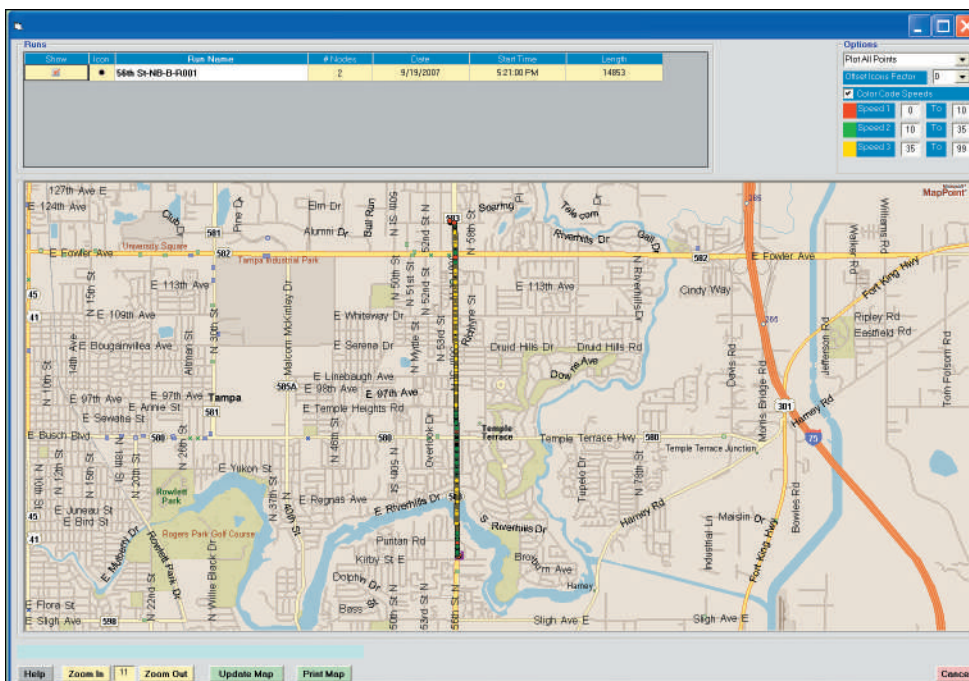
Figure T2.6 Run 1 Data Zoomed Out

center the map so you can see the entire run. You should have a screen similar to the one shown in Figure T2.6. You can see the variations in speed during this run. Now it is time to edit this run.

Our first task is to trim the start of the run. Zoom in on the beginning of the run (at the bottom of the screen). Notice that the run started off the main street. The driver started the run then merged onto 56th St going north. and passed Puritan Road fairly soon. We want to start our route at Puritan Road so we need to trim all of the points from the beginning of the run up to that street.

Click on the point that right at or slightly passed Puritan Road. You should see a screen similar to Figure T2.7.
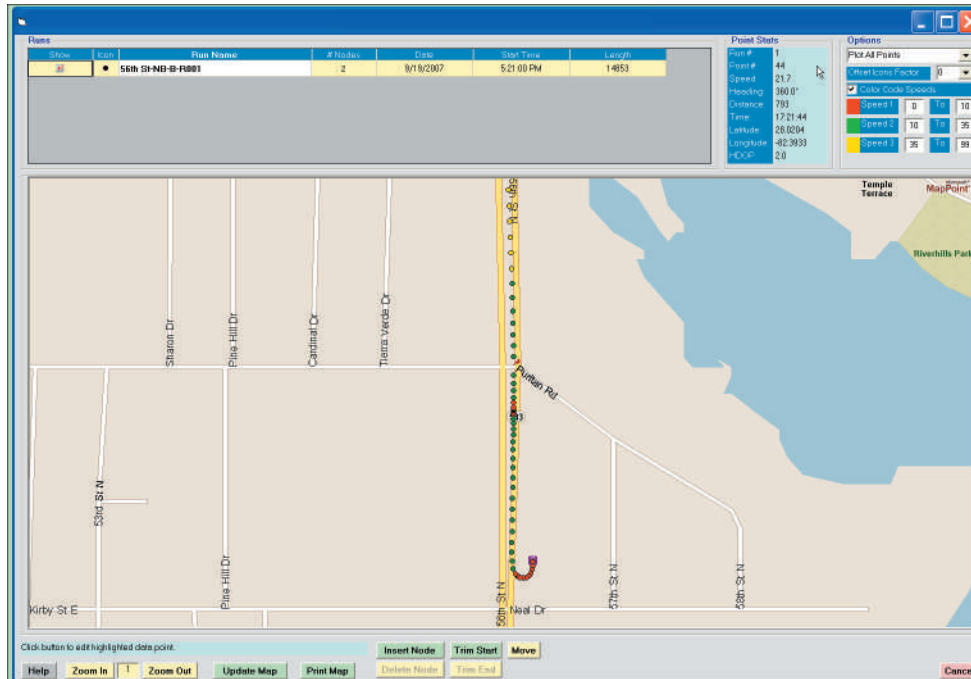
Figure T2.7Trim Start of Run

Notice that the data point changed to a push pin. This shows the currently selected data point. Also notice that there are two new additions to the screen. **Point Stats** are shown at the top of the screen, and five new buttons are visible at the bottom of the screen.

Point Stats
Shown here is everything we know about this data point.

Fig T2.8 Point Stats

Run #: This shows which run this point belongs to.
Point #: This is from the beginning of the run.
Speed: The speed of the vehicle as recorded by the GPS receiver at this point.
Heading: The direction of the vehicle as recorded by the GPS receiver at this point. 0 or 360 is NB, 180 is SB, 90 is EB, and 270 is WB.
Distance: The distance from the first point in the run.
Time: The time as recorded by the GPS receiver at this point.
Latitude, Longitude: Current values for the point on the map.
HDOP: Value as recorded by the GPS receiver for this point.

O

The point stats can be useful to help understand the data that you got in the field, but normally you won't need to pay much attention to them. The **Heading** is useful if you aren't sure if a point belongs to a specific run or to figure out the direction of a run if the run name doesn't show the direction.

Run Edit Buttons

At the bottom of the screen are five new buttons. In this case three of them are in green, meaning they are enabled now. Two are in yellow and disabled (nothing happens if you click on them).
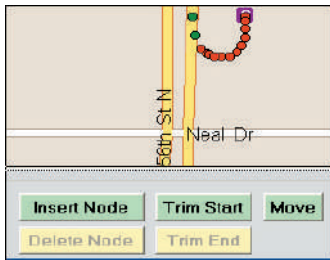
Fig T2.9 Run Edit Buttons

Insert Node: Create a node at this point.

Delete Node: Make a current node a normal data point.

Trim Start: Delete all points in the run from the beginning up to this point.

Trim End: Delete all points in the run from the end up to this point.

Move: Moves a point to a new position you select. Occasionally a data point will be obviously out of position. This can happen if the GPS receiver loses reception for a second or two. It is often obvious that a point is a little off and it is simple to move it to where it belongs.

Trim Start of Run

In our case we want to trim the points from the beginning up to Puritan Road, so click on the **Trim Start** button. The software starts at the first data point and changes each point up to the selected point into a white circle. Now the run starts at Puritan.
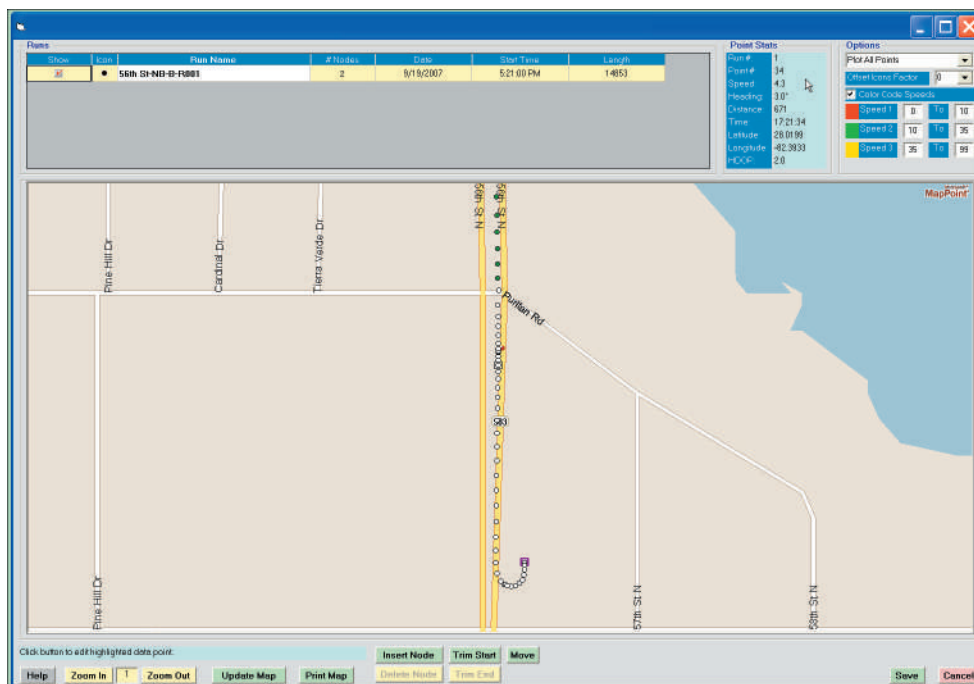
Figure T2.10 Trimmed Start of Run 1

Note, the run has not been changed permanently yet. That only occurs when you click on the Save button. So if you pick the wrong point or hit the wrong button you can always Cancel the session and re-do it.

Your screen should now be similar to Figure T2.10.

Now it is time to trim the end of the run.

Trim End of Run

In a similar manner, zoom out to show the entire route and then zoom in to show the end of the run. You can see that the driver made a left turn onto 122nd Ave (you can tell he had to wait a while to make the turn since there are quite a few data points in red right there). Then he pulled off the road into a parking lot and ended the run. We want the route to end at 122nd Ave but we don't need all of the points after that.
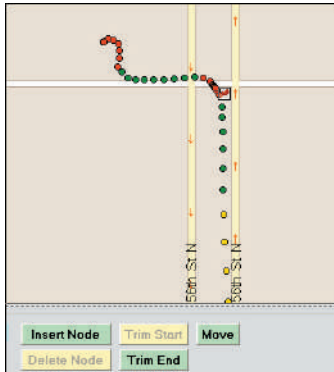
Fig T2.11 Trim End of Run

Click a point just before 122nd Ave. We don't really want the data points while he was waiting to make the left turn so pick the last green point or the first red one. Fig 3.11 shows a closeup of what the screen should look like.

Notice that now the **Trim End** button is green.

We want to delete those extra data points so click on the **Trim End** button. The software starts at the last data point and changes each point up to the selected point into a white circle. Now the run ends at 122nd Ave.

Your screen should now look like the screen in Figure T2.12.
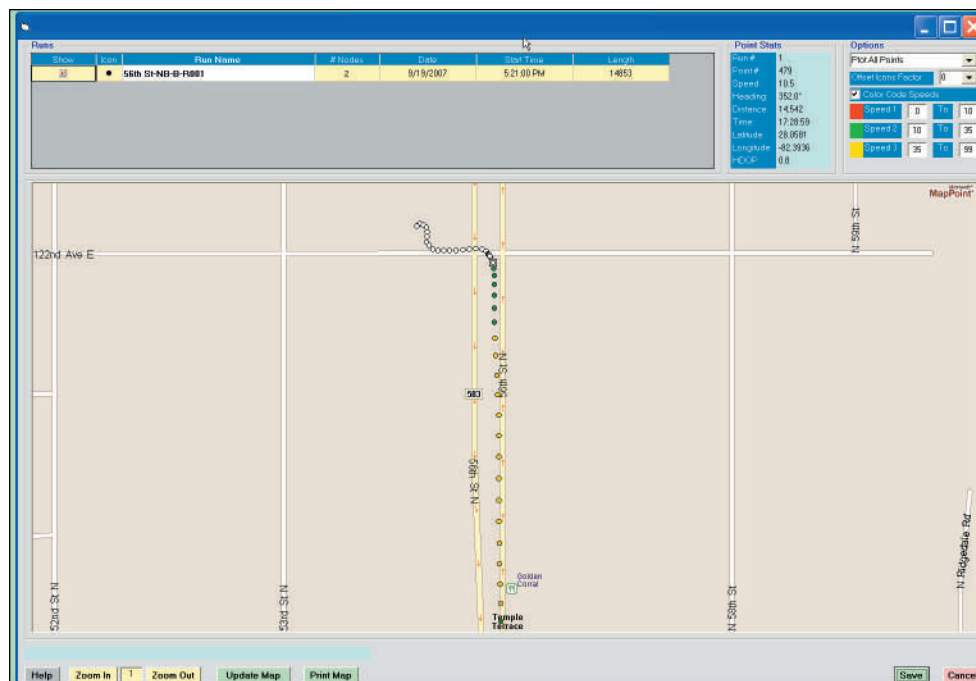
Figure T2.12 Trimmed End of Run

For many runs this all you need to do on the map-trim the start and end of the runs so they all start at the same place and end at the same place. For at least one run you also need to add the node location information for the run. This is what we will do next.

Add Nodes To Run

PC-Travel calculates a variety of statistics for the entire route and for each segment between nodes in the route. At some point the node distance and name information must be entered into the software. In previous versions of PC-Travel the node distance data typically was entered in the field while collecting the data. Now it is much simpler to do it using a map. The node names are still best entered in the Run Details screen.

You should have a list of the intersections you want to use as nodes. You don't have to use every intersection on the arterial; too many nodes makes the reports too complicated.

The first node we want to add is at E Riverhills Dr, which is the first large intersection going north from the start of the run. Zoom in and navigate on the map so that the street you want is near the center of the screen. Click on the point that is at the intersection or just past it. In this case the car was not stopped at this intersection and traveled through it at a fairly high speed so there are only a few points to choose from.

Note: You want to pick the first point that is clearly past the intersection so that all or atl least most of the delay for the intersection is in the previous segment. Don't pick points that are before the intersection.

Click on the Insert Node button. The icon for the point changes to a **N** to signify a node. Your screen should look like the screen in Figure T2.13.
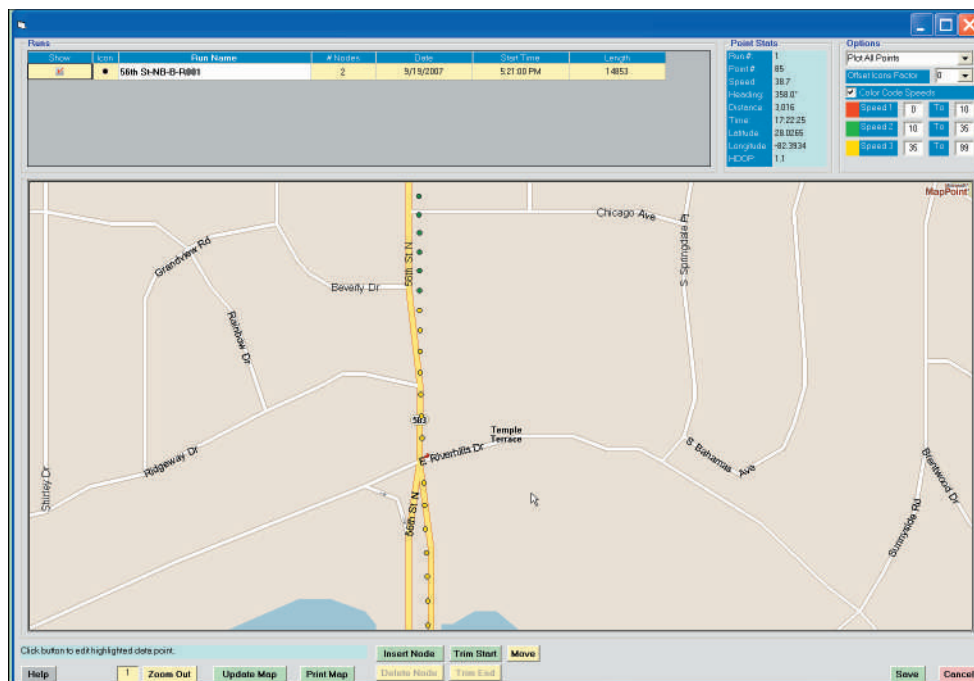
Figure T2.13 - Insert Node in Run

You can duplicate this process for each node you want to add to the run.

Delete a Node

If you decide you don't want a node at a specific spot, then it is simple to fix. Click on the Node point so it is selected then click on the Delete Node button and the point will be restored to a normal data point.

Edit Run Name
You have trimmed the start and end of the run and added the nodes.
The last step is to edit the run name and save the run.

The name of the run is shown at the top of the screen in the white text box.
You can use the same run name to simplify the number of run files you have to manage, or you can give the edited name a slightly different name to show that it has been edited.

If you want to change the file name before saving it, then double click on the text box. The cursor changes to the standard text editing cursor (an I-Beam) as shown in Figure T2.14.
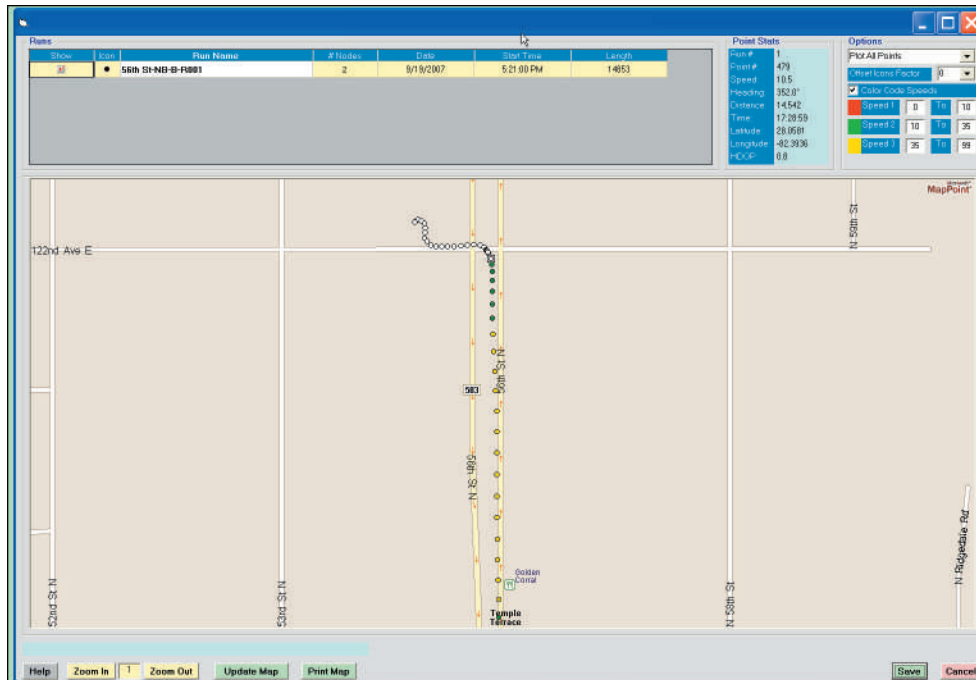
Figure T2.14 - Edit Run Name

For this tutorial , edit the name to *56th St NB-B-R0001e* (add an 'e' to the end) and then press the **Enter** key.

Note: The sample files included with the software have a "t" or "tn" added to the end of the file name to signify the run file has been 'trimmed' or 'trimmed and nodes added'.

Save the Run
When you are through editing the run (trimming, adding and/or deleting nodes, and editing the run name) then click the **Save** button in the lower right corner of the screen. A new run file will be created and saved using the name that is in the **Run Name** text box at the top of the screen. If you haven't edited the run name then this effectively will replace the existing run.

Go ahead and save this edited run. Make sure you change the name so that you don't overwrite the original run file (someone else may want to go through this tutorial and you don't want to mess that up).

Cancel Edits
If at any time before you click the **Save** button you decide you want start over or just not edit this run, then click the **Cancel** button. The software will return to the Main Screen and no changes will be made to the run.

Edit Node Names

There is one last step to do with the run we have been editing. It isn't done on the **Map Screen** but it fits into the flow of this tutorial so it is included here. We have edited the run 56th St NB-B-R001tn and trimmed the start and end, added nodes, and saved it. Now we need to give the nodes names so the reports will look better.

Node names are edited on the **Run Details** screen. Follow these steps:
>   1- From the **Main Screen**, click on the **Edit Run** icon in the toolbar near the top of the screen.
>   2- Select the run you saved on the **Map Screen**. If you followed the tutorial then the file name will be **56th St NB-B-R0001e.** You will see a screen similar to Figure T2.15, except the **Node Names** fields are blank.

This is the **Run Details** screen and it shows everything we know about this run.

The software knows there are 9 nodes and knows the distances since you marked them on the map. Now you need to edit the names of the nodes so the names will show up on the reports.

Click on the first node line in the white text box and type **Puritan** then press the **Enter** key.
You would enter all of the names in the same way until all of the node names are entered.
Once all of the names are entered you click the **Save** button. This saves the run using the name shown in the **Name** field, and returns you to the **Main Screen**. This run is now ready to be used in a study.
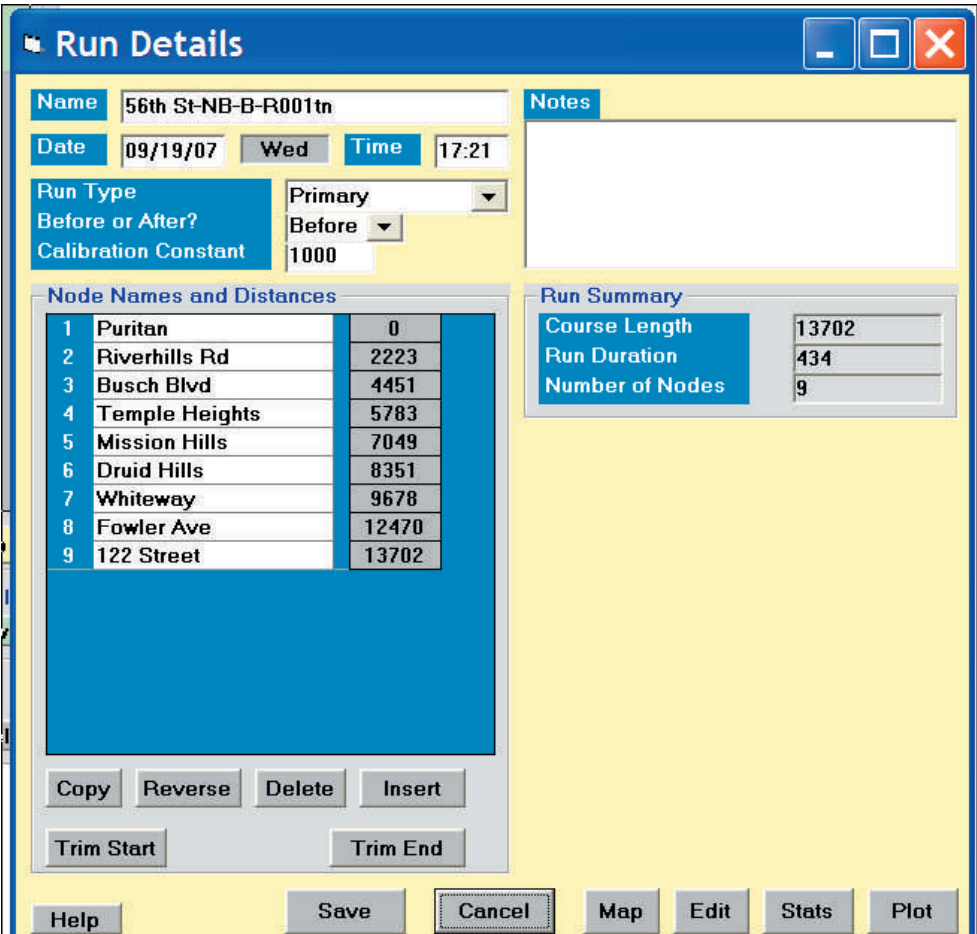
Figure T2.15 - Edit Node Names

Now let's go back to the **Map Screen** to finish up the tutorial on the mapping features.

Map Multiple Runs

It often is useful to map some or all of the runs in a study to make sure they look ok. Generally you wouldn't edit the runs in this mode, but you could if you wished.

The sample files installed with the software include a study with four runs. We will open this study and then map the four runs in it. Follow the steps carefully:

      1- Run PC-Travel and select **Open an Existing Study** from the **Startup Options** screen.
      2- Select the study *56th St-NB-PM* which is in the *Samples* folder.
      3- Click on the **Map** button. This brings up the **Map Screen** with the four runs listed at the top.
      4- Check the **Show** checkbox for each run at the top of the screen.
      5- Uncheck the **Color Code Speeds** option.
      6- Set the **Offset Icons Factor** to 2.
      7- Click the **Update Map** button.

The software maps the four runs. You should see a screen similar to the one shown in Figure T2.16.
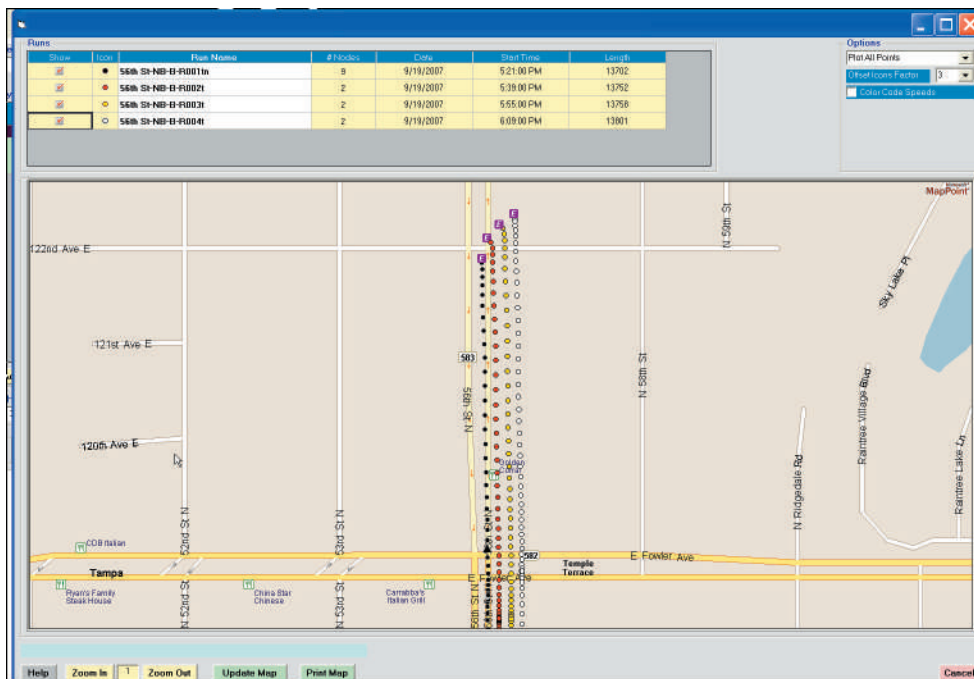
Figure T2.16 Map of Four Runs

Each run is a separate color as shown in the **Icon** column at the top of the screen. The icons are offset from each other on the map so it is easy to see the separate points for each run. The exact positioning is off, of course, but you get a good sense what each run looks like.

Note that each run ends at or near 122nd Ave; each run was trimmed in the same manner as shown in this tutorial. You can also see the one node marked on the first run at the intersection of E Fowler Ave. near the bottom of the screen.

You can click on any point and see the **Point Stats** for that point at the top of the screen.

Since we just wanted to look at the runs and not change anything, just click on the **Cancel** button to return to the **Main Screen** of PC-Travel.

Tutorial 3 - How to Create a New Study

This tutorial shows you how to create a new study from runs you have previously collected and stored on your computer.

In this case, we will create a study using three Before runs from the sample data that is installed with PC-Travel.

Run PC-Travel. You will see the Startup Options.

Click on the button labeled **Start a New Travel Time Study**.

*Note: If you are already in the program, you can select **File: New** from the main menu, or click on the first toolbar, labeled **NEW,** at the top of the screen.*

You will see the screen shown in the figure below. This is a blank Study Details screen. At the bottom of the screen are the default values for the Speed Categories, Normal Speed, and Stop Speed. Everything else is blank.
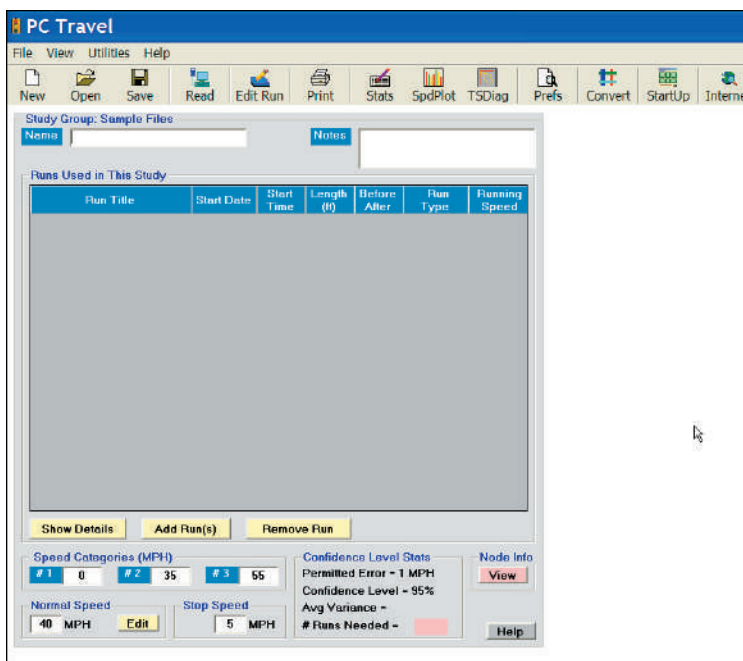
Figure T3.1 — New Study

Click on the **Add Run(s)** button in the center of the screen. This will bring up the *Select Runs* screen, which is similar to the screen shown in the Figure T3.2. The left side of the screen shows the familiar tree of folders, with the Study Groups folder highlighted *(or whatever you have set as the Study Group Root Folder in the Preferences).*
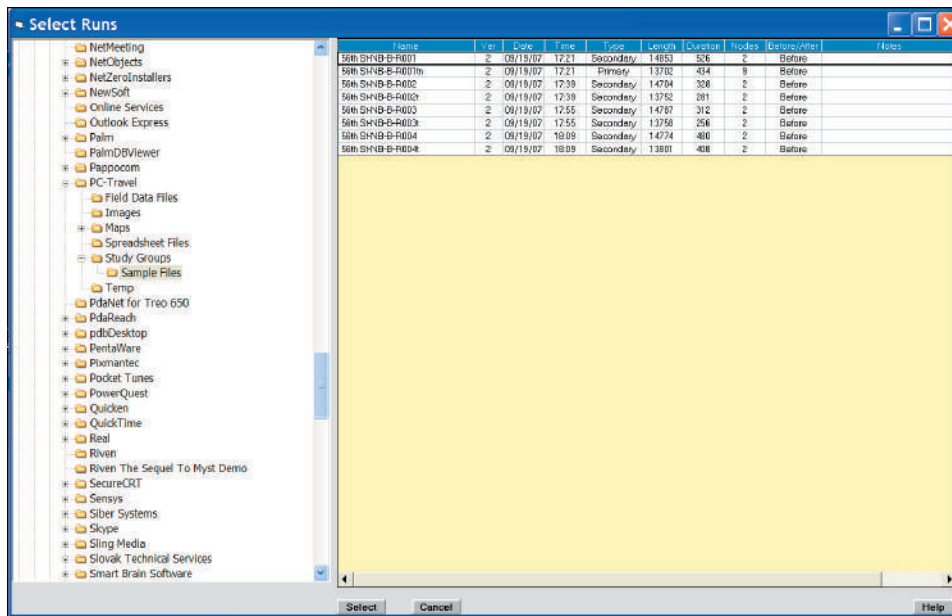
Figure T3.2 — Select Runs

Click on the study group named **Sample Files** in the tree, which is where the runs we want are located. The window to the right shows the runs that are in that study group. These runs were installed with PC-Travel and are used in various tutorials.

Select the same runs that are shown on this screen shot. The runs you select are highlighted as you click them. Your screen should now look like Figure T3.3.
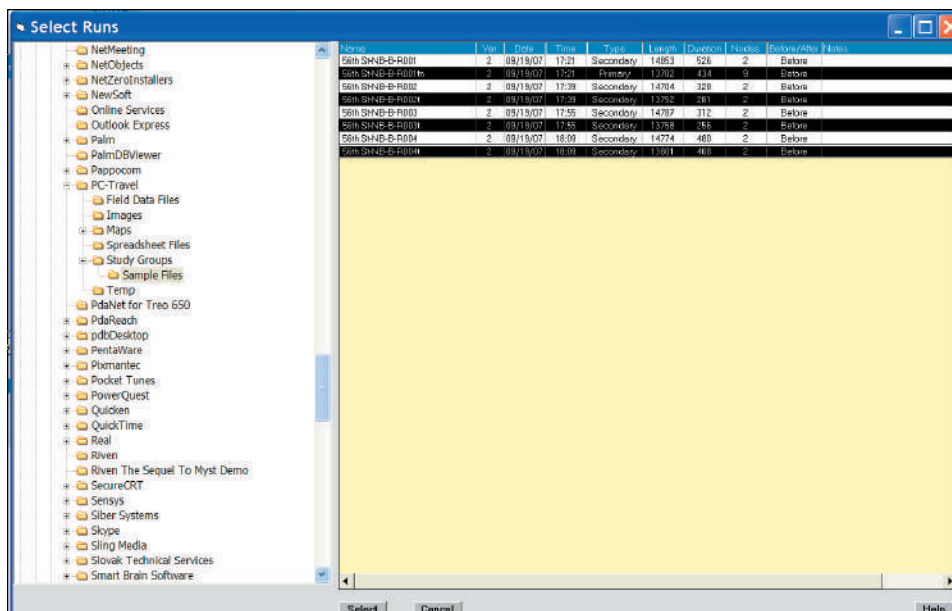
Figure T3.3 — Selected Runs

These are all of the runs we want for this particular study, so click on the **Select** button. The **Select Runs** screen disappears, and the **Study Summary** screen now shows the three runs we just selected.

Your screen should look like Figure T3.4.
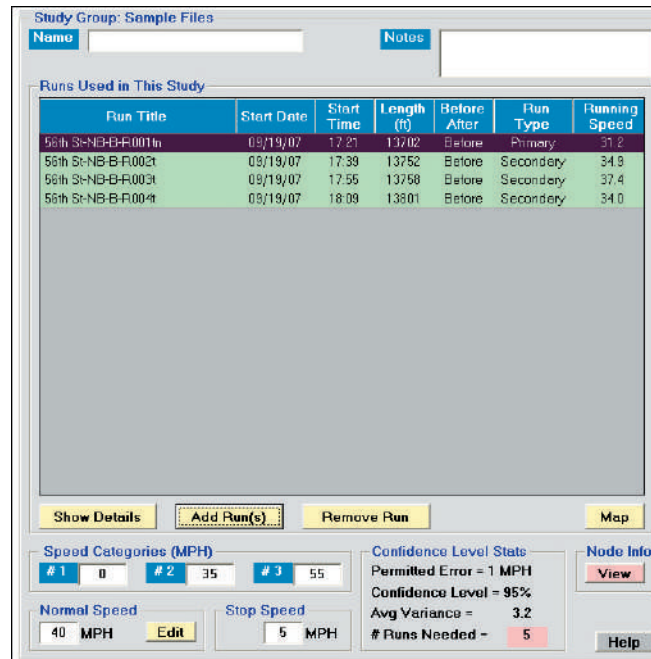
Figure T3.4 — Runs Added

The top of the screen, right above the Name label and text box, shows the Study Group as Sample Files, which is where the runs are located. The study will always be stored in the same study group as the runs.

You can view the *Run Details* of each or any of the runs by highlighting the run and clicking on the **Run Details** button. If these runs came from data just read in from field data, then you would need to edit each of the runs and give them new names, check the node names and distances, etc. *(See Note below)*.

Notice that the **View** button in the lower right corner is red. This indicates that you should check the study node distances to make sure the current distances are OK.

Click on the **View** button now. Since there is only one Primary run in this study, there is only one column of run distance data. This is typical for data collected with GPS receivers (see Chapter 2: Collecting Data With GPS Travel

Figure T3.5 — Run Distances

Time Software). Notice that all of the distances have green backgrounds. That means that for each node, all of the run distances for that node are close to the same distance. In this case, you don't need to do anything with these distances. The distances in the Current column are fine as well. Click the **OK** button to go back to the *Study Details* screen. If these runs came from data just read from field data, then there is a good chance that some of the node distances would be incorrect and you would need to edit the distances.

Note: See page 1.15 for a brief overview of how you can edit the runs on the Run Details screen and then how you can manipulate the node distances on this screen. This screen is more important if you collect data with a TDC board or OBD Interface since you can't edit the nodes on a map like you can with GPS data.

The last few things you need to do are to add any notes, give the study a name, and then save it.

Figure T3.6 — Notes

Type any notes in the **Notes** window. Remember that whatever you type will be saved with the study and printed at the bottom of the Study Summary report. Ask yourself, "What would I want to remember about this study in 6 months that isn't obvious from the data?".

The study is just about ready to save. Check everything on the Study Summary screen. Make sure the **Speed Categories, Normal Speed**, and **Stop Speed** are what you want for this study. You can change any of these parameters simply by editing the text boxes.
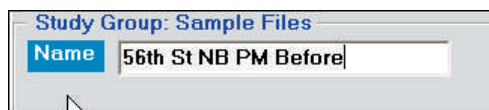
Figure T3.7 — Name Closeup

Finally, click in the far left corner of the **Name** text box at the top of the screen, and type in the name you want to give to this study. Make the name as descriptive as necessary so that you can tell what the study is about from the name alone. In this case, the name is simply the main road, 56th St., they are Northbound runs (NB), and these are the Before runs. The name will often, but not always, be an elaboration of the names of the runs in the study.
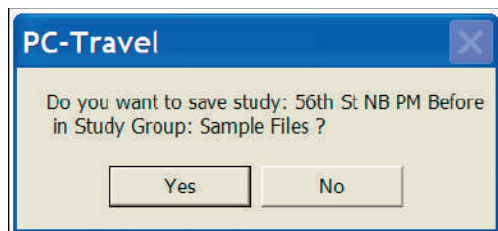
Figure T3.8 — Save Confirmation

When you have entered the name in the text box, click on the **Save** icon on the toolbar, or select **File:Save Study Now** from the main menu.

A confirmation window pops up asking if you want to save this study. It shows the name of the study and the study group. Click on **Yes** to save the study. If you realize the name or the study group is wrong then click on **No**.

The study is now saved on your computer in the study group shown at the top of the screen. You can now view the data or print reports.

—

Tutorial 4 - How to Edit Nodes in Individual Runs

Travel-time studies would be pretty simple to do and analyze if it weren't for the nodes; you could simply time how long it took you to drive from the start to the end of the route and that would be your travel time. But that doesn't give you enough information. You need to know the statistics on a node to node basis. That is how you find the intersections that are causing the biggest delays. But dealing with the node information is annoying at best. Not only do you have to be very diligent when you collect the data so that you press the New Link button accurately at each node, but you also have to type in the names of all of the nodes into the software so that the reports will make sense. This tutorial shows you how to use some of the advanced features in PC-Travel to edit the node distance names and distances in your runs, to make it as easy as possible.

Note: If you collect data with GPS receivers and have enabled the map features in PC-Travel, then you don't need to edit nodes with these techniques; you can edit the nodes directly on the map. You still need to enter the Node Names on this screen however.
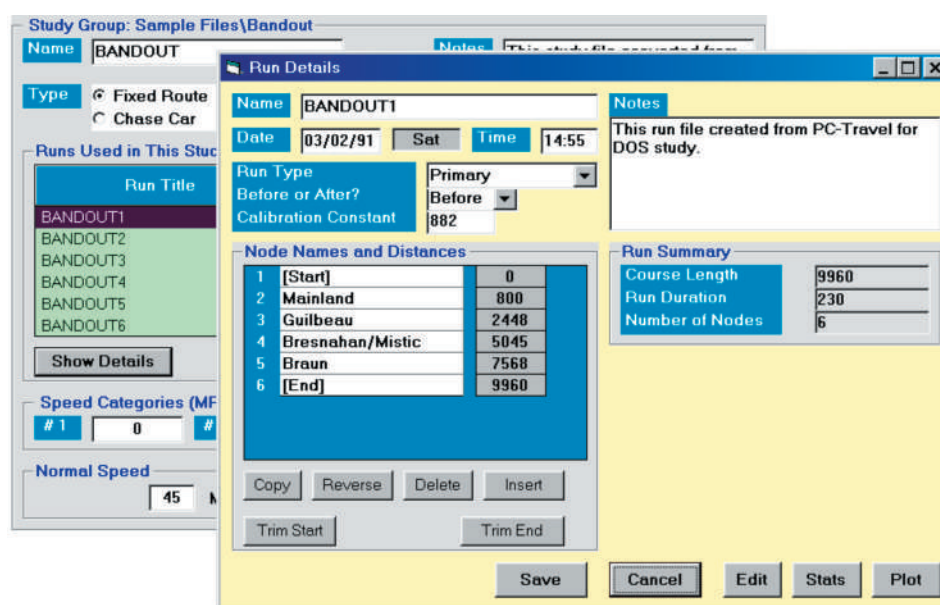
Figure T4.1 — Run Details

This is the *Run Details* screen. It shows just about everything we know about a particular run, including the node names and distances if this run is a Primary run *(remember, a Primary run is a run where you collected node distance information in the field and want to use it to find the node distances for the study)*. Most of this screen has been discussed before, in Chapter 1**.**

This tutorial will deal with the information shown in the lower left part of the screen, the window labeled **Node Names and Distances**. This is where you enter the names of the nodes, either by typing in the names *(but just once)* or copying the names from other runs *(the preferred method)*. You also can insert and delete nodes in the data, and trim the start or end of the run to make the nodes line up. These options will be explained in detail in a little while.

For this tutorial, just read the text. It isn't necessary to follow along on your computer. These operations permanently alter the runs, and that might confuse you if you then try to use the same runs in another tutorial.

—

In order for a study to analyze correctly, all of the runs in the study must start in the same place, end at the same place, and go in the same direction. This sounds simple, and usually is, but occasionally a mistake is made during a run and a node is missed, or an extra node is added, or the run is started at the wrong place. You could just ignore this run, but as you'll see, you may also be able to fix it.

The **Node Names and Distances** window in figure T4.2 has two sections:

The top shows the node names and distances. The Node Names section have a white background, which means you can edit the names simply by typing over the existing names. The distances have a gray background. Those values are calculated from the field data, and can't simply be edited by typing over them *(although, as you'll see, there is a way to edit them).*

The bottom section has six buttons. This tutorial basically will explain how to use these six buttons.

There are three situations we will examine, and each requires the use of one or more of these buttons:

Situation 1: Normal scenario where you enter the node names for runs you just processed from field data.
Situation 2: Your run has a missing or extra node and you want to fix it.
Situation 3: All of the runs were started and/or ended at different places *(which is OK).*

Situation 1: Normal scenario where you enter the node names for runs you just downloaded

There really are two parts to this situation. The first is processing the first run, where you have to type in the node names for the first *(and last)* time. The second is for other runs on the same route *(even those going in the opposite direction)*. We'll call these two parts 1a and 1b, respectively.

1a – First Run
The normal sequence with PC-Travel is the following:
• You do a study in the field.
• You process your field data and create two study groups, each containing runs for one direction.
• You create a new study and add the runs from one direction.
• You enter the Run Details information for each run and re-save the run.

Figure T4.2 — Nodes Without Names

It is during this last item that you enter the node names. Figure T4.2 shows what the screen looks like before you type in the node names. The distances are already there because they come directly from the data. Since this is the first run you are processing for this route, you need to type the names of the nodes. The first line, with a distance of 0 is where you started the run. The last line, with a distance of 9960, is where you ended the run. This is all standard and easy to do. Just click in the text box where you want to edit the name, and type in the name or edit the existing name.

Figure T4.3— Nodes With Names

You will end up with something similar to Figure T4.3. Once all of the names are entered, and you have edited the other information on the **Run Details** screen, click on **OK** to save the run information. You now have one run with all of the node names entered; you won't have to type the names in again.

1b – Subsequent Runs
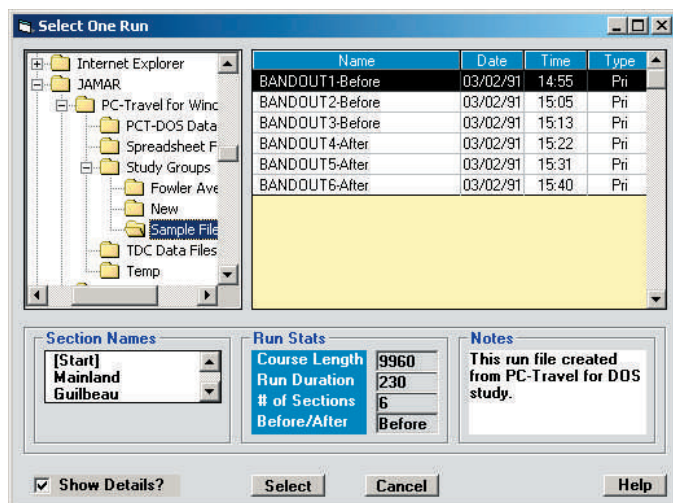
Figure T4.4 — Copy Node Names

Once you have typed in the node names once for a given route, you don't want to have to do it again, and you don't. You can copy the names from an existing run that has the same node names you want. Assume you are looking at the **Run Details** screen of a different run from the same study. Instead of typing in the node names, press the **Copy** button. A screen similar to the one shown here is displayed. It shows the list of runs in your study in the upper right hand corner window. The first run is highlighted, and if there are any node names assigned to that run, then they are shown in the lower left window. You want to highlight the run that has the node names you want then click on **Select**. You will then pop back to the *Run Details* screen with the node names copied to the appropriate fields. Then you can save the run.

You can follow a similar sequence when you create the second study with the runs going in the opposite direction, with a couple of minor additions. The first run of this new study will not have any node names yet. Instead of typing them in like you did the first time, you can copy the node names from a run from the first study group. You may need to navigate to another study group to find the run you want before you select the run. Once you are back in the Run Details screen, you will have the node names on the screen but they will be in the wrong order. Click on the **Reverse** button to flip the names from top to bottom. Save the run, and then you can follow the sequence in 1b described above for the rest of the runs in that study using this first run as the source for the node names.

Using the procedures described in 1a and 1b above, you can add node names to all of your runs, and you just have to type in the names once for each route.

Situation 2: Your run has a missing or extra node and you want to fix it

Sometimes, however, you may find that there are problems following the procedures outlined above because one or more of the runs don't have the proper number of nodes. It is easy to miss a node while collecting the data; you are busy driving and you may not record the node properly so the node isn't entered. Or you may accidentally record a node when you shouldn't, which adds a node that doesn't belong there.

You have three options when you discover a run has the wrong number of nodes:
1 – Make the run a Secondary run, which effectively ignores the node information in the run.
2 – Adjust the run node distances on the Node Distances screen before finding the averages.
3 – Fix the node information in the run.

The first choice is actually the easiest and usually the best solution. *The node distance information in any one run is only used to help find the average node distances for the study (which is done in the Node Distances screen accessed from the Study Summary).* All statistics found in the software use the study node distances. So, if you have a study with several runs, and one of the runs has bad node information, then the simplest solution is to change the run type to Secondary *(on the Run Details screen, see Fig T4.1)*. This tells the software to skip that run when it shows the node distances in the Node Distance screen, and the bad node information will not affect your data in any way.

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The second choice works if you are missing one or two nodes in a run. With this option, you use the tools available in the **Node Distances** screen to adjust the node distances shown for the runs so that the nodes in the bad run line up with the equivalent nodes in other runs. This is explained in detail in **Tutorial 4 - How to Find Node Distances in Your Study**. This is also a perfectly good option.

The third choice is for when it isn't practical to use the first two choices. If your study only has 2 or 3 runs, then skipping one or two of them would make the averages of the node distances less accurate than you might like. If your run has extra nodes, then it isn't easy to use option 2. Or, you may just decide that you want the runs to be as accurate as possible. For these cases, you can almost always fix the bad runs so that the node information is accurate.

How to Delete A Node

Figure T4.6 — Delete a Node

Assume that in one of your runs you accidentally hit the New Link button, which added an extra node to the data. When you go to the Run Details screen you see that instead of the expected six nodes, there is a seventh. A little comparison to the other runs makes it clear that the problem is the third node, at 1004 feet. That node shouldn't be there. There aren't any node names yet, since you want to have the proper number of nodes before you copy the names from another run.

Click on the text box in the third node line. Then click on the **Delete** button. The third line *(along with the distance)* disappears and there now are six nodes, which is correct. You can now copy the names from another run and proceed as normal. The software edited the data point that had the node information at 1004 feet and removed the node marker. When you save the run, you make the change permanent.

How to Insert a Node

Figure T4.7 — Insert a Node

Assume that in one of your runs you missed a node. When you go to the Run Details screen you see that instead of the expected six nodes, there are only five. A little comparison to the other runs makes it clear that the problem is that the third node is missing; the other runs have a node around 2040 feet and this run doesn't. We can fix that.

Click on the text box on the third node line, then click on the **Insert** button. A new line, along with a blank distance, is inserted in the third node position.

We know the missing node is about 2040 feet from the start. Click on the blank white text box in the distance column and enter 2040.

You now have the proper number of nodes for this run, so you can copy the node names from another run and proceed as normal. When you save the run, you make the change permanent.

If you immediately go back to the Run Details screen you may see something that seems odd. The distance that you typed in, 2040, has changed to 2051. This is normal. In fact it is unavoidable.

Figure T4.8 — Add Node Distance

Node Names and Distances

1	[Start]	0
2	Mainland	800
3	Guilbeau	2051
4	Bresnahan/Mistic	5045
5	Braun	7568
6	[End]	9960

Figure T4.9 — Node Added

Remember that node markers are embedded in the pulse data, and that the pulse data is stored every second. The software can only find distances on a second by second basis. When you inserted a node and typed in the distance, the software searched for the data point that contained the distance you entered. It then added a node marker to that data point. Later, when the software scanned the pulse data to find the node distances, it found the new marker, but used the only distance it knew, the distance traveled up to that point, as the node distance. This probably doesn't exactly match what you entered. But it is as close as the system allows, and normally is more than accurate enough. *(For a more complete discussion of how distances are measured, see Appendix 6).*

Situation 3:
All of the runs were started and/or ended at different places (which is OK)

The first two situations discussed dealt with handling mistakes that were made while collecting travel time data, specifically missing nodes or adding nodes. The third situation deals with editing runs that are done using a data collection procedure that is fairly common, but could cause problems if not handled properly.

One of the primary requirements for a successful travel time study is that all of the runs must start at the same place. All distances in PC-Travel are calculated from the start of the run. If the starting point of each of the runs in a study varies, then the study statistics won't make any sense.

Most users set up their route and add a node *(usually an intersection)* before and after the main route. They start each run at the start node and end each run at the last node. Since each run starts at the same place, everything is fine.

To start the run at the first node, you really have to be driving at the proper speed some distance in advance of the first node when you start the run. For convenience, some users like to start the run without the requirement that the driver record the node exactly at the right place. The idea is that the driver starts the run anywhere in advance of the first node of interest, then accurately marks the nodes. He then ends the run anywhere after the final node of interest.

If you start a series of runs at different places, but always have the first link at the same place, then essentially you want the software to ignore the data from the start of the run to the first node. Instead of ignoring it, we let you delete it. This is where the **Trim Start** and **Trim End** buttons are used.

Figure T4.10 — Trimming Runs

Figure T4.11 — Trimmed Runs

How to Trim Runs
Assume you have collected data as discussed above, so that the first node distance varies from run to run in this study. Also, the last node distance isn't important either because it varies from run to run. This is shown in the first screen shown here.

Click on **Trim Start**. The first node line is erased and the distances adjusted so that the first node starts at zero. The software deletes all of the data points from the start of the run up to the data point with the first node marker.

Click on **Trim End**. The last node is erased. The software deletes all of the data points from the end of the run back to the data point with the last node marker.

You need to do this for each of the runs in the study. All of the runs now start and end at the same place.

Tutorial 5 - How to Find Node Distances in Your Study
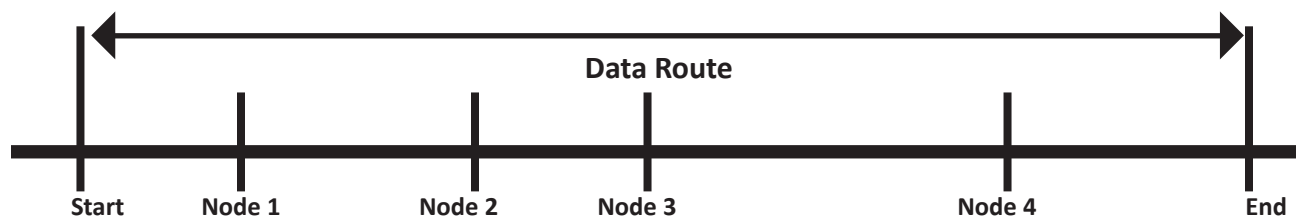
Figure T5.1 - Typical Route with Nodes

Nodes are an important concept in PC-Travel. Every study, like the runs that it is made from, starts at one well-defined point and ends at another, and usually has nodes in between *(see Figure 3.25)*. These nodes are usually cross streets, but can be anything that is easy to see while you are driving.

The program needs to know the names of each of the nodes and the distance that each node is from the starting point. Various statistics are calculated, displayed, and printed in the reports not just on the entire route, but on a node to node basis as well.

Note: If you collect data with GPS receivers and have enabled the map features in PC-Travel, then you don't need to edit nodes with these techniques; you can edit the nodes directly on the map.

Since node names and distances are so central to the operation of the software, it is important that you understand how you find the most accurate distances for your studies *(the names don't cause much confusion)*. That is the purpose of this tutorial. You will learn how to find the best possible node distances for your study. Before you get to the software, however, you need to understand some of the concepts involved.

There are basically two methods you can use to find the node distances:

> 1 – Collect node distance information while you do the travel time runs as you pass each node point during a run.

> 2 – Measure the node distances accurately in some way independent of the travel time data collection, and then manually input the distances into the software.

Since the first option is by far the most common method used, it will be discussed first.

Use Node Data From Runs

You may ask, "What's the problem? I drive the route and record each node. The software should be able to calculate the node distances from the run data." Basically, this is true. But there are two problems. One is the fact that the node distances found from the field data are not very accurate. *Appendix 6 — How Distances are Measured* explains this in detail. The second is that the nodes are recorded by people, who don't always record nodes at the proper place *(and sometimes forget to record them at all)*. The result is that the node distances for any one run are often inaccurate.

Since a typical travel time study requires multiple runs, you have multiple opportunities to measure the same node distances. Assume you did five runs in a row. You recorded nodes during each run. There is some error in each node distance caused by the inherent error in the way the distances are stored in the field data, plus the error associated with you trying to push the button at exactly the same place each run. Each node distance may have some error inherent in the measurement, but the *average* of the five node distances is probably pretty accurate, or at least more accurate than any one run you might pick.

The idea of averaging the node distances from all of the runs is the basis for the **Node Distances** screen used in PC-Travel. The more runs there are that have node distance information, the more accurate the averages will be. This leads to two of the fundamental rules for collecting good travel data:

1 – Record nodes on every run you do. This is fairly easy to do. You are out there anyway, so you might as well collect the node information for each run.

2 – It is better to not record a node at, then to record it several seconds late. Sometimes it is impossible to record the node just when you want to, especially if you are doing the study by yourself; the traffic may keep you busy as you pass the node. Just skip the one node. You'll probably have several measurements for that node by the end of the day. However, if you know you mis-timed a node, make a note on your field sheet at the end of the run so that you can deal with it later back in the office.

When you read and process the field data, you create runs from the data and store them in a Study Group. You edit the parameters of each run in the Run Details screen *(See page 1.15)*. If you designate the run as a Primary run *(which means that you collected node information in the field and you want the software to use it)* then the run has node names and distances for you to enter or edit. The names are entered manually or copied from other runs. The distances are found from the pulse data collected in the field. Occasionally you need to fix bad node information in the run. **Tutorial 3 — How to Edit Nodes in Individual Runs** explains how to do this. When you save the run details, the node information is ready to be used in a study.

Once the runs are created and edited as needed, you create a study using some or all of those runs. Before the software can find the statistics for the study, which include statistics on a node-to-node basis, it has to find the node distances that will be used in that study. That is done, with your help, on the **Node Distances** screen.

First, you need to run the software and open a study so you have data to use.

1 – Run PC-Travel and from the **Startup Options** screen, select **Open Existing Study**.
2 – If necessary, navigate to the **Sample Files** study group.
3 – Click on **Bandout-Mixed Runs** from the list and then click on **Select**. You'll see the **Study Details** screen as shown below in Figure T5.2.

Figure T5.2 — Study Summary Screen

4 – Click on the **View** button in the **Node Distances** window. This will bring up the Node Distances screen.

Figure T4.3 — Node Distances Screen

The **Node Distances** screen shown above shows the **Names** of the nodes and the **Current** distances assigned to each node for this study on the left side of the screen. ***Ultimately, the only thing that matters is that the Current column has the best possible distances.*** The names and distances default to the values of the first Primary run. The distances are often close enough to use. However, these rarely are the *best possible* distances. There are several ways to get these better distances.

The right hand side of the Node Distance screen shows the node distances for each of the Primary runs in the study. The **Avg** column is the average of all of the run distances in that row. In this case, there are six runs *(only five are visible without scrolling)*.

Notice that most of the numbers have a green background, and two have red backgrounds. Each number should be close in value to the other numbers in the same row, since they represent the attempt of the data collector to mark the same node. The software compares each distance to the value in the Avg column. If the two distances are close *(within 500 feet by default, but you can change this in the Preferences screen, see Appendix 5)* then it shows a green background. If it isn't close, then it shows a red background.

Look at the two red values in Run 5. It is pretty clear what happened here. The data collector missed the node at Bresnahan/Mistic. This makes the other two distances below that node out of place. The 7408 that is now in the Bresnahan/Mistic space should be in the Braun row, and the 9917 should be in the [End] row.

> *Note: When this run was first created, the missing node could have been inserted in the Run Details screen; then this screen would have all green entries. Alternatively, you could go back to the Run Details screen for run 5 and set the type to Secondary. Then the run wouldn't show up on this screen at all. You usually have several different options available to you to deal with bad or missing nodes. The best option is the one that gives the software the most node distance data points to average, since that will give the most accurate results. Therefore, as the best option we always recommend fixing the runs by inserting or deleting nodes as needed. As the next best option, adjust the node distances on this screen as shown in this tutorial. Finally, if all else fails, make the run a Secondary run. This is the least desirable since it eliminates all of the node distances for that run from the averaging operation, not just the one or two bad ones.*

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Assume that you don't want to fix the run, but you want the distances that are out of place to be put where they belong. You can do this easily. Just follow along:

Avg	Run 1	Run 2	Run 3	Run 4	Run 5
0	0	0	0	0	0
766	800	771	744	752	736
2354	2051	2420	2409	2453	2392
5463	5045	5077	5049	5086	7488
7928	7568	7505	7543	7522	9917
9934	9960	9972	9949	9885	

1 – Click on the number 9917. A solid border appears around the cell.

2 – Point the cursor at the bottom of the cell, right on the line. The cursor will change from a cross to an arrow.

Avg	Run 1	Run 2	Run 3	Run 4	Run 5
0	0	0	0	0	0
766	800	771	744	752	736
2354	2051	2420	2409	2453	2392
5463	5045	5077	5049	5086	7488
7928	7568	7505	7543	7522	
9934	9960	9972	9949	9885	9917

3 – Press and hold the left mouse button and drag the cell down one cell and let go of the mouse button.

4 – The 9917 cell is now one row lower.

5 – Repeat steps 1-4 with the number 7488.

Avg	Run 1	Run 2	Run 3	Run 4	Run 5
0	0	0	0	0	0
766	800	771	744	752	736
2354	2051	2420	2409	2453	2392
5059	5045	5077	5049	5086	
7523	7568	7505	7543	7522	7488
9931	9960	9972	9949	9885	9917

Figure T4.4 —
Select and Move Node Distances

We now have the distances in the proper rows. There is a blank entry, but that is OK. The software will ignore it.

Click on **Recalc Avg**. The values in the **Avg** column change, and now all of the numbers have a green background.

Click on the **Copy Avg to Current** button. The values in the **Current** column now match the **Avg** column. These values are now the best we can get from our data, and are probably more accurate than just choosing the distances in any one run.

When you are happy with the values in the **Current** column, click **OK**. If you get the distances all messed up, just hit **Cancel** to go back to the *Study Summary* screen without making any changes.

The new distance values in the **Current** column are not a permanent part of the study yet. If you want to save the new values with the study, then click on the **Save** icon in the *Study Summary* screen. The new distances, plus any other changes to the study you have made, are saved.

This whole procedure may seem a little cumbersome, but if you don't want to fiddle with the node distances you usually don't have to. If you prepare the runs properly you will see only green values when you first see this screen. If there are some red values, you still have several options. You can go back and fix the runs that are causing the problems, which is probably the best option. You can make one or more of the runs Secondary runs so that they don't show up on this screen. Or you can use the procedure described here to move the distances around so that the distances are in the correct rows.

You can't solve all bad node problems by moving node distances around. If you have a run with an extra node, then you really need to fix it by deleting the node in the *Run Details* screen. Also, if there are the proper number of nodes, but the distance is way off because the driver hit the button very late, then you also need to fix that in the *Run Details* screen. However, the most common problem is a missing node, which is easy to adjust for on this screen.

Please realize that you are not permanently altering the node data in the runs in any way. All you are doing is temporarily moving the node distances to different rows *on this screen* so that you can find the best possible average distance for that node. The only way to permanently fix node problems is in the *Run Details* screen.

Tutorial 6 - How to Edit Sensor Data
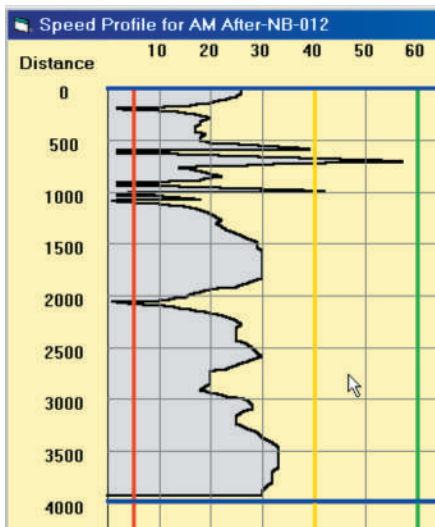
**Figure T6.1
Problem Sensor Data**

There may be times when your data needs editing. Usually there is an apparent problem with one of the graphs. Instead of the nice smooth variations in speeds that you normally see, you see uneven jumps, as shown in Figure T6.1 of a Speed Profile for a run *(which you can see by clicking on the **PLOT** button on the **Run Details** screen)*. This is real data sent to us by a user. It is pretty clear that something weird is happening in the 500-1000 foot range. The rest of the graph looks fairly typical. There is a normal looking slow to a stop, probably at a stop light, at the 2000 foot mark. The rest of the graph looks OK. Still, that funny looking data is likely to cause the statistics to be off.

This tutorial will show you how you can edit the sensor data in your runs to eliminate some problems you might find. This is a read-along tutorial, you don't have to follow-along on your computer.

Note: This tutorial only applies to data collected with a Jamar TDC board; if you use GPS receivers or OBD Interfaces then you don't need this tutorial.

Let's take a closer look at the sensor data that makes up this run.

In the **Run Details** screen, click on the **EDIT** button.
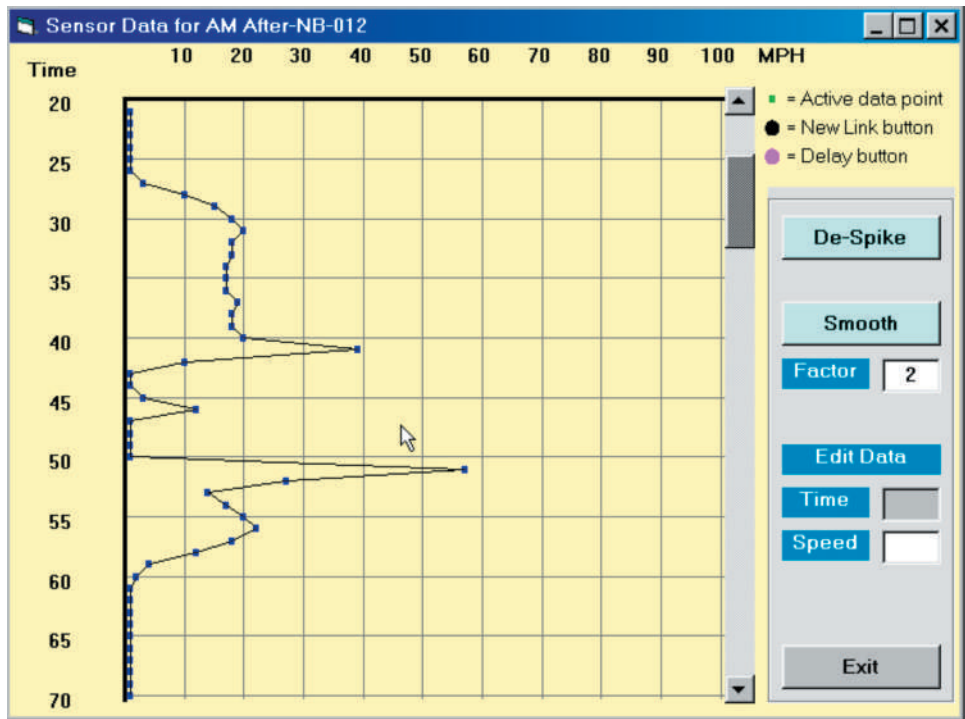
Figure T6.2 — Edit Sensor Screen

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Figure T6.2 is the Edit Sensor screen. The graph is a Speed vs Time plot of the sensor data collected in the field during one run. Each data point is one second of data. You can scroll through the data using the scroll bar. The graph shows 50 seconds of data at a time.

Here you can see that there is a sharp spike at 41 seconds, a small spike at 46 seconds, another large spike at 51 seconds, and another small spike at 56 seconds. The rest of the data on this screen looks OK.
We know that cars can't go from 20 MPH to 40 MPH in one second, so there clearly is a problem here**.** The first impulse might be to distrust all of the data and go back and re-do the data collection. You don't necessarily have to do this, however. You might be able to edit the data so that it is usable.

> *Note: When you modify the data using the options on this screen you are modifying a copy of the data stored in the run. To make the changes permanent you must click on the SAVE button on the Run Details screen, which is where you go when you exit this screen. You also might add a note to the run before you save it to explain that the data was edited.*

The Edit Sensor screen gives you three ways to modify the data:
1 – De-Spike
2 – Smooth
3 – Edit individual data points.

De-Spike Data
The De-Spike option is very simple. When you click on the **De-Spike** button, the software scans through the data looking for patterns that look like spikes.

A *spike* is defined as a 3 consecutive data points, S1, S2, & S3, that have one or more of the following charac-teristics:
1 – S2 - S1 > 20 *(MPH)*
2 – S2 - S1 > 10 AND S3 - S2 > 10 *(MPH)*
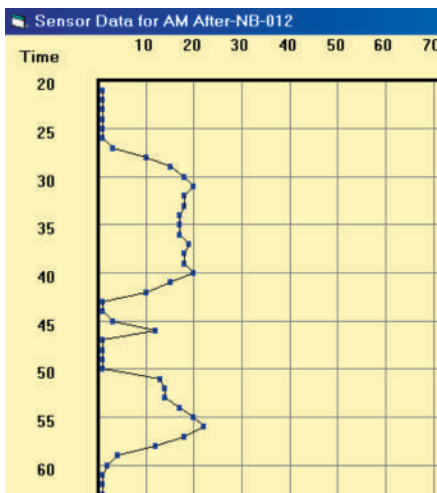
Figure T6.3 — De-Spiked Data

The software scans through the data. When it finds a spike, it replaces the middle data point *(S2)* with the average of the other two points. The software then continues on until all of the data has been scanned. The graph is then updated to show any changes.

Figure T6.3 shows how the data in Figure 3.30 looks after it has been De-Spiked. Notice the spikes at 41 seconds and 51 seconds are gone. There still is a little spike at 46 that looks a little odd. This can be taken care of with either of the other two editing options, smoothing, or actual editing of the data points.

Smooth Data

Sometimes the data looks a little *jerky*, instead of nice and smooth like it should. After all, cars make fairly smooth transitions from one speed to another, the large mass of the car makes it difficult to do anything else. If you smooth out the data a bit, it will more closely represent what the car was actually doing on the road.
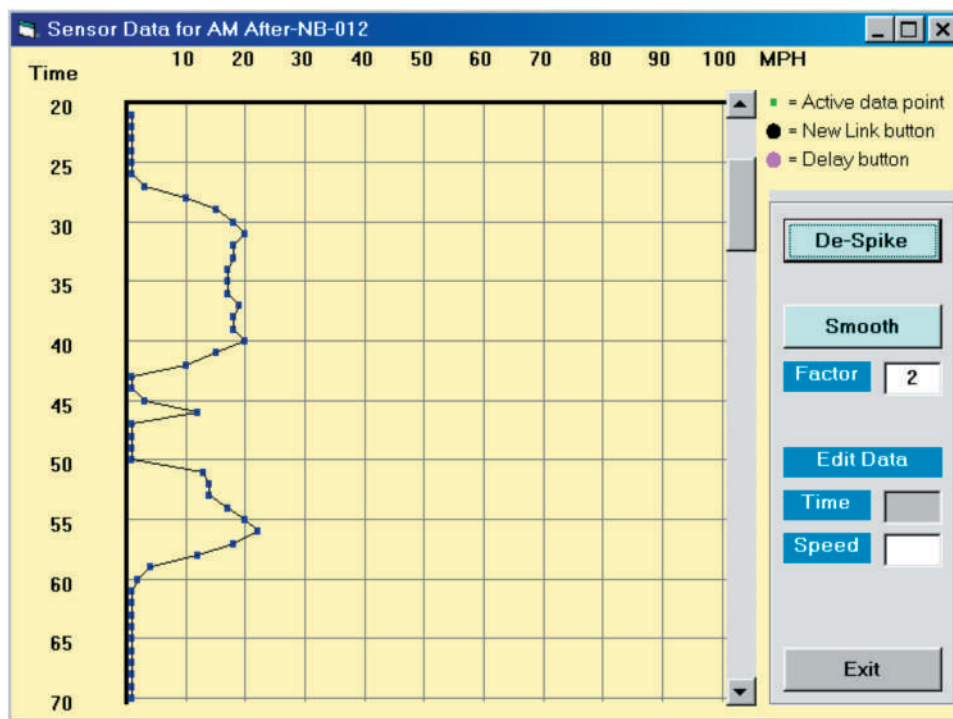
Figure T6.4 — Sensor Data Before Smoothing

Smoothing Factor

Notice that below the **Smooth** button is a text box labeled ***Factor***. This setting tells the software how much smoothing should be done. The lower the setting, the greater the smoothing effect. The default is 2, which seems to work reasonably well, but you can change it as you see fit. Values above 5 don't do much at all. A value of zero will smooth every point. The factor essentially tells the software how much of a difference there must be between consecutive data points before a point should be smoothed.

When you click the **Smooth** button, the software scans through the data and finds the difference in speed between consecutive data points. If it is greater than the Smoothing Factor, then that point is set to the average of the two points around it. The software then continues through the data until all of the data has been scanned. The graph is then updated to show the new data values.
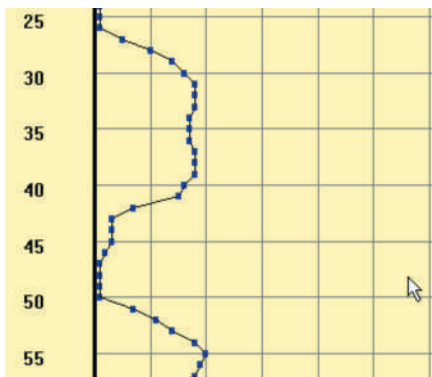
Figure T6.5 — Smoothed Data

Figure T6.5 shows the result of smoothing the data *once*, with a setting of 2. Notice how much, well, *smoother*, the data looks. That annoying little spike at 46 seconds is also gone now.

You can run the smoothing routine several times. Just click on the Smooth button again. The software will make another pass through the data and smooth points as needed.

You also can change the Smoothing Factor and continue to smooth the data. But be careful, if you do too much smoothing, the speed profile can change significantly. Like many things, a light touch is best.

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Edit Data
If you only have a few data points that don't seem right then you can directly edit those points.

To select the data point to edit:
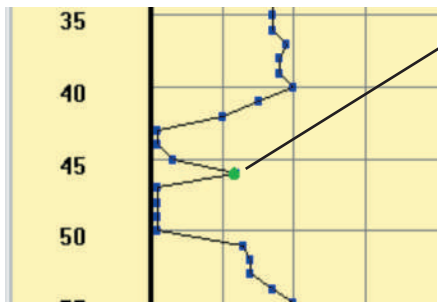
Click on the point you want to edit. The point turns green. Figure 3.34 show a selected point from the same data we used in the other examples. Here, we're going to get rid of that little spike in the data at 46 seconds.

Notice the text box labeled **Speed** now shows the number 12, which is the speed of the point shown in green. The **Time** shows 46. The box is in gray because you can't edit that number directly.

Figure T6.6 — Selected Data Point and Values

To edit the data:
Click on the Speed text box and type in the new speed you want. Press the Enter key when the speed is the value you want. The graph updates to show the data point at the new value.
<div align="center">

Or
</div>
Click on the green point, hold the left mouse button down, and drag the point to the new speed value, then release the mouse button. The Time and Speed boxes now show the new values.
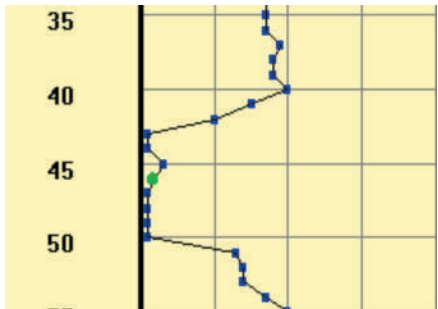
Figure T6.7 shows the graph after editing the data point at 46 seconds from 12 to 2. The graph now looks a little more realistic. The value in the **Speed** text box now shows the new value.

You can use this option to clean up the occasional data point that seems out of place.

Figure T6.7 — Edited Data Point and Values

How Does Data Get Spikes?

You might reasonably ask, "How does data get spikes like these in it?". The answer is it doesn't, unless there is a problem with the sensor, or with the way the sensor is installed.

The transmission sensor picks up signals that are designed to go to the speedometer electronics of your car. The sensor sends those signals *(through wires)* to the sensor electronics where the signal is amplified, conditioned, and passed on to the TDC.

Assuming everything is working properly, if 10 pulses are detected on the speedometer cable, then 10 pulses are delivered to the TDC *(it's not quite that simple, but for the sake of this argument, pretend it is)*. All the TDC knows is that it is supposed to count the number of pulses, so if extra pulses are added to the 10 pulses, it has no way of knowing.

It is a sad fact of electronics life that all wires are small antennas, radiating signals and receiving signals from all of the other wires in the area. It is also a sad fact that a car is a great source of spurious electronic noise that can easily be added to the signals traveling through wires if the wires aren't installed properly.

When you see data like the data in Figure 3.30, you can be almost certain that electrical noise from something in the car is being coupled into the signal going to the TDC. This causes the TDC to count more pulses than it should, which makes the speed for that second too high.

If the sensor is installed properly, according to the directions included with the sensor installation kit, then you won't see problems like this. But it is easy to make little mistakes installing the kits. Make sure all of the connections are well made. If you use terminal blocks, make sure the screws are tight on the terminal block and that the wires are crimped properly to the spade lugs. Sometimes re-routing the wires will reduce the amount of noise coupling into the cables.

How can you avoid noisy sensor problems?

First, make sure you install the sensor kit properly. Follow the directions carefully.

Second, test the sensor before you collect any critical data. A good way to test the sensor is simply to drive around with the TDC connected to the sensor. Set the TDC to Travel Time mode as if you were doing a run. The display shows the current speed, among other things, as shown in the image here. The speed display usually lags a little bit when you speed up or slow down, but it should track the speedometer on the car fairly closely. You shouldn't see wild variations in the speed; this may be an indication of a problem with the sensor.

```
 Travel Time Study
 Run:01      Link:01
 Dist=0843   Speed=27
 07:12:52  L Key = 12
```
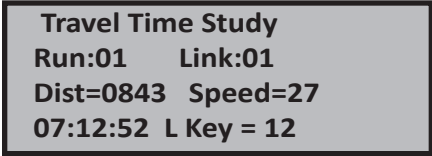
T6.8 TDC Display

Summary

There is a good chance that you will never need to edit your sensor data. Usually the data coming into the TDC is very clean. However, it is nice to know that if you do develop a noisy sensor, or a bad connection, or whatever causes the data to have spikes or jitter, that you have a way to clean up the data so that you can use the data to produce accurate travel time studies. Don't ignore the source of these problems even though you can clean them up in the software. Find the cause of the problem so you won't have to use this option at all.

Tutorial 7 - How to Export Statistics to a Spreadsheet

PC-Travel has extensive report options but some users may want to be able to generate their own reports or use the data calculated by the software in another program. To help these users, the software has an Export to Spreadsheet option, which allows you to export the study and/or run statistics into one of two file formats: a Microsoft Excel spreadsheet file (.xls), or a generic tab delimited text file which can be used with most spreadsheet, database, or custom designed programs. This tutorial will show you how to export a study using a sample study included with the software.
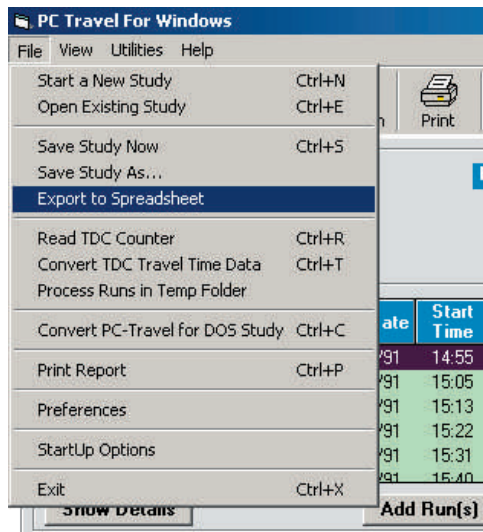
Figure T7.1 — Export Selection

1 – Run PC-Travel and select **Open Existing Study** from the Startup Option screen.

2 – Navigate to the Study Group Sample Files and select the BAND-OUT study.

3 – Select **Export to Spreadsheet** from the **File** menu in the *Study Summary* screen *(see Figure T6.9)*.

You will then see the screen shown in figure T7.2 below.
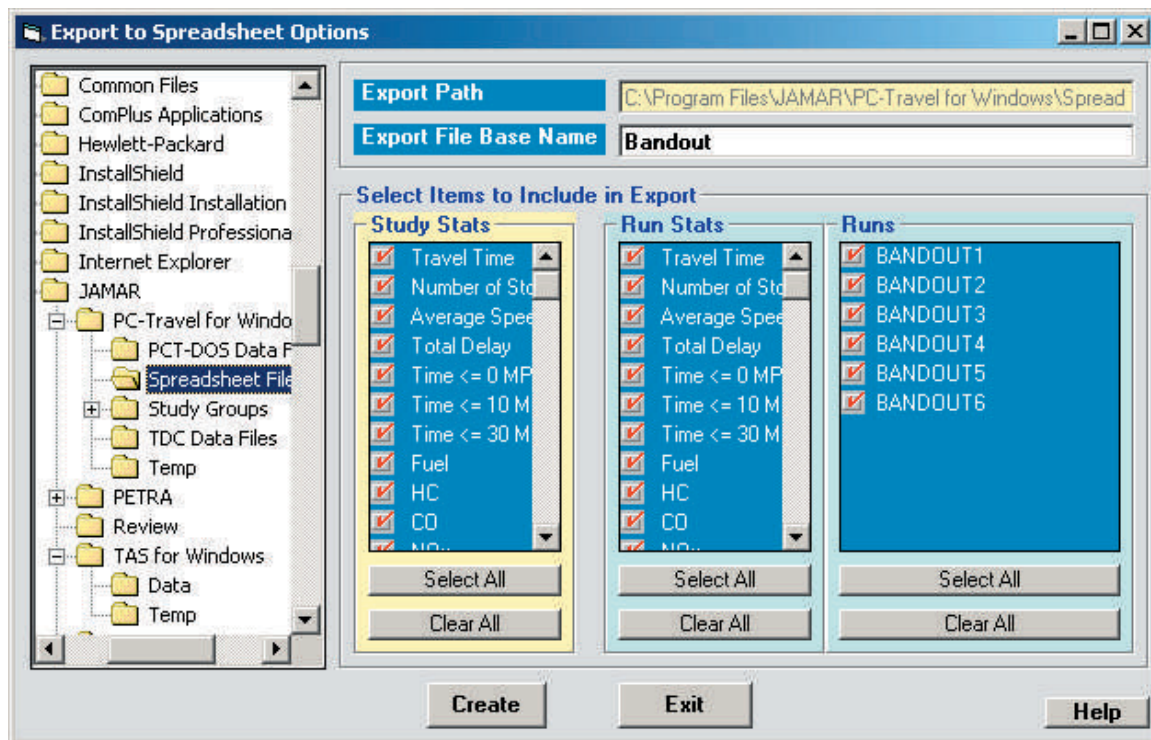
Figure T7.2 — Export to Spreadsheet Options Screen

There are several parts to this screen, and each part will be explained in the next few sections. This screen allows you to choose the destination folder for the spreadsheet files, the base name of the two spreadsheet files you can create, as well as choose which study and run statistics to export. For example, if you aren't interested in the fuel and emissions statistics then you don't have to include them in the exported data.

Export Path

The window on the left side of the screen shows the familiar folder tree which is used in many of the screens in PC-Travel. The current export path folder is highlighted *(the folder icon is shown in an open position)*. This is the folder where the exported spreadsheet files will be stored. The text box window labeled **Export Path** at the top of the screen shows the complete path to this folder. You cannot edit this text window, it simply shows you the path to the folder that is highlighted in the tree.

The default value is the value stored in the Preferences screen. If you change the export path, then the new path will become the default path the next time you run PC-Travel.

You can set the path to point to any folder on your computer. However, the folder you want must already exist; you can't create a new folder on this screen. Simply navigate to the folder you want to use on the tree and then click on the folder. The name in the Export Path text box will change to show the new path.

For this tutorial, just keep reading. Don't change the export path.

Export File Base Name

The Export to Spreadsheet normally creates two separate files, one for the study statistics and one for the run statistics. Each file will have the same base name *(the first part of the file name)*. The study statistics file will be named ***<Base Name>- Study Stats.*** The run statistics file will be named ***<Base Name>- Run Stats.***

The default base name is the name of the study. This is shown in the text box labeled **Export File Base Name** when you first see the screen. You can edit the base name to anything you want if you don't want to use the study name. Just click in the text box and edit the name as desired. However, for this tutorial, we'll accept the default name, so just leave it alone.

Select Items to Include in Export

We tried to give you as much flexibility as possible when exporting study and run stats. To that end you can select only those statistics you want to include with the exported data. You can select which study stats to include, you can select which run stats to include, and you can select which runs from the study to include.

The first two windows show the eleven statistics that are calculated in PC-Travel. The third window shows the list of runs that are in the current study.

Simply click on the statistic or run name to either select it or de-select it.

The **Select All** and **Clear All** buttons let you select *(with a check)* or clear *(no check)* all of the statistics or runs in that window.

If you are following along with the tutorial: the **Export Path** and **Export File Base Name** are set to the default values displayed when you first see this screen. Let's suppose we want all of the statistics included in the exported files. Click on the three **Select All** buttons so that there are checks next to each statistic and run name. Now click **Create**.

Note: The software remembers which statistics you selected and will place checks on those stats the next time you display this screen. If you rarely want to include fuel or emissions stats, for example, you won't have to check or uncheck the stats each time you export data. Since the number of runs varies from study to study, the run information is not stored; the software assumes you want to include all of the runs in the run stats and sets the check marks accordingly.

Figure T7.3 — Export to Spreadsheet Statistics

Figure T7.3 shows the results after you clicked the **Create** button on the previous screen. The software creates two spreadsheets; the Study Stats are shown in the upper window and the Run Stats are shown in the lower window. Only the stats you selected are shown. You can scroll through the two spreadsheets to make sure you have included everything you meant to include *(and just as important, haven't included stats you didn't want).*

The **Study Stats To Export** format is essentially identical to the format you see in the other parts of the software where the study stats are shown, specifically the View Study Stats option and the Overall Study Stats report option. The nodes are listed down the screen. The various statistics go across the screen. These are the averages over all of the runs in the study. The last line shows the totals.

The **Run Stats To Export** format is a little different from other parts of the software. The top of the spreadsheet shows the name, date, time, and type *(Before or After)* for each run selected for export. Below this, each run statistic selected has a section where the nodes are listed down the screen and the stats for that node are shown going across the screen, under the appropriate run. If you selected all 11 run stats then there will be 11 sections going down the screen. Each section is labeled to show what statistic is shown.

There are three buttons at the bottom of the screen:

Cancel   Click this to exit this screen, either after you have exported the files you want, or if you realize you made a mistake and don't want to export files yet.

Export to Tab File   Click this if you want to create tab delimited text files.

Export to Excel File   Click this if you want to create Excel files.

For tutorial followers: Click both of the Export... buttons. The software creates the appropriate files and displays a message confirming the export files were created successfully. If there is a problem with the export, then an error message is displayed.

Study & Run Stats: Excel Format

Node #	Length	Node Names	Travel Time	# of Stops	Avg Speed	Total Delay	Time <= 0 MPH	Time <= 10 MPH	Time <= 30 MPH	Fuel (gals)	HC (gr)	CO (gr)	NOx (gr)
1	0	[Start]											
2	800	Mainland	14.3	0.0	38.1	2.2	0.0	0.0	2.2	0.0073	0.6491	8.4385	0.3933
3	1648	Guilbeau	40.5	0.5	27.7	15.8	4.3	8.0	19.8	0.0178	1.7398	17.4961	1.1285
4	2597	Bresnahan/Mis	64.2	0.5	27.6	24.5	10.5	14.3	26.5	0.0469	3.9732	59.8937	2.6248
5	2523	Braun	45.7	0.2	37.7	7.3	0.8	1.5	6.5	0.0463	3.8942	66.6312	2.6939
6	2392	[End]	36.2	0.0	45.1	-1.0	0.0	0.0	0.0	0.0202	1.6078	23.1407	0.9634
Total	9960		200.8	1.2	33.8	48.8	15.7	23.8	55.0	0.1385	11.8640	175.6002	7.8038

Figure T7.4 Study Stats in Excel

Node #	Length	Node Names	BANDOUT1 03/02/91 14:55 [Before]	BANDOUT2 03/02/91 15:05 [Before]	BANDOUT3 03/02/91 15:13 [Before]	BANDOUT4 03/02/91 15:22 [Before]	BANDOUT5 03/02/91 15:31 [Before]	BANDOUT6 03/02/91 15:40 [Before]
Travel Time								
1	0	[Start]						
2	800	Mainland	12	15	12	20	12	15
3	1648	Guilbeau	25	40	48	27	42	61
4	2597	Bresnahan/Mistic	118	51	56	43	61	56
5	2523	Braun	41	55	42	50	39	47
6	2392	[End]	33	39	36	38	34	37
Total	9960		229	200	194	178	188	216
Number of Stops								
1	0	[Start]						
2	800	Mainland	0	0	0	0	0	0
3	1648	Guilbeau	0	0	1	0	1	1
4	2597	Bresnahan/Mistic	2	0	0	0	1	0
5	2523	Braun	0	1	0	0	0	0
6	2392	[End]	0	0	0	0	0	0
Total	9960		2	1	1	0	2	1

Figure T7.5 Run Stats in Excel

The two figures shown above display how the study and run stats that were exported in Excel format look when opened in Excel. You need to clean up the formatting of the cells a bit before they look exactly like this, but presumably you know how to do this *(probably much better than we do)*. As you can see, you get a pretty faithful duplication of the spreadsheets shown on the screen.

What you do with the data from this point on is completely up to you. We would be interested in learning what you do with this data that we don't do in the PC-Travel software. If you come up with something you wish were incorporated into the regular software, please let us know.

Study & Run Stats: Tab Delimited Format

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Node	Length	Node Names	Travel	# of	Avg	Total	Time <=	Time <=	Time <=	Fuel	HC	CO	NOx
2	#			Time	Stops	Speed	Delay	0 MPH	10 MPH	30 MPH	(gals)	(gr)	(gr)	(gr)
3	1	0	[Start]											
4	2	800	Mainland	14.3	0	38.1	2.2	0	0	2.2	0.0073	0.6491	8.4385	0.3933
5	3	1648	Guilbeau	40.5	0.5	27.7	15.8	4.3	8	19.8	0.0178	1.7398	17.4961	1.1285
6	4	2597	Bresnahan/Mistic	64.2	0.5	27.6	24.5	10.5	14.3	26.5	0.0469	3.9732	59.8937	2.6248
7	5	2523	Braun	45.7	0.2	37.7	7.3	0.8	1.5	6.5	0.0463	3.8942	66.6312	2.6939
8	6	2392	[End]	36.2	0	45.1	-1	0	0	0	0.0202	1.6078	23.1407	0.9634
9	Total	9960		200.8	1.2	33.8	48.8	15.7	23.8	55	0.1385	11.864	175.6	7.8038

Figure T7.8 — Study Stats in Tab Delimited Format Opened in Excel

	1	2	3	4	5	6	7	8	9
1	Node	Length	Node Names	BANDOUT1	BANDOUT2	BANDOUT3	BANDOUT4	BANDOUT5	BANDOUT6
2	#			03/02/1991	03/02/1991	03/02/1991	03/02/1991	03/02/1991	03/02/1991
3				14:55	15:05	15:13	15:22	15:31	15:40
4				[Before]	[Before]	[Before]	[Before]	[Before]	[Before]
5	Travel Time								
6	1	0	[Start]						
7	2	800	Mainland	12	15	12	20	12	15
8	3	1648	Guilbeau	25	40	48	27	42	61
9	4	2597	Bresnahan/Mistic	118	51	56	43	61	56
10	5	2523	Braun	41	55	42	50	39	47
11	6	2392	[End]	33	39	36	38	34	37
12									
13	Total	9960		229	200	194	178	188	216
14									
15	Number of Stops								
16	1	0	[Start]						
17	2	800	Mainland	0	0	0	0	0	0
18	3	1648	Guilbeau	0	0	1	0	1	1
19	4	2597	Bresnahan/Mistic	2	0	0	0	1	0
20	5	2523	Braun	0	1	0	0	0	0
21	6	2392	[End]	0	0	0	0	0	0
22									
23	Total	9960		2	1	1	0	2	1

Figure T7.9 — Run Stats in Tab Delimited Format Opened in Excel

The two figures shown above show how the study and run stats that were exported in tab delimited text file format look when opened in Excel *(I know, if you are going to use Excel you would probably use the Excel format. However, we don't have another spreadsheet program to use as an example so use your imagination).* You need to clean up the formatting of the cells a bit before they look exactly like this, but presumably you know how to do this *(probably much better than we do).*

You can also use the tab delimited text file format files in other programs, such as database programs or programs that you write yourself in C++ or Visual Basic.

What you do with the data from this point on is completely up to you. We would be interested in learning what you do with this data that we don't do in the PC-Travel software. If you come up with something you wish were incorporated into the regular software, please let us know.

Appendices

Appendix 1 - Adding Maps to PC-Travel

One of the best new features in PC-Travel version 2 is support for maps. If you collect data with GPS receivers then the latitude and longitude information from the GPS receiver is stored with the other data and can be used to show your data on a map of the streets in your area. You can edit the run data and trim the start and/or end of the runs, you can insert or remove nodes, and you can move data points if they are plotted in the wrong spot. (See Tutorial 2 for an introduction to the mapping features in PC-Travel.)

To do all this you need maps of your area in the proper format in the proper folders on your computer. There are several ways to accomplish this depending on several factors. This Appendix will attempt to show you a few of the more common ways to get the street maps ready for PC-Travel.

PC-Travel currently supports two GIS modes, **MapPoint** and **ArcGIS Shapefile**. You select between these two modes in the **Preferences** screen.

MapPoint Mode:
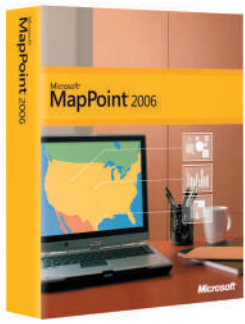
This is the simplest way to get maps into PC-Travel. MapPoint is the GIS software sold by Microsoft. When installed on your computer it has street maps for all of North America. The maps are very good and are as current as any other street maps you can buy, and better than most. The current version is MapPoint 2006, which sells for about $250, but can often be found for considerably less. There is an older version called MapPoint 2004. This works just as well but the maps, reasonably enough, are not as up-to-date as the current version. If you have relatively new roads in your area then they may not be in the 2004 edition. You can often find MapPoint 2004 on the Internet (try Amazon.com or eBay.com) for $50 or less. MapPoint 2008 (or 2009, there is some confusion about this) is scheduled for release in late July 2008. It will have the most current maps you can find. Once the new version is released the MapPoint 2006 version will probably be discounted.

If you buy and install some version of MapPoint on the same computer as PC-Travel then that is all you have to do. Set the **GIS Mode** to **MapPoint** in the **Preferences** screen and the software will show your maps as needed.

ArcGIS Shapefile Mode:
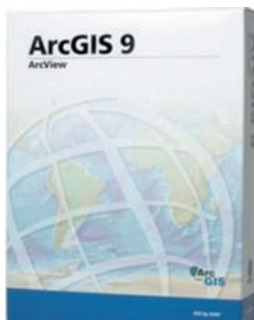
The second GIS mode in PC-Travel is called ArcGIS Shapefile because the map files used are in the shapefile format used by ArcGIS from ESRI, which is the most common GIS platform used by the customers who might want to use PC-Travel. There are other GIS programs in use to be sure, but ArcGIS is by far the most common.

The ArcGIS shapefile format has become so much of a standard that it is supported by other programs, including the Census Bureau and other companies that supply street map files, as we will see in the next section of this Appendix.

This mode is considerably more complicated, but if you carefully follow the steps shown here then you will be able to create the proper map files you need without the expense of MapPoint.

There are two common scenarios that will be discussed next, one if you have ArcGIS now and therefore have access to the streetmaps you need, and one if you don't have ArcGIS and need to get the maps in some other manner.

Scenario 1: You Currently Have ArcGIS

ArcGIS is so common in the traffic industry that there is a good chance someone in your organization has it. If they do and it is relatively recent version then you should be ok. The current version is ArcGIS 9.2, which is the version the steps shown here assume. Other versions may require somewhat different steps.

There are three steps in this process:
1- Use ArcGIS to create the shapefiles for the area you want to support in PC-Travel.
2- Use TatukGIS Viewer to re-format the shapefiles so they look good on the map.
3- Copy the re-formatted shapefiles to the Maps folder in PC-Travel.

Create Shapefiles

ArcGIS comes with a media kit that includes several DVDs. One is called Streetmap USA. Put this in your DVD drive of your computer. Open an Explorer view so you can navigate around the contents of the DVD. Open the DDA folder. You will see a screen similar to Figure A1.1.
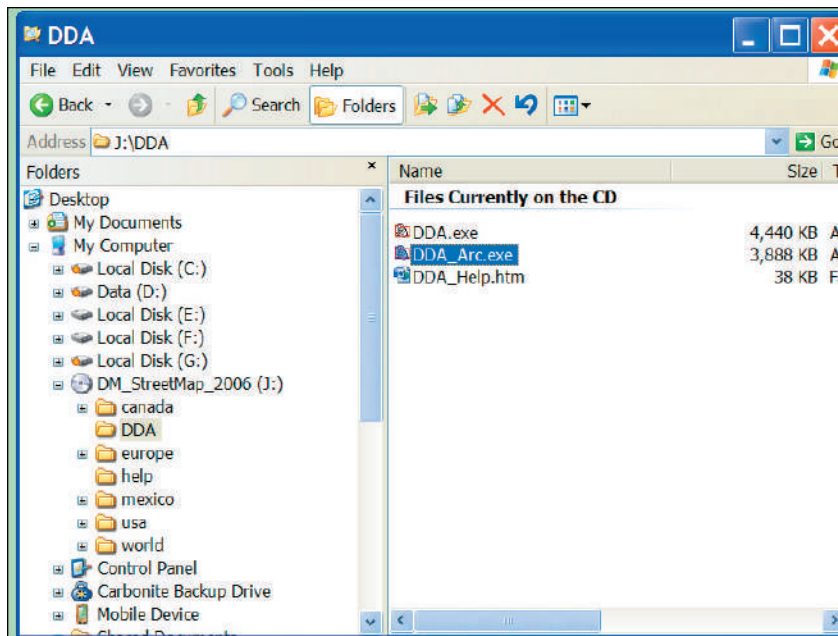
Figure A1.1 Contents of StreetMap USA DVD

Double click on the DDA_Arc.exe file to run it. This is the **Data Distribution Application (DDA)** program to use if you have ArcGIS installed on your computer. This is the ESRI program we will use to pick the area of interest and create the shapefiles for that area.

The **DDA** program will load on your computer. Initially the middle of the screen will be blank.

Click on **File** and then **Open** in the menu at the top of the screen.

Click on the the **USA** folder to open it if it isn't already open.

Select **StreetMap USA.mxd** from the list of files.

At this point your screen should look like Figure A1.2
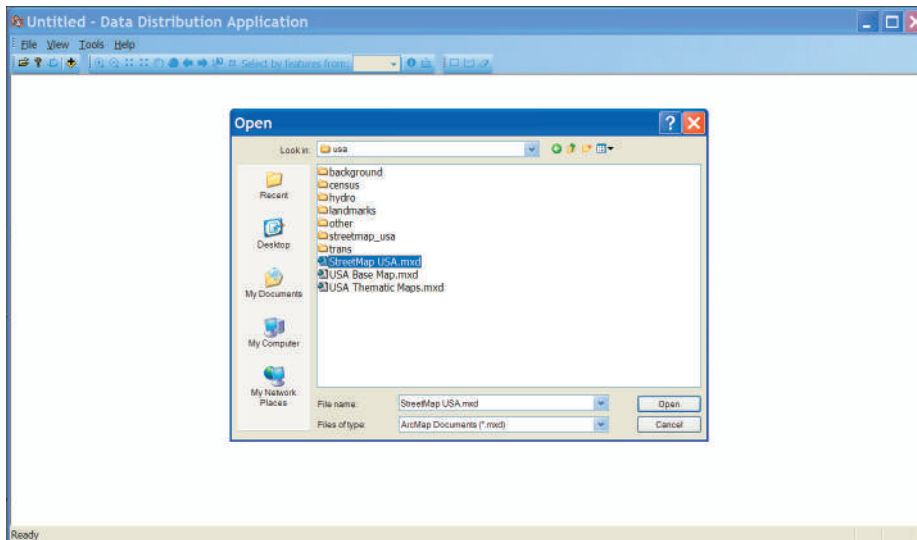
Figure A1.2 StreetMapUSA.mxd Ready To Open

Now click on **Open**.

A map of the USA opens. Now you want to zoom in to the area where you will do your travel time studies. Use the Zoom tool in the tool bar to do this. Give some thought to the area you select. If you pick too large an area you will spend extra timing zooming into the area of your studies; this isn't a big deal but it is something to consider. Make sure the area you pick will show all of the studies you are likely to do; you will have to redo this procedure if you want to expand the area at a later date.
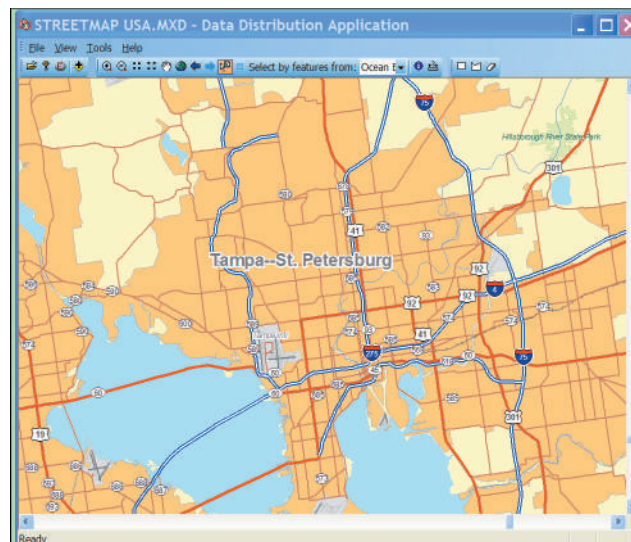
Figure A1.3 Select Map Area

In this example the map is zoomed to the greater Tampa, FL area.

Note: you can change the size of the window to get the map to show exactly what you want to show.
In this case a 'squarish' window shows the proper area, so the window was shaped accordingly. Whatever is visible in the window is what will be extracted to the shape files.

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The next step is to set the **Extraction Options**.

Click on **File:Extract** from the menu at the top of the screen.
This opens the **Extraction Options** screen.

The **Select Extraction Boundaries** should be set to *By Current Extent*.

The **Select Output Format** should be set to *ESRI Shapefile (shp)*.

Enter a name into the **File Name** field in the **File Name Properties** section. Pick a name that describes the area you selected on the map. In this case we might enter *Tampa-*.

Note: Enter a dash ("-") at the end of the name you enter. The DDA will create many files, most beginning with the name you enter here and ending with a name that represents the feature stored in that shape file. The dash makes it a little easier to read the file names created.

Set **Select Output Directory** to *C:\Program Files\PC-Travel\Maps\Temp*. This folder was created when you installed PC-Travel. There are some .ini files in the folder that will be used later to edit the shapefiles created here.

You should have a screen that looks similar to Figure A1.4.

Click on the **Extract** button.
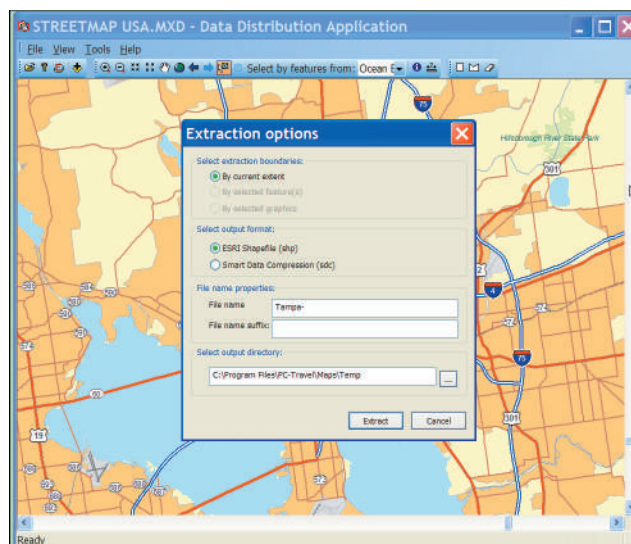
Figure A1.4 Ready To Extract

The DDA will extract the data and create the shapefiles. This can take quite a while (tens of minutes often, but not hours). The software shows a status window to let you know how it is doing. When it is done the program closes. You can put the DVD back in its case; you won't need it again (at least until you have to repeat this procedure for another area).

We now have a folder of shapefiles for the study area. The next step is to modify the shapefiles so the roads, highways, rivers, lakes, parks, etc. on the maps look nice.

The list of shapefiles extracted by the DDA is quite extensive. A map in ArcGIS, like the one in Figure A1.3, is made up of many layers. Each layer is a different *feature* on the map. A feature might be the street system, or the highway system, or rivers, or lakes, or parks, or city, state, or county boundaries, or many other things. Each feature when extracted is a separate shapefile. Actually the term shapefile is a bit misleading. Each shapefile is composed of several different files, each of which contain different data for that feature. One of the files has an extension of .shp, which is the shapefile, but the other files are equally important. Figure A1.5 shows some examples of the files that were extracted from the map shown in Figure A1.3.

Fig A1.5 Shape Files

It is not important that you understand what the various files do and how they work together. Just remember that any software that works with shapefiles, like PC-Travel, must work with all of these files and they all need to be in the same folder. Be careful if you move or delete any files in the group. Usually it is better to move all of them at once or leave them alone.

The extracted shapefiles have all of the information we need to display on a map, but the information on how the various features should look (what colors they should be, how wide the lines should be, whether areas should be filled with a color or not), is not there. We could display these shapefiles, but the map would just have thin black lines, which would not look good. Fortunately, however, there is a relatively simple way to make these shapefiles display in an attractive and informative manner on our maps.

TatukGIS Viewer

The GIS engine used in PC-Travel to display shapefiles is made by a Romanian company called TatukGIS. This software integrates into Visual Basic, which is the software used to write PC-Travel. TatukGIS allows programs written in Visual Basic to display maps, interact with the maps, print the maps, and a host of other map related operations. What is nice about this software is that there is no runtime license required, which means that when you buy PC-Travel you don't have to worry about licensing the GIS engine as well. This isn't true for other GIS programs that work with Visual Basic. TatukGIS supports shapefiles natively, which makes it easy to use.

TatukGIS makes a program called **TatukGIS Viewer** which is free for anyone to download and use. Among its many features is the ability to add *symbology* to shapefiles. What this means is you can use the software to decide how different features look when displayed on maps. We will use TatukGIS Viewer to edit the shapefiles extracted by the DDA so that they look good on maps.

Install TatukGIS Viewer

If you ordered the PC-Travel CD when you bought PC-Travel then the install program for TatukGIS Viewer is in the TatukGIS folder on the CD.

If you don't have the CD, then you can download the TatukGIS Viewer install program from the www.pc-travel.com support site.

The installation is a standard Windows type install. Run the installer program and follow the directions. Normally there is no reason not to accept all of the default values. For convenience you should install TatukGIS Viewer on the same computer where you have PC-Travel.

Once you have installed TatukGIS Viewer you can follow the procedure in the next section to edit the shapefiles.

Edit Shapefile Properties

Note: These directions assume you have followed the procedures in the previous section and have a list of files in the C:\Program Files\PC-Travel\Maps\Temp folder. There also should be seven .ini files in that folder that were installed when you installed PC-Travel. Seven of these .ini files start with ArcGIS. An example is ArcGIS-highways.ini.

Run **TatukGIS Viewer**. You will see a screen similar to Figure A1.6.
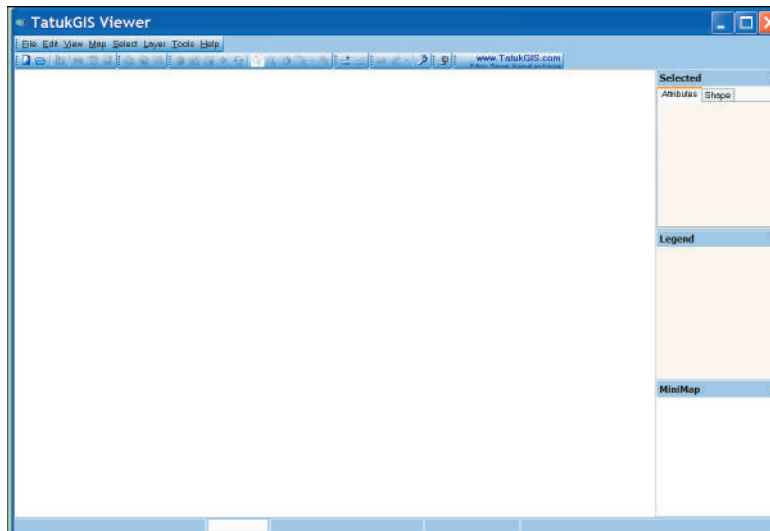
Figure A1.6 TatukGIS Viewer - New Project

Note: If a map is displayed then click on File:New Project to clear the screen.
If the Legend panel is not visible then click View:Panels:Legend.

Of the many layers that were created by the DDA program there are seven we want to add to the new project. These are the layers that have the most interesting features for our application. Obviously we want to show streets and highways. But other features help make the maps look more attractive and useful. Each layer will be added to the project and then the properties for that layer will be loaded from a prepared .ini file. The order you load the layers is important so follow the sequence shown.

    1- Click on **Layer:Add** in the menu at the top of the screen.
    2- Navigate to the **C:\Program Files\PC-Travel\Maps\Temp** folder.
    3- Select *x-world30.shp* where *x* is the file name you used in the DDA program for your files.
    4- Click **Open**. This brings up a large grey rectangle which is the background for the map.
    5- Click on **Layer:Load layer properties** in the menu.
    6- Select *ArcGIS-world30.ini* from the list. The rectangle changes to a light grey color.

    1- Click on **Layer:Add** in the menu at the top of the screen.
    2- Navigate to the **C:\Program Files\PC-Travel\Maps\Temp** folder.
    4- Select *x-lalndmrk.shp* where *x* is the file name you used in the DDA program for your files.
    5- Click **Open**. This probably will bring up lots of little areas on the map.
    6- Click on the new layer name (x-lalndmrk) in the Legend box on the side of the screen.
    7- Click on **Layer:Load layer properties** in the menu.
    8- Select *ArcGIS-landmarks.ini* from the list. The little areas change to a light green color.

    Note: Step 6 is highlighted because it is the step that is most often missed. You have to select the layer you want to edit before you load an .ini file.

At this point your screen will look something like Figure A1.7. Not very interesting yet, but it will get better.
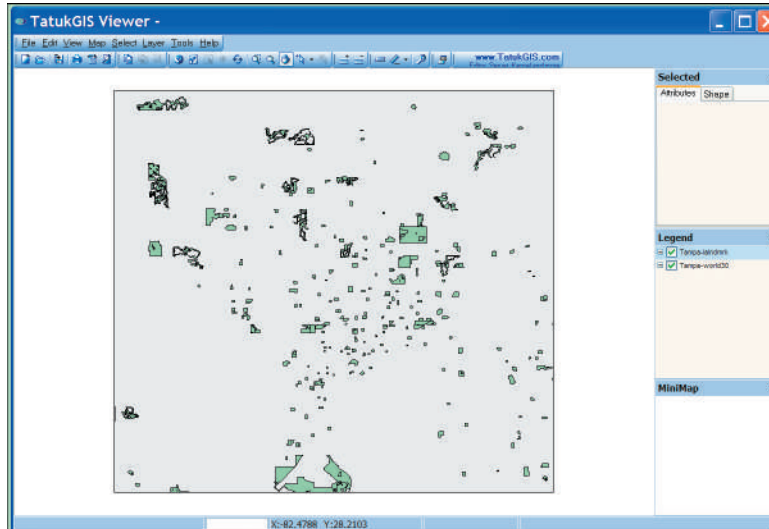
Figure A1.7 Project After 2 Layers Added

Follow the same eight steps shown on the previous page for the following layers in the order shown:

Layer Name	*INI File*
x-parks.shp	ArcGIS-parks.ini
x-md_riv.shp	ArcGIS-md_riv.ini
x-md_wat.shp	ArcGIS-md_wat.ini
x-streets.shp	ArcGIS-streets.ini
x-highways.shp	ArcGIS-highways.ini

Remember to substitute the proper shape file name and INI File at the appropriate times.
Remember to select the proper layer in step 6 before loading the .ini file.

When you are done you will have a screen similar to Figure A1.8
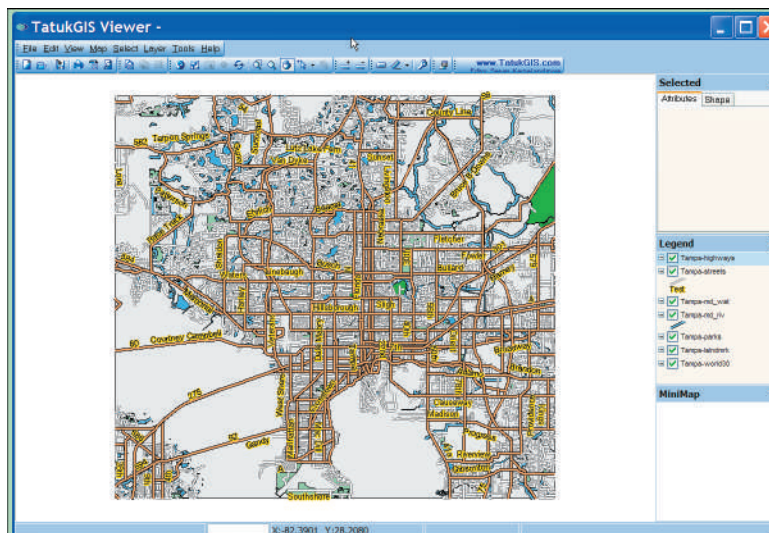
Figure A1.8 Project With All Layers Added

We now have the map looking like a decent map. Your map may look very crowded and busy. That's ok; we will take care of that in the next step.

Load Map Units

The next step is to set the map units so that the software understands how distances are calculated in the layers that are used in the map.
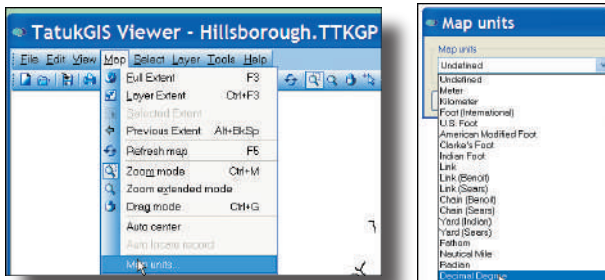
Figure A1.9 Load Map Units

Click on **Map** in the menu at the top of the screen.

Click on **Map Units** from the drop down box.

Click on the down arrow and select **Decimal Degree** from the long list of options, then click **Ok.**

You probably noticed that the screen greatly simplified so that all you can see are the major highways on the map. This is because there are settings in the project to decide when to show certain road types on the map. In this case the local roads are only shown when you are zoomed in fairly close. This cuts down on the clutter.

Pick Background Color

The maps look a little better if the background color isn't white; you get a little contrast with the roads and text. It is easy to set the background color.

Figure A1.10 Select Background Color

Click on **Tools** on the menu at the top of the screen.
Click on **Options** from the drop down list.
Click on the **Map** tab.
Click on the down arrow in the **Colors** section.
This brings up a screen similar to Fig A1.10. You can pick one of the colors shown but most people like a very soft background color. One option is a very light green background. To set this:
Click on the Light Green square on the bottom row so it is highlighted, then click on the **More Colors** button.
Click on the **Define Custom Colors** button.
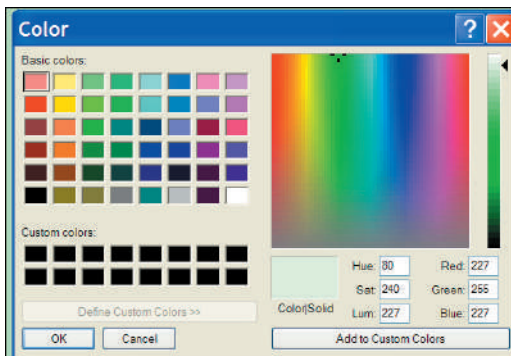
Figure A1.11 Define Custom Color

You will see a screen like Fig A1.11. On the far right is a graduated color scale that starts at white at the top and progresses down to black at the bottom. The little triangle shows the currently selected color. Click on the arrow and drag it up one or two spots so that the arrow is just below the white section.

Click on the **Add to Custom Colors** button then click on **Ok**. This brings you back to the previous screen.

Click on the **Apply** button and the background of the map should change to the new color. Feel free to experiment to get the color you like. Some people like a light yellow or a light grey. It is up to you.

Save Project File

The last step is to save this project so that PC-Travel can load the proper properties for the layers that are defined here.

Click on **File:Save Project As...** in the menu at the top of the screen.

Enter a file name for this project. Use the same name you used in the DDA program (but you don't need to add a dash this time). Click **Save**. This saves the project in the Temp folder where all of this work occured.

We also want to save this project in another location, the actual location PC-Travel will look for it.

Click on **File:Save Project As...** again.
Click on the **Up Folder** icon at the top of the Window, or click the down arrow button in the **Save In:** list box and select the *Maps* folder.
Enter *PCT* in the **File Name** text box, then click **Save**.

This creates a PCT.ttkgp project file in the Maps folder. PC-Travel looks in this folder for the shape files and for the project file that defines the symbology of the layers in the shapefiles.

The last step is to move all of the files except the .ini files in the Temp folder to the Maps folder. These are the files created by the DDA program. Technically you don't have to move all of the files since we don't use all of them, but it is easier to move them all. Use any of the Windows techniques to move the files.

When you are done you should have a lot of files in the Maps folder now and only the .ini files in the Temp folder. Congratulations you have succesfully created maps of your area and formatted them to use in PC-Travel.

Misc Notes:

The procedures shown here are only one way to get to the same result. If you know a better way, please let us know so we can share the information.

The way the map looks is completely adjustable. If you would like to learn how TatukGIS Viewer works and come up with different symbology for the features, then please feel free to experiment. If you come up with some looks you like, let us know and we will share them with others on the **www.pc-travel.com** website.

You can extend the ideas in this tutorial to include other layers that are generated in the DDA . We tried to use the fewest number of layers as possible to make the procedure as simple as possible. You can **Add** other layers and define the symbology, just make sure you save your project as PCT and copy it to the **Maps** folder.

Scenario 2: You Don't Have ArcGIS

If you don't have ArcGIS, or even if you have ArcGIS but don't have easy access to the data, you still can get the maps you need without too much trouble, and you can get them for free!

The key to this magic is the US Government, which provides Census Data free of charge. Part of this data include TIGER files which contains geographic and cartographic data of the entire country. Very recently (March 2008) the format for these files was changed to the very same shapefile format we want. These files are now called TIGER/Line Shapefiles and can be downloaded for free from the Internet.

This makes our task much simpler. This section of the tutorial will show you how to download the shapefiles for your area and then how to add the symbology to make the shapefiles look good on maps.

Download Shapefiles

Go to **http://www.census.gov/geo/www/tiger/tgrshp2007/tgrshp2007.html** (or Google 2007 TIGER/Line Shapefiles). This site has more information than you would ever want or need to know about TIGER shapefiles.
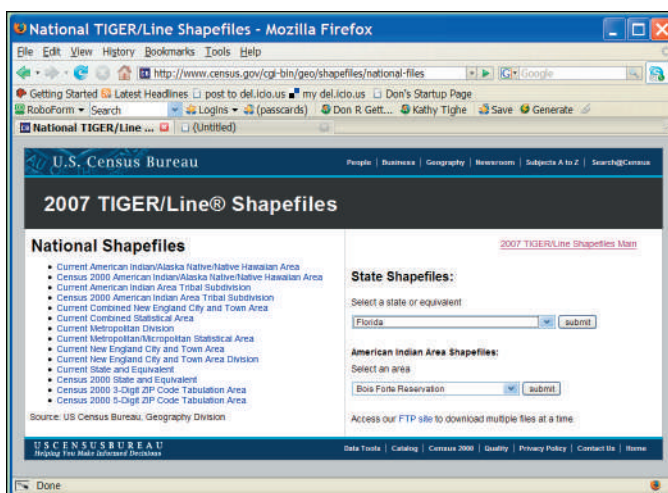
Figure A1.12 Select State

Click on the **Download TIGER/Line Shapefiles** link about 2/3 of the way down the page. This brings up the screen shown in Figure A1.12.

Select your state from the drop down list, then click on the **submit** button.

You will see a similar screen where you can select the County of the data you want from the drop down list. Click on the **submit** button.

Note: All TIGER/Line Shapefiles are organized by County. That is the smallest area you can download.
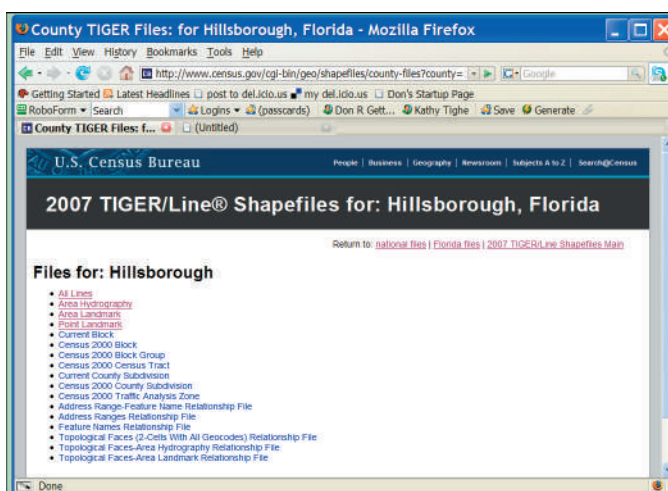
Figure A1.13 Select Shapefiles To Download

This brings up the screen shown in Figure A1.13. This is the list of all of the shapefiles that are available. We only need the first two, **All Lines** and **Area Hydrography.**

First click on **All Lines**. You will see a message asking if you want to **Open or Save** the file. Select **Save** then click **Ok**. Then navigate to the **C:\Program Files\PC-Travel\Maps** folder and click on **Save**.

Do the same thing for **Area Hydrography**.

You now should have two zip files in the **Maps** folder.

Unzip Downloaded Files

Open a Windows Explorer window and navigate to the **Maps** folder where you stored the zip files.
Unzip them into the same folder. You can delete the zip files if you wish; you won't need them again. You will
have a list of files similar to what is shown in Figure A1.14.

Fig A1.14 List of Shapefiles

Note: There are some .ini files in the folder starting with ArcGIS and with Tiger2007. These were copied when PC-Travel was installed. We will use the Tiger2007 ini files in this section.

There are two sets of shapefiles in the folder. The shapefiles have a very specific naming convention.

A typical file name might be **fe_2007_12057_edges00.***.

The **fe** shows that this is a Census Bureau file.
The **2007** is the version of the files.
The **12057** identifies the geographic extent of the file.
edges is the layer type.
00 indicates that the file contains Census 2000 geography.

Note: If the 00 is not present then the file contains current geography, which is good. This means the data in the file is the most current available. If you do have 00 in the file, then you should occasionally check the www.census.gov site shown earlier to see if your files have been updated. The governement is trying to get all of the data up to date as fast as possible but you know how governments are...

TatukGIS Viewer

The GIS engine used in PC-Travel to display shapefiles is made by a Romanian company called TatukGIS. This software integrates into Visual Basic, which is the software used to write PC-Travel. TatukGIS allows programs written in Visual Basic to display maps, interact with the maps, print the maps, and a host of other map related operations. What is nice about this software is that there is no runtime license required, which means that when you buy PC-Travel you don't have to worry about licensing the GIS engine as well. This isn't true for other GIS programs that work with Visual Basic. TatukGIS supports shapefiles natively, which makes it easy to use.

TatukGIS makes a program called **TatukGIS Viewer** which is free for anyone to download and use. Among its many features is the ability to add *symbology* to shapefiles. What this means is you can use the software to decide how different features look when displayed on maps. We will use TatukGIS Viewer to edit the shapefiles downloaded from the Census Bureau so that they look good on maps.

Install TatukGIS Viewer

If you ordered the PC-Travel CD when you bought PC-Travel then the install program for TatukGIS Viewer is in the TatukGIS folder on the CD. If you don't have the CD, then you can download the TatukGIS Viewer install program from the **www.pc-travel.com** support site. Look on the **Downloads** page in the Utilities section.

The installation is a standard Windows type install. Run the installer program and follow the directions. Normally there is no reason not to accept all of the default values. For convenience you should install TatukGIS Viewer on the same computer where you have PC-Travel.

Once you have installed TatukGIS Viewer you can follow the procedure in the next section to edit the shapefiles.

Edit Shapefile Properties

Note: These directions assume you have followed the procedures in the previous section and have the shape-files in the C:\Program Files\PC-Travel\Maps folder. There also should be two .ini files in the Temp folder that were installed when you installed PC-Travel: Tiger2007-AllLines.ini and Tiger2007-AreaWater.ini.

Run **TatukGIS Viewer**. You will see a screen similar to Figure A1.15.
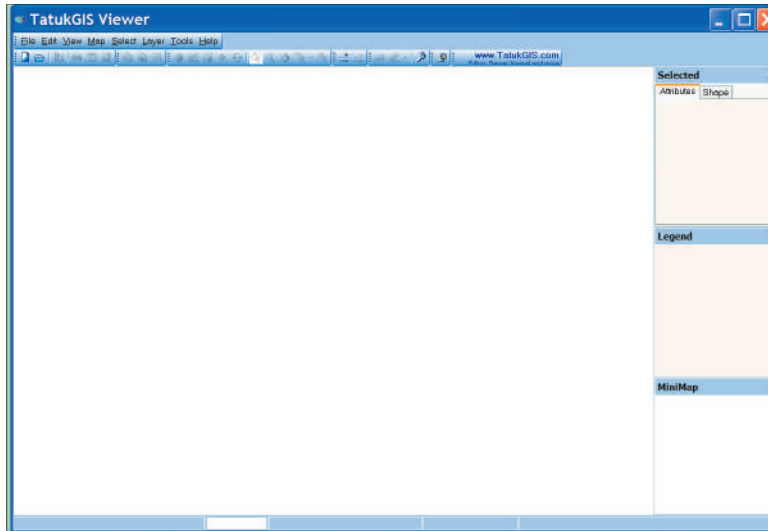
Figure A1.15 TatukGIS Viewer Screen

Note: If a map is displayed then click on File:New Project to clear the screen.
If the Legend panel is not visible then click View:Panels:Legend.

Each shapefile is loaded as a separate layer to the map. Each layer will be added to the project and then the properties for that layer will be loaded from a prepared .ini file. The order you load the layers is important so follow the sequence shown.

> 1- Click on **Layer:Add** in the menu at the top of the screen.
> 2- Navigate to the **C:\Program Files\PC-Travel\Maps** folder.
> 3- Select *x-AreaWater.shp* where *x* is the prefix of the files in your folder.
> 4- Click **Open**. This usually brings up lots of grey areas. These are all of the water areas in the county.
> 5- Click on **Layer:Load layer properties** in the menu.
> 6- Navigate to the **Temp** folder and select *Tiger2007-AreaWater.ini* from the list. The areas turn a light blue.

> 1- Click on **Layer:Add** in the menu at the top of the screen.
> 2- Navigate to the **C:\Program Files\PC-Travel\Maps** folder.
> 4- Select *x-edges.shp* where *x* is the prefix of the files in your folder.
> 5- Click **Open**. This brings up lots of thin, black lines.
> *6- Click on the new layer name (x-edges) in the Legend box on the side of the screen.*
> 7- Click on **Layer:Load layer properties** in the menu.
> 8- Go to the **Temp** folder and select *Tiger2007-AllLines.ini*. The lines look more like roads.

> *Note: Step 6 is highlighted because it is the step that is most often missed. You have to select the layer you want to edit before you load an .ini file.*

You now should have a map that looks somewhat like Figure A1.16
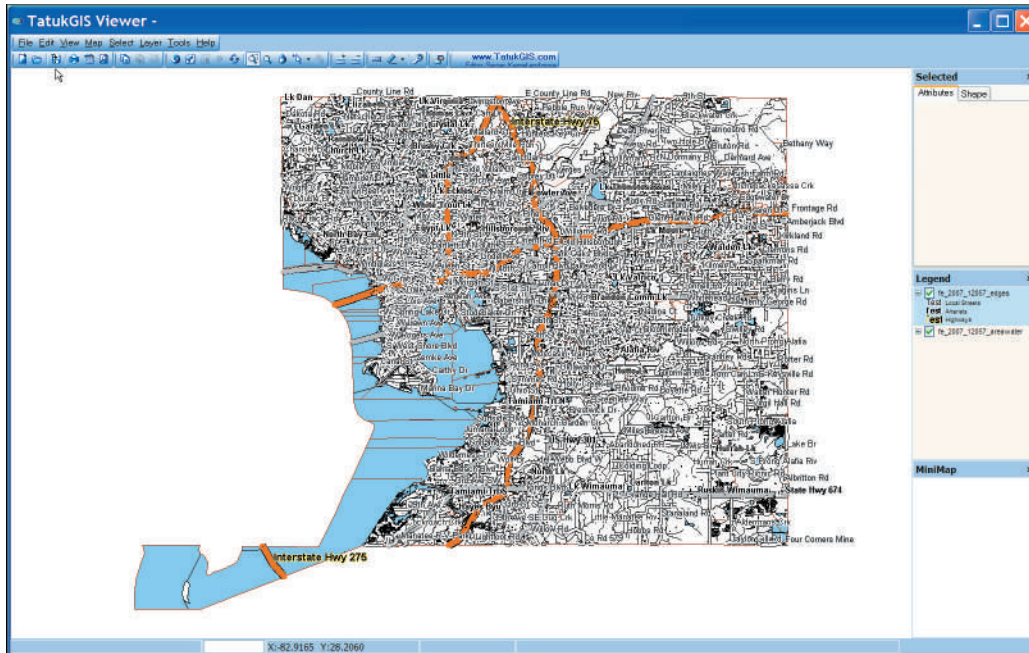
Figure A1.16

We now have the map looking like a decent map, although it may look a cluttered. We will take care of that next.

Load Map Units
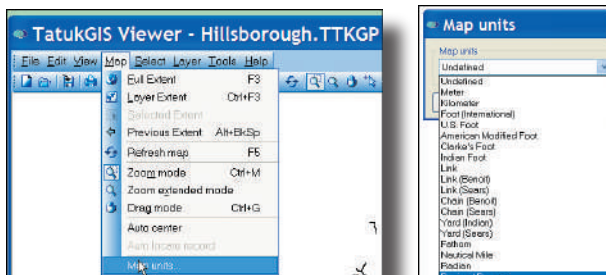
Figure A1.17 Load Map Units

The next step is to set the map units so that the software understands how distances are calculated in the layers that are used in the map.

Click on **Map** in the menu at the top of the screen.

Click on **Map Units** from the drop down box.

Click on the down arrow and select **Decimal Degree** from the long list of options, then click **Ok**.

You probably noticed that the screen greatly simplified so that all you can see are the major highways on the map. This is because there are settings in the project to decide when to show certain road types on the map. In this case the local roads are only shown when you are zoomed in fairly close. This cuts down on the clutter.

Pick Background Color

The maps look a little better if the background color isn't white; you get a little contrast with the roads and text. It is easy to set the background color.

Figure A1.18 Select Background Color

Click on **Tools** on the menu at the top of the screen.
Click on **Options** from the drop down list.
Click on the **Map** tab.
Click on the down arrow in the **Colors** section.
This brings up a screen similar to Fig A1.18. You can pick one of the colors shown but most people like a very soft background color. One option is a very light green background. To set this:
Click on the Light Green square on the bottom row so it is highlighted, then click on the **More Colors** button.
Click on the **Define Custom Colors** button.
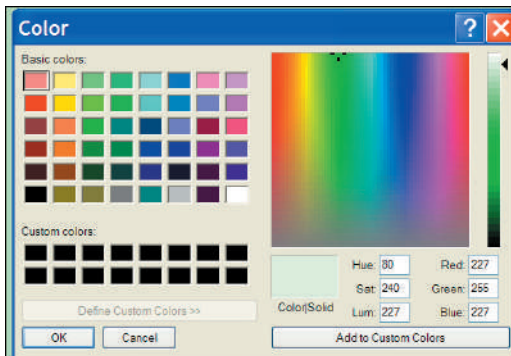
Figure A1.19 Define Custom Color

You will see a screen like Fig A1.19. On the far right is a graduated color scale that starts at white at the top and progresses down to black at the bottom. The little triangle shows the currently selected color. Click on the arrow and drag it up one or two spots so that the arrow is just below the white section.

Click on the **Add to Custom Colors** button then click on **Ok**. This brings you back to the previous screen.

Click on the **Apply** button and the background of the map should change to the new color.

Feel free to experiment to get the color you like. Some people like a light yellow or a light grey. It is up to you.

Save Project File

The next step is to save this project so that PC-Travel can use it.

Click on **File:Save Project As...** in the menu at the top of the screen.

Enter a file name for this project. PIck a logical name; the name of the County most likely. Click **Save**. This saves the project in the Temp folder where all of this work occured.

We also want to save this project in another location, the actual location PC-Travel will look for it.

Click on **File:Save Project As...** again.
Enter *PCT* in the **File Name** text box, then click **Save**.

This creates a PCT.ttkgp project file in the Maps folder. PC-Travel looks in this folder for the shape files and for the project file that defines the symbology of the layers in the shapefiles.

When you are done you should have the shape files in the Maps folder now and only the .ini files in the Temp folder. Congratulations you have succesfully created maps of your area and formatted them to use in PC-Travel.

Misc Notes:

The procedures shown here are only one way to get to the same result. If you know a better way, please let us know so we can share the information.

The way the map looks is completely adjustable. If you would like to learn how TatukGIS Viewer works and come up with different symbology for the features, then please feel free to experiment. If you come up with some looks you like, let us know and we will share them with others on the **www.pc-travel.com** website.

If you do make changes then make sure you save both the .ini for the layer you edit, and the project file. Just make sure you save your project as PCT and copy it to the **Maps** folder so PC-Travel will use your version.

Conclusion:

This appendix showed three different ways for you get maps of your area to use in PC-Travel.

First, you can use Microsoft's **MapPoint** software. If you don't already have it, then you can buy it new for about $230 or for much less if you search on eBay and Amazon for older versions. If you are a college or educational institute then you can get an Academic version for less than $100. The advanatage of **MapPoint** is it automatically installs street maps for the entire country when you install it; you don't have to worry about the maps at all.

Second, if you have **ArcGIS** in your office, you can use the **Streetmap USA** maps that came with the software, or you can use your own street maps if you can get them exported as shapefiles. Since the way shapefiles look on a map is not stored in the shapefiles themselves you need a way to set the symbology to use. We use a program called **TatukGIS Viewer**, a free program, for this. You saw how to use **TatukGIS Viewer** to create a project file that has the symbology for the maps to make them look like street maps.

Third, if you don't have **MapPoint** or **ArcGIS** you can still easily get the maps you need, and for free! The US Government recently changed the format of the geographic and cartographic files supplied by the Census Bureau to use the same shapefile format we want to use. You saw how to download the shapefiles for your county from the Internet and how to use **TatukGIS Viewer** to create a project file with the symbology we need.

In some ways the third option might be the best. If your county has had the street features realigned (this brings the files up to date and fixes lots of errors in the data from the 2000 census) then these might be the most accurate maps you can find, even better than the maps in ArcGIS or MapPoint. (see the Note on page A1.11).

Finally, please remember that we are not GIS experts; we are trying to provide you with procedures to get maps that will work with PC-Travel, but it is a very complicated field. If you find any better ways to do any of this, please let us know so we can pass on the information to others.

Appendix 2 - Sensor Installation and Troubleshooting

If you are using a TDC unit to collect travel time data, you must install a Modular Distance Sensor (MDS) in the vehicle to send information to the TDC. Use the following instructions for installation of the MDS.

1. Find a location under the vehicle dashboard that will allow fairly easy access to the MDS. **Do Not** mount the MDS on the heater ducts or where the heater vents will blow directly onto it. Attach the MDS using the nylon ties or Velcro provided.

2. Locate the two wires coming from the Vehicle's Speed Sensor (VSS).

   • On most Ford and Chrysler pick-up trucks, the best place is on the rear end differential housing using the rear ABS signal.
   • On General Motors pick-up trucks, the best place is the VSS at the transmission.
   • On many vehicles (both trucks and autos) you can go to the cruise control signal or to the vehicle ECU which is often located under the dashboard.

(Your local Auto/Truck dealer can usually tell you where the VSS can be located on your vehicle. If you need additional assistance, contact Ridge Engineering.)

3. Route the red and black end of the 20' grey VSS cable through the firewall. This can usually be done by using an existing rubber grommet where other wires pass through the firewall. If you cannot locate an existing hole, **CAREFULLY** drill a small hole large enough for both the VSS cable and the +12Volt/Ground wires. **EXTREME CAUTION** must be taken to insure you do not drill into anything mounted on the opposite side of the firewall or cut any existing wiring.

Use the cable ties provided while routing the cable to the location for getting the speed signal that you previously identified. Attach the red and black wires of the VSS cable to the vehicle's speed sensor wires using the tap splice connectors provided. The **red** wire goes to the high-speed signal wire; the **black** goes to the low speed signal wire.

NOTE: The tap splice connectors are supplied for convenience for initial installation. However, we recommend that once the installation is completed and you have verified the instrument is working properly, remove the tap splice connectors and solder the connections. Insulate using electrical tape or silicone.

4. Plug the connector of the VSS cable into the hole labeled *VSS Input* located on the right side of the MDS.

5. Route the black telephone-style cable from the jack labelled DMI on the MDS to pigtail jack on the cable connected to the TDC. It does not matter which end of the cable is plugged into the MDS jack or pigtail jack.

6. Route the Red (+12 Volts) and Black (Ground) power cables directly to the vehicle's battery. This can be done using the same feed through location that was used for the VSS Cable. If, out of convenience, you elect to obtain the +12VDC and ground from a fuse panel or other location under the dashboard, **make sure it is a constant 12 volt source** and **not** one that is switched off with the ignition key. We also recommend the circuit should have as few devices as possible to avoid voltage fluctuations from Turn Signals, Brake Lights, etc. Plug the power cable into the hole labeled *Power* on the MDS.

A diagram of the complete installation for the MDS is shown in Figure A2.1.
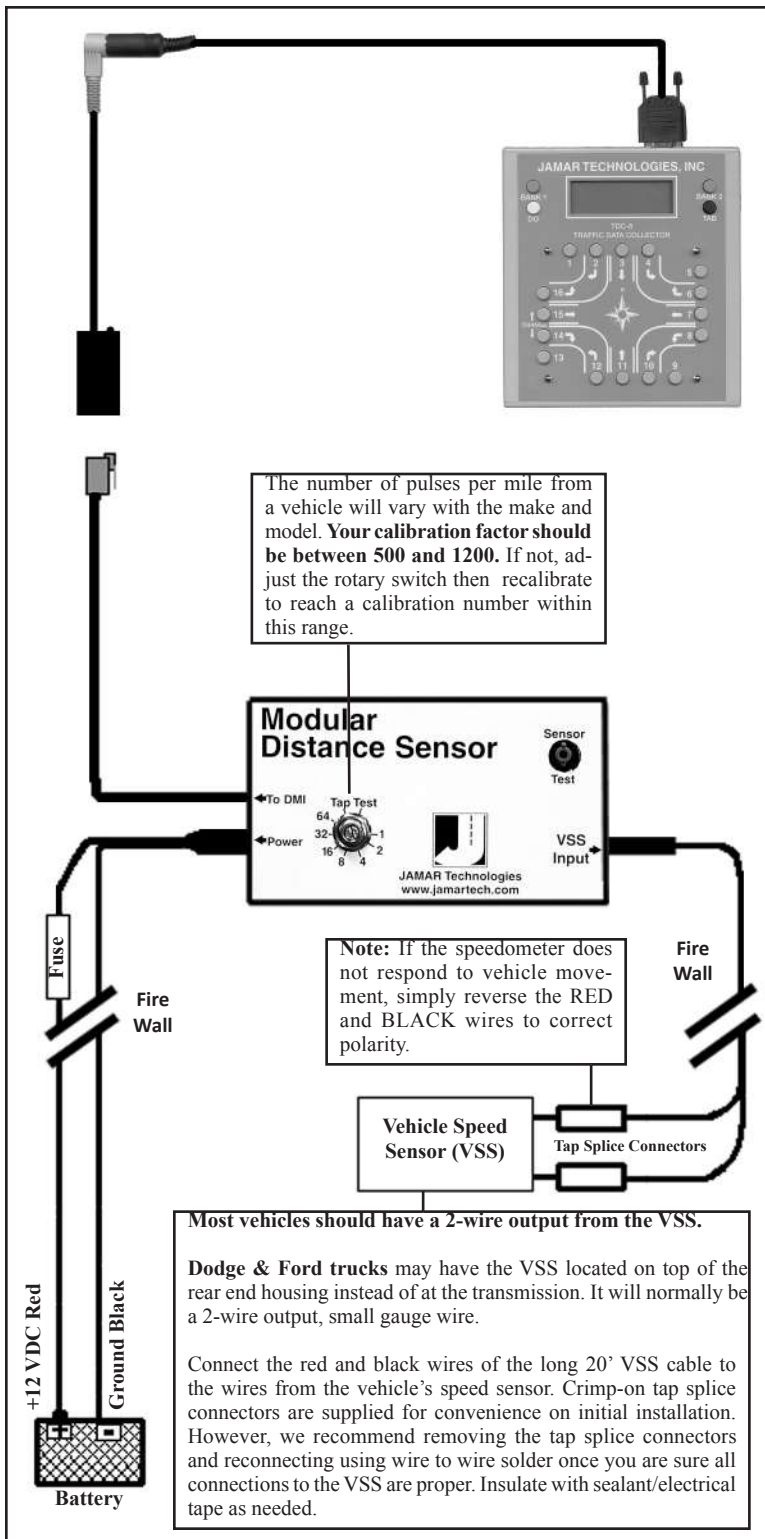
The number of pulses per mile from a vehicle will vary with the make and model. **Your calibration factor should be between 500 and 1200.** If not, adjust the rotary switch then recalibrate to reach a calibration number within this range.

Note: If the speedometer does not respond to vehicle movement, simply reverse the RED and BLACK wires to correct polarity.

Most vehicles should have a 2-wire output from the VSS.

Dodge & Ford trucks may have the VSS located on top of the rear end housing instead of at the transmission. It will normally be a 2-wire output, small gauge wire.

Connect the red and black wires of the long 20' VSS cable to the wires from the vehicle's speed sensor. Crimp-on tap splice connectors are supplied for convenience on initial installation. However, we recommend removing the tap splice connectors and reconnecting using wire to wire solder once you are sure all connections to the VSS are proper. Insulate with sealant/electrical tape as needed.

Figure A2.1 - MDS Installation Diagram

Adjusting the
Vehicle Speed Sensor Pulse Rate

The signal pulses coming from the vehicle speed sensor are generated for use by the vehicle's computer, engine/transmission control, fuel management, ABS brakes, etc. The pulse rate can vary from 4,000 to in excess of 100,000 pulses per mile. The MDS will condition and amplify these pulses for use by the TDC. Since the higher pulse rates are not required for accurate travel time, the MDS incorporates a divider circuit to reduce the pulse rate. This is done by adjusting the rotary switch on the front of the MDS.

Although your particular vehicle may vary, generally Chrysler and Ford vehicles use a 4 to 1 ratio (position 4 on the switch) while General Motors vehicles use a 16 to 1 ratio (position 16 on the switch). To adjust the ratio, use a small screwdriver to rotate the switch until the slot in the switch points to the desired ratio. *Note that when the switch is turned counter-clockwise until it stops, it is at the 1 to 1 ratio.*

The adjustments go from 1 to 1 (1 pulse into the sensor, 1 pulse out) through 64 to 1 (64 pulses into the sensor, 1 pulse out). The Tap Test positions are explained in the next section. You may need to adjust the ratio again based on the results of the calibration procedure described in Chapter 2. Any time you change the pulse ratio, you will need to re-calibrate the TDC.

If Your TDC Fails to Record Pulses
If your TDC fails to record pulses during calibration, perform the following operational checks:

Check 1

Locate the Sensor Test button on the front upper right of the MDS, shown in Figure A2.2. When pressed, this will generate an internal low-level signal that is fed directly into the VSS Input circuit. First, unplug the VSS Input connector from the right side of the MDS. Second, turn on the TDC and set into calibration mode as discussed on page 2.4. Next, using a small pointed object (pen, pencil, screwdriver, etc.) or your finger press the Sensor Test button for a few seconds. The TDC should show pulses when the button is pushed. What number it showed doesn't matter, as long as it did show pulses being received.
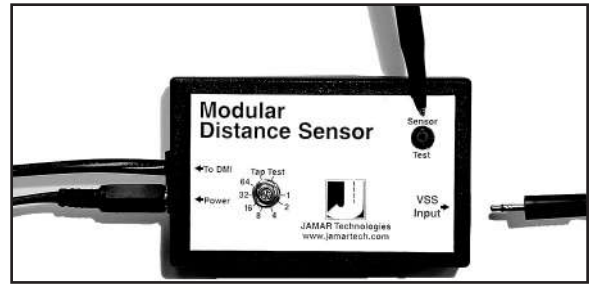

Figure A2.2 - Sensor Test

If the TDC did show pulses, everything from the MDS up to the TDC is okay and the problem is most likely either a poor connection at the vehicle's speed sensor or the connection is not at the correct location to get the vehicle speed signal. The speed sensor output is generally at the transmission or the rear differential. If you are unsure about being attached to the correct output, disconnect the plug and move the vehicle. If the speedometer does not function, you have chosen the correct plug wires.

If you are at the correct location, make sure you have a good electrical connection at the tap in point. Once you are sure you tapped into the correct location, it is always better to wire solder the connection.

After checking the connection, plug the VSS Input connector back into the MDS and try the TDC again. If the TDC counts, you can proceed with calibration. If the TDC still does not count, go to Check 2.

Check 2

The Tap Test will determine if the distance pulses being sent from the MDS are getting to, and being processed by, the TDC. The Tap Test is performed using the rotary switch shown in figure A2.3. First make sure you note the current position of the rotary switch (1, 2, 4, 8,16, 32 or 64), as you will have to return the slot back to this same position after the test is completed.
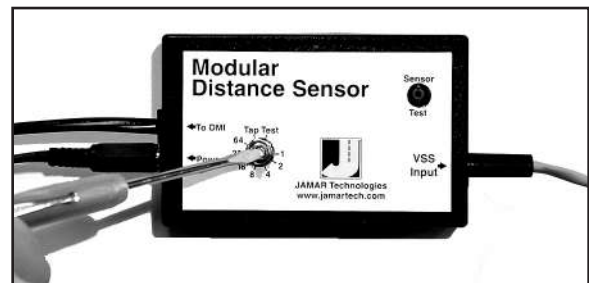
Next, turn on the TDC and set into calibration mode as discussed on page 2.4. Using a small screwdriver, rotate the switch between the Tap and Test positions four or five times. (Note that when

Figure A2.3 - Tap Test

the switch is turned clockwise until it stops, it is at the Test position.) The TDC should register pulses. The count shown does not matter, just as long as the TDC did register a count. If it did count, the cabling from the MDS to the TDC and the TDC itself are OK. If the TDC did not count, the problem is most likely a bad cable or connection to the TDC, or the TDC itself is bad. If available, try another TDC and repeat the Tap Test. If the second TDC doesn't count, the problem has to be the cabling between the MDS and the TDC.

Once the test is complete, return the Rotary Switch to the previous position.

If the previous steps do not correct the problem, contact us using the information on page iii.

Appendix 3 - Pocket PC Supplement

This supplement provides some additional information on using PDA with the GPS Travel Time software. For current information on what PDAs are supported by the GPS Travel Time software, visit www.gps2traveltime.com.

Pocket PC Installation Procedure
It is a simple process to install GPS2PDA on your Pocket-PC PDA. It is required, though, that you have set up an ActiveSync partnership with your desktop computer. If you are unsure of how to do this, consult the instructions that came with your Pocket-PC PDA.

It is recommended that you place your PPC into its cradle and allow ActiveSync to run prior to starting the installation procedure. The installation software will use ActiveSync to copy the files to your PDA.

Installation from the PC-Travel CD
Place the PC-Travel CD into the CD drive of your PC. The computer should recognize the new cd and show you the Installation Options screen, which includes an *Install GPS Travel Time Software* button. Click this button. On the next screen, click the *Install GPS to PDA* button. On the next screen, click *Install GPS to PDA for Pocket PC* and the installer wizard will start.

Installation from a Downloaded Installer Program.
If you downloaded the installer program from the GPS2TT web site, or were emailed the installer program, then unzip (you need a program like WinZip to do this) the file into an empty folder on your computer. This results in a file called **GPS2PDA PPC Installer.exe.** Double click on this file to start the install wizard.
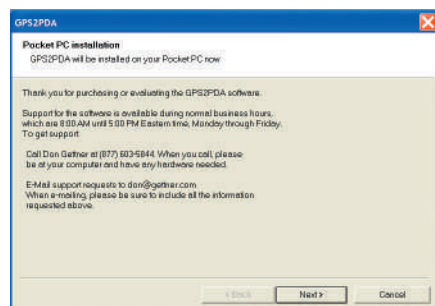

Figure A3.1 - Welcome

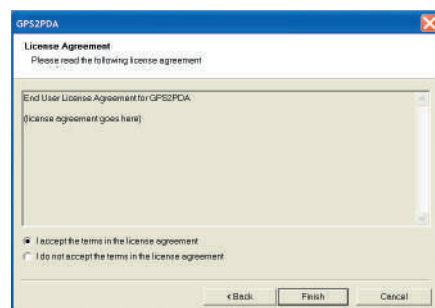At the first screen click the **Next** button.

Figure A3.2 - License Agreement

Select the I accept the terms in the licence agreement option and click the **Next** button.
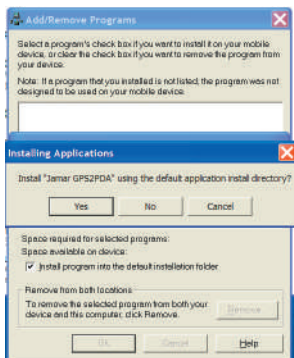
Figure A3.3 - Installing

Once the wizard opens communications to your PPC, it will ask you if you want to save GPS2PDA in its default directory. Click **Yes** if you would like to have GPS2PDA in the main memory of your PPC in the ***Program Files*** folder. This option is simplest and would be best for most users. Click the No button if you would like to install GPS2PDA on an expansion card. The wizard will then take you to another screen that allows you to choose the location in which you'd like to install GPS2PDA.
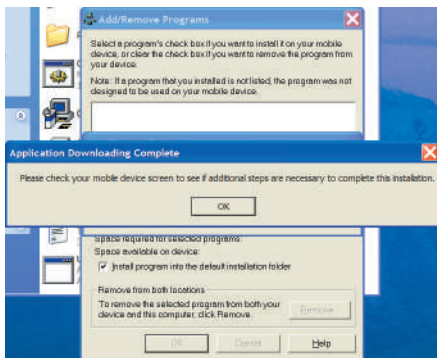

Figure A3.4 - Installation Complete

This is the final screen in the wizard. Click the **OK** button and check your PDA to see if there are any additional steps you need to take to complete the installation of GPS2PDA. There may not be any further steps, but that will vary depending on what type of PPC you are using.

Enter Serial Number For GPS2PDA

Now that the program has been installed on your PDA, you need to enter your serial number for GPS2PDA.

GPS2PDA uses a serial number to help prevent unauthorized use of the software. This number must be entered into the software and stored on your PDA. With most Ridge Engineering software you enter the serial number when you install the program. PDAs are a little different so you need to enter the serial number the first time you run the program.

When you first run GPS2PDA, there will not be a serial number in memory, so you will be brought to this screen. Enter the 20 digit serial number that came with the program. If you received a CD from Ridge Engineering, it will be on a label on the back of the CD. When you enter the serial number be sure to include the hyphens (-) between the characters.
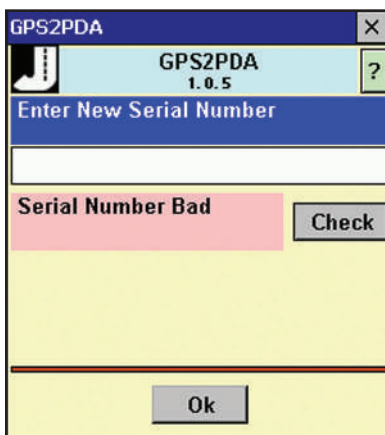
Figure A3.5 - Serial # Bad

Tap on **Check**. The software will check the number you entered to see if it is OK. If there is a problem *(usually an error entering the characters)* then the status message area will be in red, and the message ***Serial Number Bad*** displayed.

If the serial number checks out OK, then you will see a screen similar to the second screen shown here. The status message area will now be in green and the message will be the more encouraging ***Serial Number OK***. Tap **OK** to store the serial number and go to the Splash Screen.
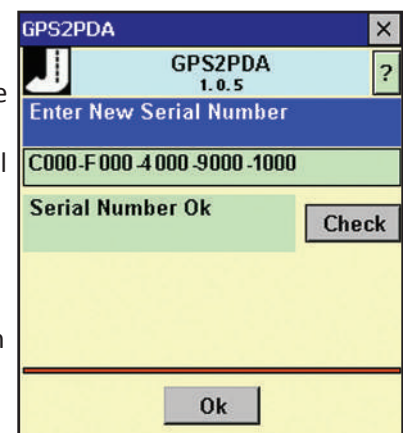
Figure A3.6 - Serial # Good

Demo Mode
If you downloaded GPS2PDA from the Ridge Engineering website just to try it out, then you can set the software to run in Demo Mode.

Tap on the **Demo** button on this screen. The serial number will change to DEMO-DEMO-DEMO-DEMO-DEMO.

Tap **OK**. The software will now operate as usual, ***except no data will be stored in the database file in the PDA*** *(so you can't actually process any data you collect)*. You can see exactly how the software will operate on your PDA. This is a good way to tell if that old PDA you have will actually work OK with GPS2PDA.

How to Transfer GPS2PDA Data from Your PDA to Your Computer

After you collect the travel time data in the field you need to transfer it your computer so PC-Travel can process the data.
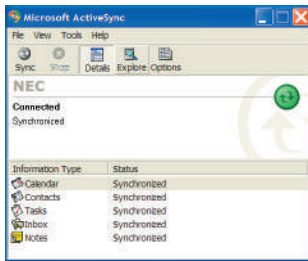
First, connect your Pocket PC to your computer and let them connect via ActiveSync. If your PPC is already connected, the easiest thing to do is remove it from the cradle then replace it. During the synchronization process, the ActiveSync window will open by itself. Click on the **Explore** icon in the ActiveSync window.

Figure A3.10 - ActiveSync

You are now looking at the *Explore Window* which displays the files and directories on your PPC. Double click on **My Pocket PC**.
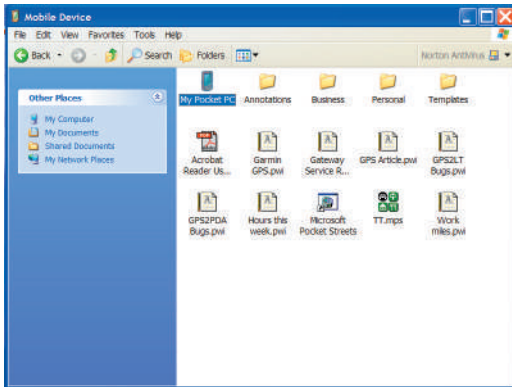
Figure A3.11 - PPC Explorer

Now double click on **Program Files**. If you installed GPS2PDA on a storage card *(or any location other than the default directory)*, these steps will be slightly different.

Figure A3.12 - Program Files

At the next screen, double click on the **GPS2PDA** folder. This is where the software saves your travel time data.

Figure A3.13 - Start GPS2PDA

PC-Travel Reference Manual
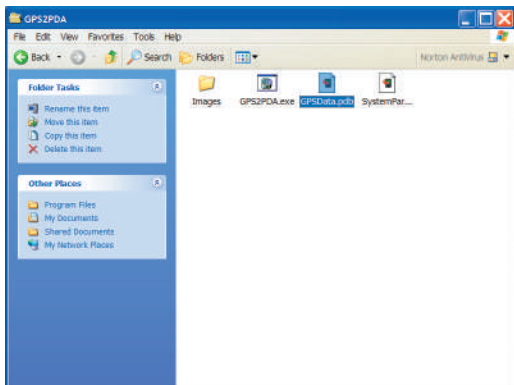
Figure A3.14 - Select GPSData.pdb

The GPS2PDA folder on your PPC will contain, among other things, a file called **GPSData.pdb**. This is the file that contains all of your travel time field data. The point of this exercise is to copy **GPSData.pdb** into the **Field Data Files** folder on your desktop computer.

Leave the GPS2PDA window that you opened through Active-Sync visible while you open the **Field Data Files** folder that is on your desktop computer. PC-Travel's setup program has installed a **Field Data Files** folder in the **PC Travel for Windows** folder. If you're not sure where to find the **PC Travel for Windows** folder, here are the steps in a nutshell:

First, open **My Computer** from your Desktop.
Double click on your **C: Drive**.
Open the **Program Files** folder, then open the **Ridge Engineering** folder.
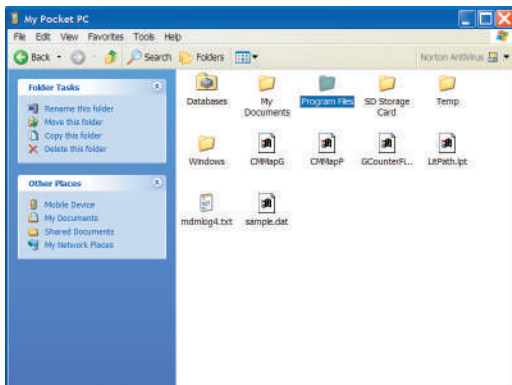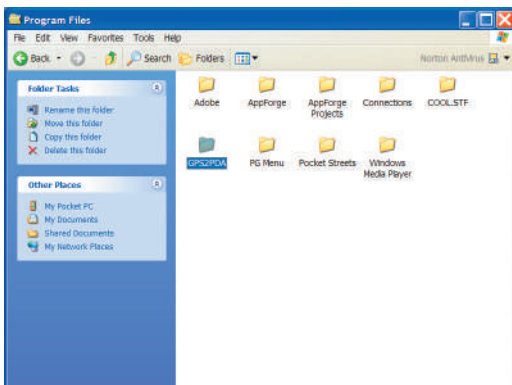Open the **PC Travel for Windows** folder. The **Field Data Files** folder is under this folder.

Now click again on the **GPS2PDA** window that applies to your PPC.

Click and hold the **GPSData.pdb** file and drag it into the second **PC Travel** window that you've opened. This
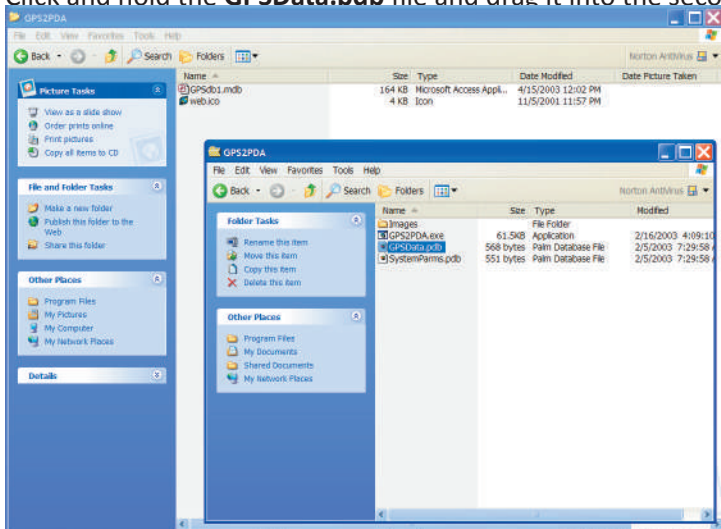
Figure A3.15 - Move GPSData.pdb

copies your travel time data from your PDA to the **Field Data Files** folder on your desktop computer. *(If you aren't comfortable dragging and dropping files on your computer then you may want to get someone to show you how to do it. Once you do it once or twice it becomes very easy.)*

Your field data is now safe and sound on your computer and your PDA is ready to be put back into action in the field. ***However, before you try to upload more field data to your computer, you need to run PC-Travel and process your current data.*** Keep in mind that you can't rename the **GPSData.pdb** file on your PDA so you must overwrite it every time you synchronize your field data. For a description of PC-Travel's use in tandem with GPS2PDA, refer back to the main section of this manual.

Appendix 4 - Palm Supplement

Palm OS Software Installation

Installation from the PC-Travel CD

Place the PC-Travel CD into the CD drive of your PC. The computer should recognize the new CD and show you the Installation Options screen, which includes an *Install GPS Travel Time Software* button. Click this button. On the next screen, click the *Install GPS to PDA* button. On the next screen, click the *Install GPS to PDA for Palm* button that is appropriate for your Palm OS. The installer wizard will then start.

Installation from a Downloaded Installer Program.

If you downloaded the installer program from the GPS2TT web site, or were emailed the installer program by Ridge Engineering, then unzip *(you need a program like WinZip to do this)* the file into an empty folder on your computer. This results in a file called **GPS2PDA Palm Installer.exe.** Double click on this file to start the install wizard.

At the *Welcome Screen*, click the **Cancel** button to quit the wizard if you have any programs currently running. Close the other programs and restart the wizard. If you agree with the copyright warning and you've performed at least one synchronization with your PDA, then click the **Next** button to carry on with your installation.
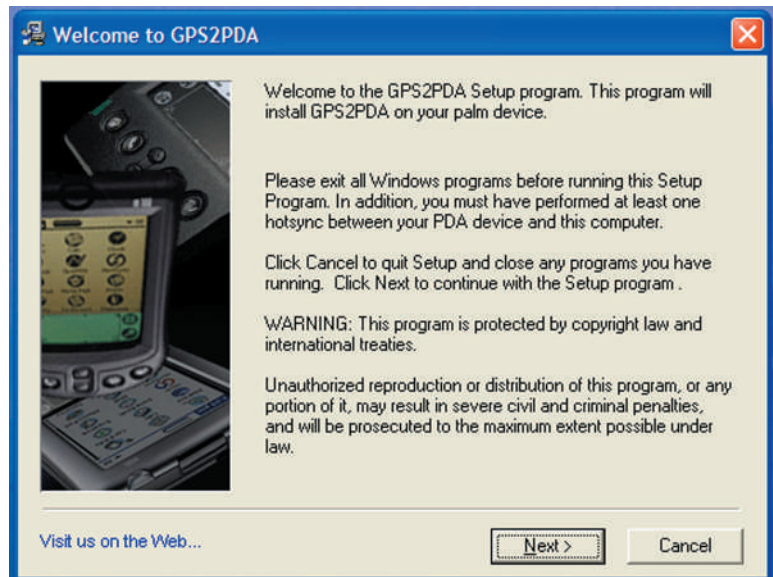
Figure A4.1 - Welcome

The installation wizard will automatically find any PDA synchronization information that you may have on your computer. If you only have one Palm device set up to HotSync with your computer, then that device is selected automatically. If you have connected more than one Palm PDA to your system, click the down arrow in the box to pick the one on which you'd like to install GPS2PDA. Once the proper Palm device has been selected, click the **Next** button to proceed.
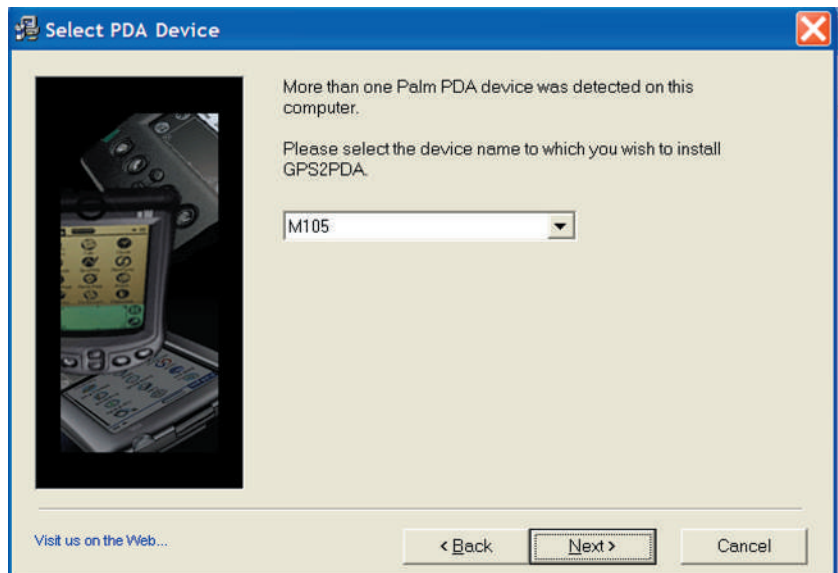
Figure A4.2 - Select Device

Finally, GPS2PDA is ready to be installed on your Palm. The program has been added to HotSync Manager's installation list so that it will be loaded onto your Palm the next time you perform a HotSync. Click the button labeled **Finish** to exit the wizard.
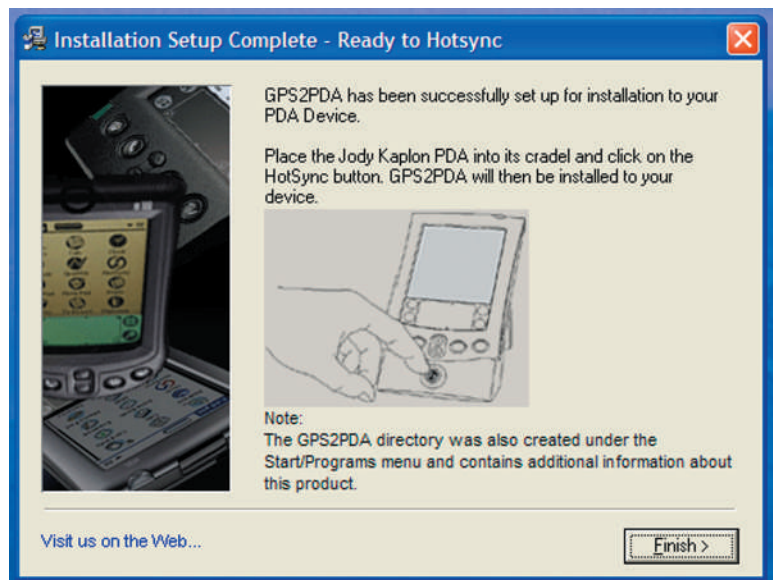
Figure A4.3 - Installation Complete

Installing the GPS2PDA HotSync Conduit

It's time to install what's known as a Conduit. This conduit is what tells HotSync to synchronize and convert your GPS2PDA data. All of the necessary conduit installation files can be found on the PC-Travel CD. The CD should already be in your CD drive *(as a result of the installation in the previous section)*. This time, click on the Install Palm Data Conduit button and the installation wizard will begin. The screens are shown below.

Figure A4.4 - Welcome

Click the **Next** button.
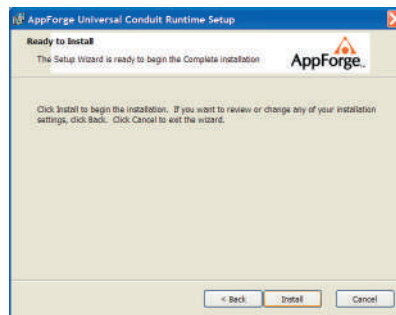
Figure A4.5 - Ready to Install

Click the **Install** button here.

Figure A4.6 - Finished

Click **Finish**.

Now double click on the **GPS2PDA.bat** file. Your screen will blink at you momentarily as this program runs. The last action of the **GPS2PDA.bat** file is to restart your HotSync Manager.

At this point, you should check and make sure that your conduit was properly installed. Here's how:
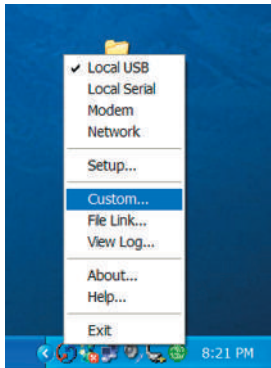
**Figure A4.8 -
Select Custom**

Click on the HotSync Manager's icon in your system tray. A menu will pop up, similar to the image here.

Select **Custom.** This will display a new window that will show a list of conduits that are performed each time you HotSync your Palm PDA.

Check to make sure that GPS2PDA is listed in this window as shown below. If it is, everything went to plan, click **Done**.
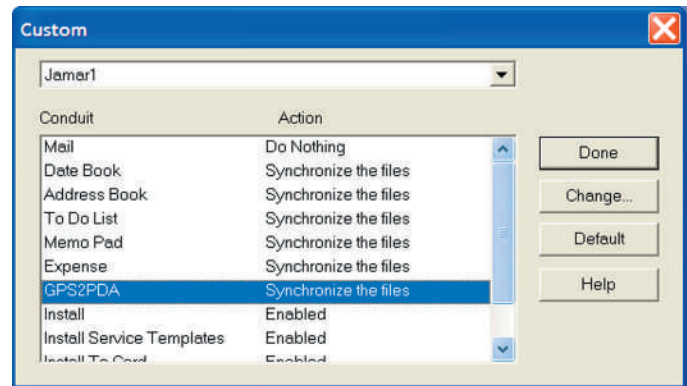
Figure A4.9 - Locate GPS2PDA

Creating an Open Database Connectivity Data Source Name (ODBC DSN)

Now the acronyms start to get scary. The conduit you just installed in your HotSync Manager wants to synchronize all of the records from the GPS2PDA database on your Palm device with some file on your desktop computer. All that remains is to tell your desktop which file should be used for synchronization.
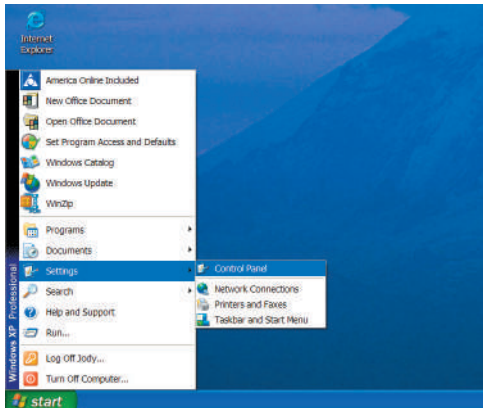
Figure A4.10 - Select Control Panel

These next steps are accessed through your PC's Control Panel. To navigate to the control panel, click on the **Start Menu**, then **Settings**, then **Control Panel**.
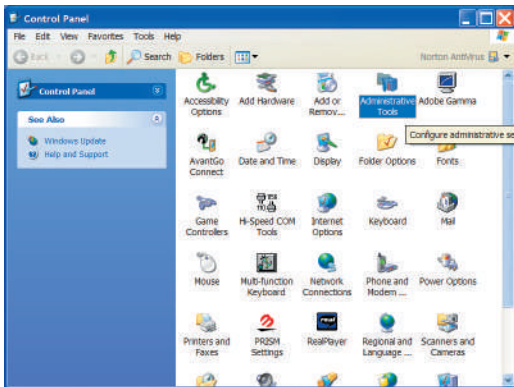
Figure A4.11 - Administrative Tools

This is your PC's Control Panel. It will look slightly different depending on which version of Windows that you are running. In Windows 2000 and Windows XP, you'll now select **Administrative Tools**, otherwise, just click on **Data Sources (ODBC)**.
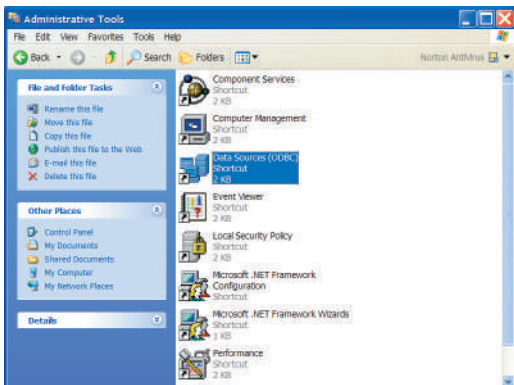
Figure A4.12 - Select Data Sources

This is the Administrative Tools screen for Windows 2000 or Windows XP. Click **Data Sources (ODBC)** to proceed.
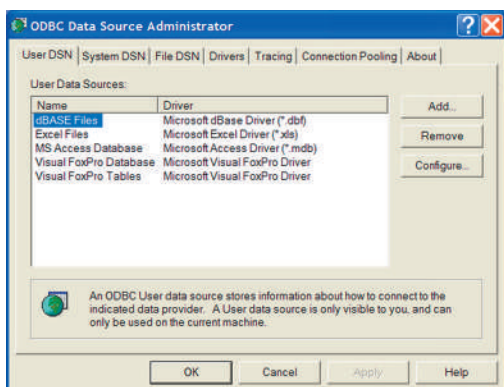
Figure A4.13 - User DSN

You're now faced with a window that has a lot of buttons and a lot of tabs; remain calm. Select the tab entitled **User DSN**. Under the **User DSN** tab, click on the **Add** button.
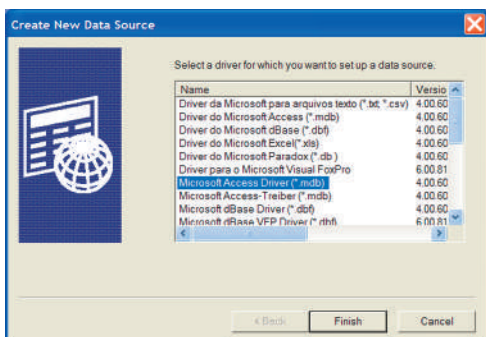
Figure A4.14 - Microsoft Access Driver

The next screen is a list of drivers. Choose the **Microsoft Access Driver (*.mdb)** option. Now click the **Finish** button to continue.
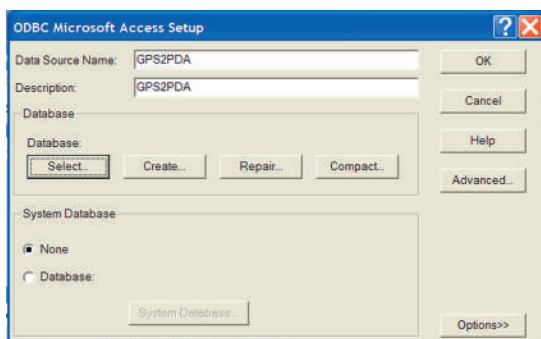
Figure A4.15 - Enter Information

For your next step, enter *GPS2PDA* in both the **Data Source Name** and **Description** text boxes. From this same window, click the **Select Database** button.
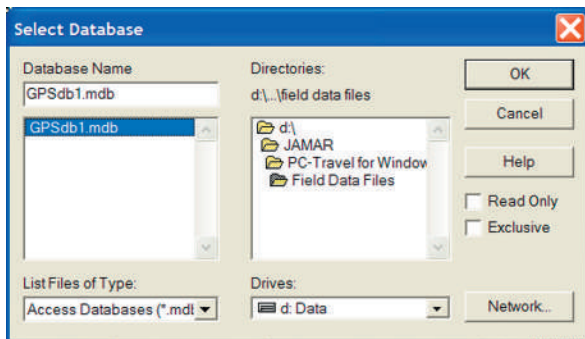
Figure A4.16 - Select Database

At the *Select Database* screen, use the tree window in the center to navigate to the **Field Data Files** folder *(it's in the* **PC-Travel** *folder)*. Once you have selected **Field Data Files** from the folder tree, a file called **GPSData.mdb** will appear in the box on the left. Select **GPSData.mdb** from the box on the left. Click the **OK** button on this screen, then click **OK** once again and you're done.

The stage is set for you to take travel time data in the field and synchronize it with your computer once you return to the office.

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How to Transfer GPS2PDA Data from a Palm PDA to Your Computer

Once you've gone through all the rigors of installing the custom GPS2PDA HotSync Conduit and creating a OBDC DSN, transferring your travel time data couldn't be easier. All that you have to do is place your Palm PDA in its cradle and press the HotSync button.

During the HotSync process, the conduit you installed will write all of your field data to the Microsoft Access Database file called GPSData.mdb that is stored on your desktop in the PC-Travel\Field Data Files folder. What actually happens is the conduit looks for a file called GPSData.pdb that is stored on your PDA. This file has your field data. The .pdb means it is a Palm Database file, a file format used in all Palm PDAs to store data.The data in this file is converted to the GPSData.mdb file that is then copied to your computer.

Your field data is now safe and sound on your computer and your PDA is ready to be put back into action in the field. *However, before you try to upload more field data to your computer, you need to run PC-Travel and process your current data.* Keep in mind that you can't rename the **GPSData.pdb** file on your PDA so you must overwrite it every time you synchronize your field data. For a description of PC-Travel's use in tandem with GPS2PDA, refer back to the main section of this manual.

For more details on using PC-Travel with GPS2PDA field data, go to the *Using GPS2PDA Data with PC-Travel* section in the main body of the manual.

Appendix 5 — Descriptions of the Preferences Options

PC-Travel has many options that you can set or select to help customize the software to your own personal preferences. These options are stored on your computer and loaded into the software each time you run the program. You view or change the options in the Preferences screens.

There are three ways to load the Preferences screens:

1 – You can select **Define/Edit Program Preferences** from the *Startup Options* screen.

2 – You can select the **Prefs** icon from the toolbar in the *Study Summary* screen.

3 – You can select **Preferences** from the **File** menu in the *Study Summary* screen.

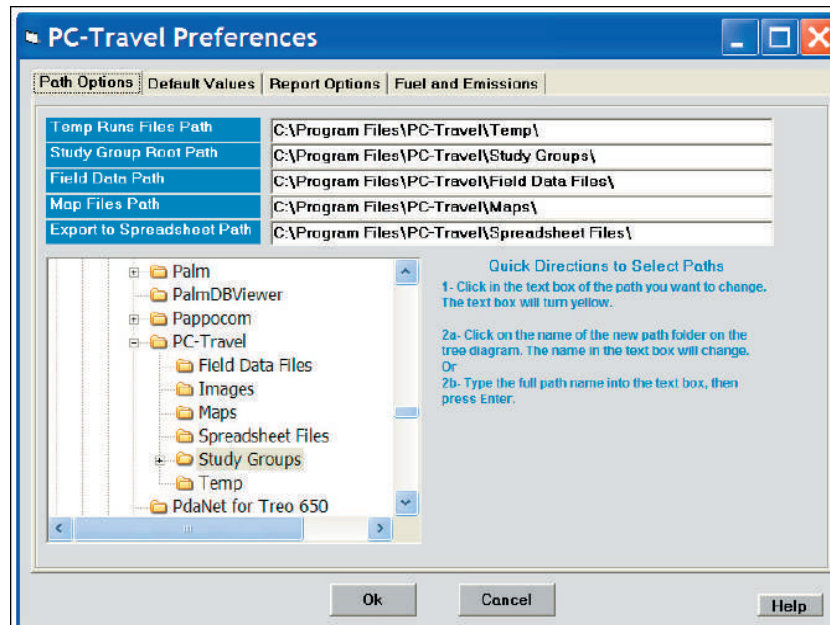If you do one of these, you will see the screen shown below.

Figure A5.1 — Path Options Screen in Preferences

The figure shown here is the Path Options screen, and is the first of the four screens in the Preferences section. The various screens are selected by clicking on the tabs at the top of the screen. There are four tabs — Path Options, Default Values, Report Options, and Fuel & Emissions Options.

Path Options
PC-Travel, like most Windows programs, stores data in files, and those files must reside somewhere on your computer in folders. Where those folders are located on your computer is called the *path*, and you can change the paths used in the program to suit your needs.

Note: If you are not comfortable with computer terms such as file, folder, directory, subdirectory & path then this isn't the place to learn it. Either find a good book on Windows (preferably) and learn how files and folders work, or (most likely) just accept the default values the software suggests and don't worry too much about it.

There are five different types of files that are used in PC-Travel, and each type of file is stored in a separate folder (or set of folders). The five paths are listed at the top of the screen.

Below the paths on the left side of the screen is a tree diagram showing how your folders are organized on your computer. If you are familiar with Windows then you should be familiar with the way this tree works; you can scroll around using the scroll bars and you can expand and contract the tree by clicking on the + and - signs to the left of the folders.

To the right of the tree is some text that gives quick directions on how to set the various paths. The basic idea is simple, you pick the file type for the path you want to change, and then you navigate to the folder you want to use for those files.

Temp Files Path
When you read a TDC-8 counter, the data is first stored in the **TDC Data Path** *(see below)*, and then each of the runs in that data is extracted and stored with a temporary name in one folder. These runs are then processed later in the Process Temporary Runs screen. The **Temp Files Path** points to this folder.

The install routine creates a folder called Temp as a subdirectory to the PC-Travel folder, and the **Temp Files Path** is initially set to this folder. You probably won't need to change this path, but you can if you find it necessary.

Study Group Root Path
The concept of a Study Group is explained in Chapter 1, but basically a Study Group is a folder where related runs and studies are stored. The **Study Group Root Path** points to the parent directory of the many Study Group folders that you create when you do your studies. All Study Groups are subdirectories of this parent directory. Several of the screens in the software show a tree diagram similar to the one in Figure A5.1. The top of the tree is set to the Study Group Root Path folder so that all you can see are your Study Groups and not your entire computer. *(There are also trees like the one in Figure A5.1 where you need to be able to navigate throughout your entire computer. These trees don't have a root path, per se.)*

The install routine creates a folder called Study Groups as a subdirectory to the PC-Travel folder, and the **Study Group Root Path** is initially set to this folder. Unless you do many travel time studies, you probably won't need to change this path, but you can if you find it necessary.

If you do plan to do lots of studies, then you may want to create different Study Group Root folders on your computer *(such as one for each year or one for each customer if you are a consultant)*. Every study you do at a new location usually ends up with two new study groups, one for each direction of travel. It doesn't take long to have dozens of study groups, which could result in a long list of study groups in the tree listings. This is fine as far as the software is concerned, but may be a little awkward to use. We suggest you initially start with the default structure that the install routine creates and see how that works. Once you are comfortable with how the software deals with study groups, files and folders, then you can create a system to handle your studies.

Field Data Path
Data collected in the field is typically copied to this folder either manually if you are using a laptop to collect your data (typically using GPS2LT) or automatically if you use PDAs to collect your data. PC-Travel looks in this folder first when it is time to process your data.

When you read a TDC counter, the data is read from the counter and stored in the folder set by the ***TDC Data Path***. You can then clear the TDC counter and use it for other things, even if you don't plan to process the travel time data immediately. At any time you can choose to process the TDC data from the Startup Options screen *(select Process Runs button)* or from the Study Summary screen *(select Process Runs in Temp Folder from the File menu)*. See Tutorial 3 for more details.

The install routine creates a folder called Field Data Data Files as a subdirectory to the PC-Travel folder, and the ***Field Data Path*** is initially set to this folder. You probably won't need to change this path, but you can if you find it necessary.

Map Files Path
One of the features of PC-Travel is support for maps to show your data collected with GPS receivers. You can edit the data in a variety of very useful ways (See Tutorial 1).

If you select ArcGIS Shapefiles as the GIS mode (see Page A.33), then this folder is used to store the shapefiles for your area. See Appendix 1 for a complete description of this process. If you use MapPoint as your GIS engine, then this folder is not used.

Export to Spreadsheet Path
A feature of the PC-Travel software is the option to export the study and run statistics calculated by the program to file formats that can be processed with other software programs. You can export to a Microsoft Excel spreadsheet file format *(.xls)* or to a generic tab delimited text file *(if you don't know what that is then you probably don't want to do it.)*

The ***Export to Spreadsheet Path*** points to the folder where the exported files are stored. The install routine creates a folder called Spreadsheet Files under the PC-Travel folder and the ***Export to Spreadsheet Path*** is initially set to this folder.

You may want to change this path if you plan to export files. You may want to have the path set to a folder that is under the software application you want to use to process the exported files. The choice is yours.

Default Values
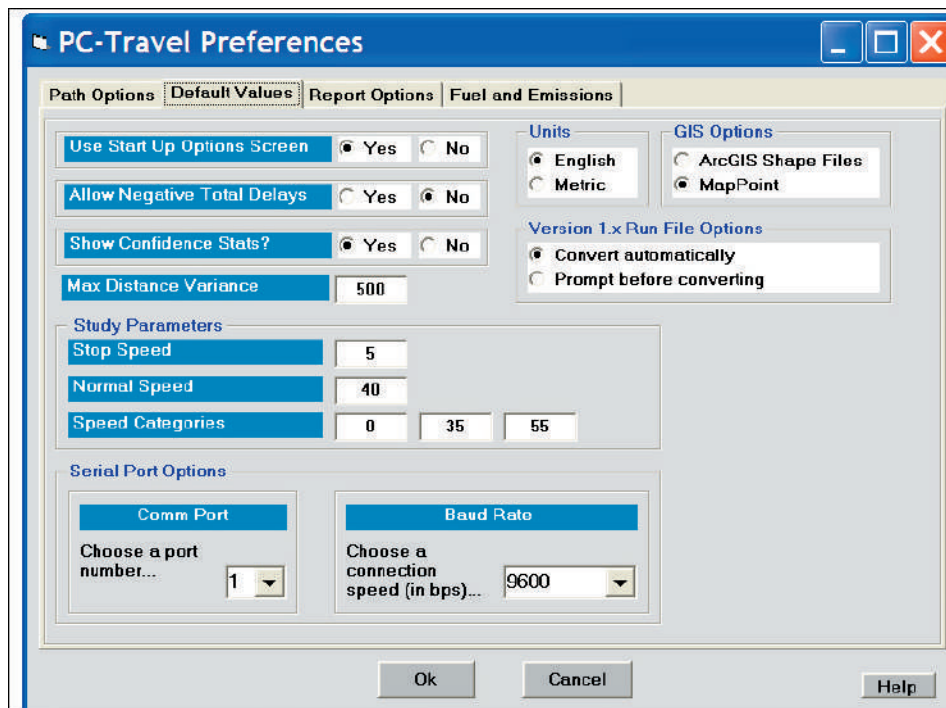
Figure A5.2 — Default Values Screen in Preferences

The figure above shows the Default Values screen, which has a hodgepodge of default options that you can set in the software. Most of these options can be adjusted in other places in the software on a study by study basis; the values on this screen are the default values that are used initially. Many of these options you will set just once and never adjust again.

Use Startup Options Screen
When you first start PC-Travel, you normally see the Startup Options. Some users don't like this screen, so for them we give them a way to turn it off. Click on the **No** checkbox and you won't be bothered again.

Units
You can choose between English and Metric units for the length and speed values shown on the screen and on the reports. The software checks this setting whenever it has to display or print a length or speed.

English units use feet for distance and Miles Per Hour (MPH) for speed. Metric units use meters for distance and Kilometers Per Hour (KPH) for speed.

GIS Options
PC-Travel supports two methods to show maps in the software. One uses MapPoint, the GIS program from Microsoft. The other uses industry standard files called Shapefiles that are used by ArcGIS, a program sold by ESRI. Shapefiles have become so comon that basically all GIS programs support them in one way or another. Recently the US government starting distributing free geographic and cartographic data in shapefile formats, making it an even more attractive option.

Max Distance Variance

Avg	Run 1	Run 2	Run 3	Run 4	Run 5
0	0	0	0	0	0
766	800	771	744	752	736
2354	2051	2420	2409	2453	2392
5463	5045	5077	5049	5086	7488
7928	7568	7505	7543	7522	9917
9934	9960	9972	9949	9885	

Figure A5.3 — Node Distances

This value is used in the Node Distances screen, part of which is shown here, to help determine if the node distances in the runs are good or not. Each run in the study is a column in the right side of the grid. Each node distance found in the run is shown in a separate row in that column. Since all of the runs started in the same place, ended in the same place, and the driver probably tried to mark each node at the same place, the assumption is that there should be the same number of nodes in each run, and the distances for each node should be about the same. Since the TDC-8 doesn't measure distances precisely *(See Appendix 6 — How Distances are Measured)*, the values won't be identical, even if the driver was very good at pressing the New Link button as he drove by the node point, but they will be fairly close.

The software compares each node distance to the average of all of the node distances for that row. If the distance is less than the **Max Distance Variance**, then the distance is shown in green. Otherwise, the distance is shown in red. Values in red alert you to a potential problem. See ***Tutorial 4 — How to Find Node Distances in Your Study*** for a complete discussion of this topic.

The default value is 500 feet, which is good if your nodes are widely spread apart, as they are in most studies. You might want to adjust this value if you like to have many nodes in your studies, and they tend to be closer together. You want the value to be high enough so that if you miss a node in the field the next node in the data (which will show up on the missing node's row) shows up with a red background. However, you don't want the value so low that you get red backgrounds on data that is OK. In general, values as low as 200 feet usually are safe.

Study Parameters: Stop Speed, Normal Speed, and Speed Categories
These parameters are described in Chapter 1. You can set the default values that are shown on the Study Summary screen when you create a new study.

Note: The values are unit-less. That means that if you change the Units from English to Metric, these numbers don't change. A value of 5 for Stop Speed means 5 MPH for English units and 5 KPH for Metric. This normally would never be an issue, since you likely will pick one unit or the other and not switch.

Serial Port Options: Comm Port and Baud Rate
You use the serial port on your computer to read the travel time data collected in the field with your TDC counter. The software needs to know the Comm Port on your computer that is connected to the TDC counter *(always using the Ridge Engineering cable that came with the counter)*. This isn't always easy to determine. If you aren't sure, try Comm 1 and try to read a TDC counter. If that doesn't work, try Comm 2.

The software also needs to know the Baud Rate that is set on the TDC counter. This setting determines the speed at which the data is transferred. The default is 9600 and really there is usually no reason to ever change this.
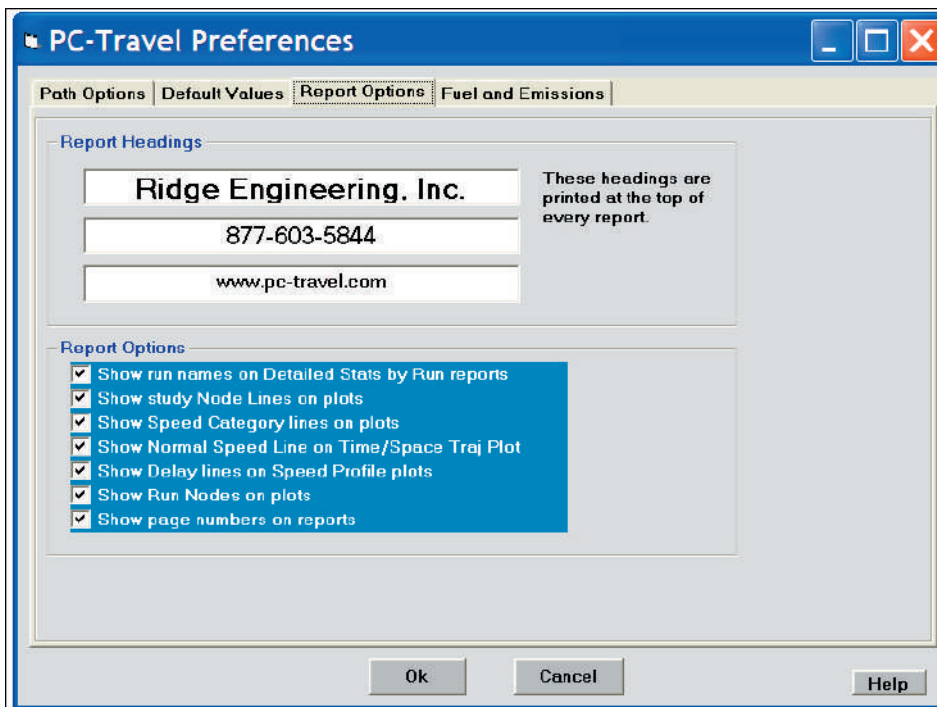
Report Options

Figure A5.4 — Report Options Screen in Preferences

PC-Travel has extensive report capabilities since the end result of almost all travel time studies are printed reports showing the results. You can customize the reports to suit your needs. The values on this screen are the default values that are used whenever you go to the Select Reports to Print screen. You can change any of these values on a report-by-report basis by clicking on the Report Options button on that screen.

Report Headings

Figure A5.5 — Report Headings

These headings are printed at the top of every report. There are three headings, but you don't have to use all three. The top line is printed in bold in a larger font size than the other two lines. All three lines are centered on the page. Normally, you set these values once and don't worry about them again. Put the name of your organization or city or whatever on the top line and your address and/or phone number on the next two lines.

If you are a consultant, however, you probably would want to have your customer's name at the top of every report. In that case, you would set the headings when you print the reports, not on this screen. Some consultants use the third line to say **"Prepared by: Acme Consultants"** or something similar.

Show Page Numbers on Reports

Figure A5.6 — Report with Page Numbers

You can easily print reports that have thirty or forty or more pages. The software even prints a Table of Contents that reference the page numbers. So normally, you would probably want to show the page numbers on all reports. However, you may print a report for your use, and want to copy just a few of the pages to send to someone else. Sending reports that say Page 2, and then Page 9, and then Page 22 may look odd. For these occasions, it might be useful to not show the page numbers on the reports. If you do this all of the time, you may want to uncheck this option.

Show Run Names on *Detailed Stats by Run* Reports

Run names can be fairly long, but the space available for the run names on the reports is limited. To solve this, the software prints the run names at an angle above the run columns. On most printers this looks fine, but on some older dot-matix printers the names come up very ragged. If you have an older printer, or if you just don't like the way the run names look, then you can turn this option off and the names won't be printed.
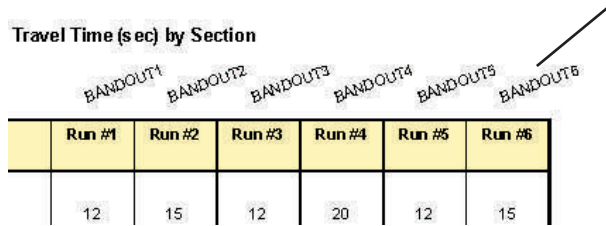

Figure A5.7 — Run Names on Report

Figure A5.8 — Node Lines and Speed Category Lines on Plot

Figure A5.9 — Normal Speed Line on Time/Space Trajectory Plot

Show Study Node Lines on Plots & Show Speed Category Lines on Plots

Node Lines: Nodes are shown on the plots as thick black lines, with the name of the node shown on the left side of the graph. You may have several nodes close to each other so that the graph looks cramped. This is unusual, but it can happen. The plot might look better without the node lines and names shown on the plot. Whatever the reason, if you don't want them on the plot, then you can turn off this option.

Speed Categories: You can set three speed categories and the software will find the time driving at or below these speeds for each node during a run. The speed categories are shown as three lines on the plots, a red line for Speed Category 1, a yellow line for Speed Category 2, and a green line for Speed Category 3. Whatever the reason, if you don't want them on the plot, then you can turn off this option.

Show Normal Speed Line on *Time/Space Trajectory* Plots

The Normal Speed is a parameter used to find Total Delay. It typically is the posted speed limit or the design speed for an arterial. The Normal Speed is shown as a thick green line on the Time/Space Trajectory plot, which is useful to show the progression of traffic through the signals on the arterial. There may be instances where the Normal Speed isn't appropriate on this plot, or the thick line might obscure the details of the smaller lines behind it *(especially on a black and white printer)*. If you don't like this option, you can turn it off.

Show Delay Lines on Speed Profile Plots & Show Run Nodes on Plots

Figure A5.10 —
Show Delay Lines on Plot
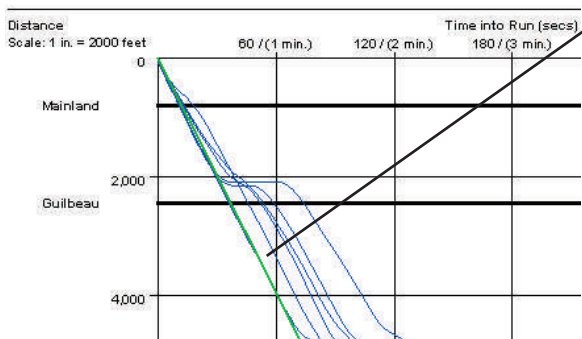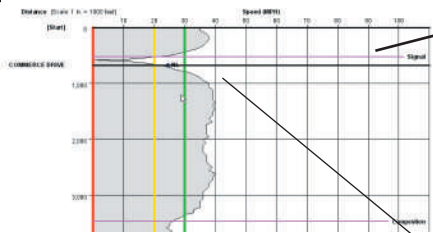
Delay Lines: You have the option to mark reasons for delay when you do a travel time study. You do this by pressing different buttons on the TDC-8 as you do each run. You can have the graphs show where the delay buttons were pressed *(the pink line)* along with the meaning of the button *(the text at the end of the pink line)*.

Run Nodes: The Node Lines shown on the plot are for the entire study, and usually are the average of all of the node distances for the runs in the study. You can have the graphs show where the node button was pressed for this run. The software prints a small solid circle and the text "NL" at the proper distance. This should always be right next to the node line. Sometimes the average distance used for the study appears to put the node a couple of hundred feet away from where the actual node for that run occurred, which may be on the wrong side of the intersection. Showing the Run Nodes may help explain why the delay appeared to occur after the intersection instead of before it.

Fuel and Emissions
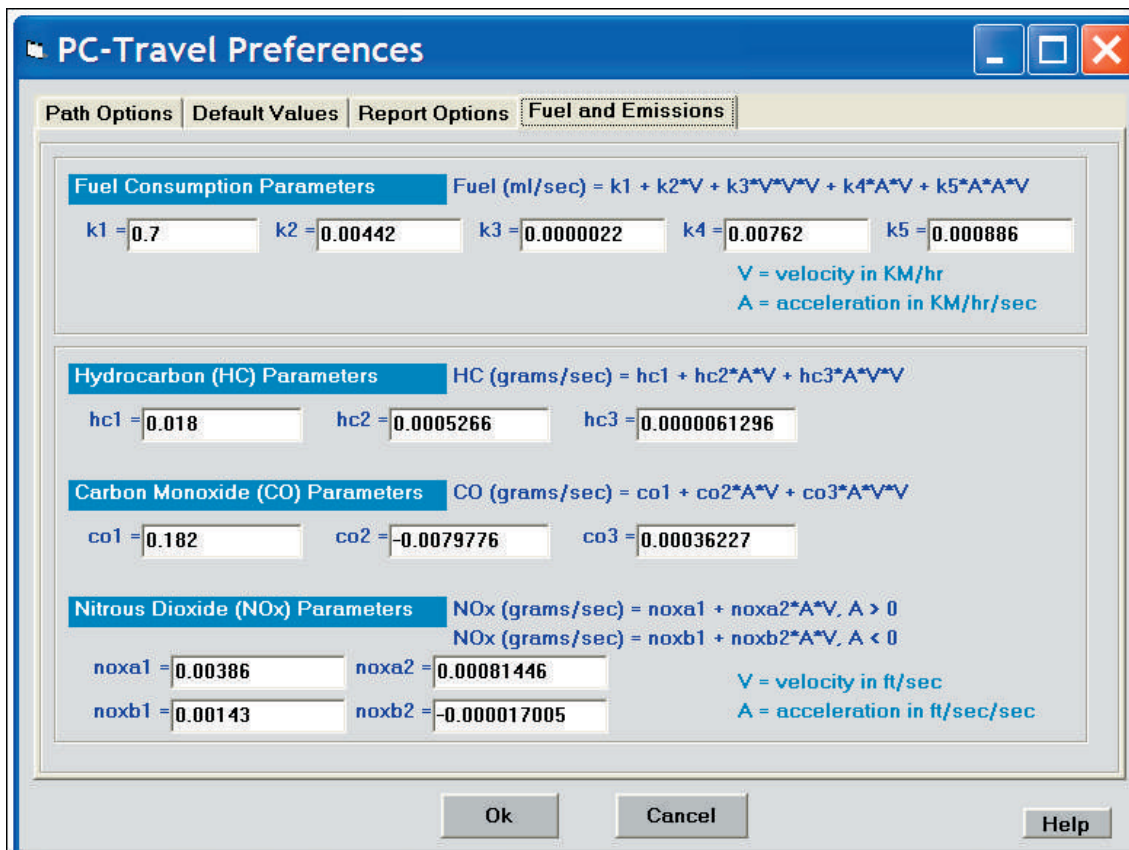
Figure A5.11 — Fuel & Emissions Screen in Preferences

PC-Travel can calculate fuel and emission statistics using fairly simple models developed over ten years ago. These models use formulas that have a variety of constants, shown in the figure above.

The default values are shown in the white text boxes. You can edit any of these values if you so desire.

Unless you understand exactly what you are doing, we suggest you leave them alone.

Appendix 6 — How Distances are Measured

PC-Travel is a travel time and delay analysis program and is not intended to be used as a distance measuring instrument like the RAC (Road Analysis Computer) distance measuring devices that Ridge Engineering sells. However, distance traveled is a component of travel time, and understanding the way distances are measured and calculated may help you to understand the results of your travel time analyses.

Data is collected in the TDC-8 by counting the number of pulses coming from the transmission sensor and storing the count on a second by second basis. Each pulse from the sensor represents a constant distance traveled by the vehicle. The software converts the number of pulses to distance using the Calibration Constant that you found when you calibrated your vehicle. Therefore, the TDC-8 measures the distance traveled every second, which is the speed of the vehicle. We say the data collected by the TDC-8 is the *instantaneous speed* of the vehicle on a second by second basis.

When you push one of the buttons on the TDC-8, either the New Link button or one of the delay buttons, the TDC-8 adds a marker to the data for the second in which you pushed the button. All the analysis software can tell from the data stored in the TDC-8 is that you pushed the button sometime during a particular second. Also, only one button push can be stored in any given second. If you push a button twice in the same second, the second button is stored in the next second *(you almost never do this in travel time studies)*.

It is important to remember that you are using this program to measure travel times and delays, and that as long as the distance measurements are accurate enough to accurately report speed and travel time and also are accurate enough for traffic operations purposes, then everything is OK. If you really want to be able to measure distances very accurately, then you should use a true distance measuring instrument like a Jamar RAC-200. However, that won't give you the history of speeds and stops, which is the reason for PC-Travel.

The way the data is collected has some subtle implications, especially in the way that distances are measured:

> **Distance measurement is not continuous, it jumps in second by second increments.** The faster you are going the larger the jumps from second to second. If you are traveling at 60 MPH *(88 ft/sec)* then each data point is 88 feet from the last data point.

> **Any button pushes can only be measured to the nearest second in time, and to the distance traveled in that second.** If you are traveling at 60 MPH and push the New Link button, the software only knows the distance to within 88 feet *(the distance at the beginning of the second in which the button was pushed to the distance at the end of the second)*.

> **The total length of the route you travel is measured accurately.** If you start a run going 30 MPH *(by pressing the DO button)* and end a run going 30 MPH *(by again pressing the DO button)* then the total error in the route distance will be 2 X 44 feet *(the error in the starting second and the error in the ending second)*, plus the error in the transmission sensor *(which is about 1 foot per mile),* or less than 100 feet even if the entire route is 5 miles or more long. This is more than adequate for travel time and delay studies.

> **The Node Distance errors are proportional to the speed of the vehicle when the New Link buttons are pressed.** Again, if the vehicle is going 60 MPH as it passes through several nodes, then each time you press the New Link button, the software will only be able to calculate the distance to within 88 feet, even if you precisely press the button at the same place during each run.

It is this last implication that is the most noticeable in PC-Travel. It is the reason that the **View Node Distances** screen *(part of which is shown in figure A6.1)* is designed the way it is. Assuming you press the New Link button

Avg	Run 1	Run 2	Run 3	Run 4	Run 5
0	0	0	0	0	0
766	800	771	744	752	736
2354	2051	2420	2409	2453	2392
5463	5045	5077	5049	5086	7488
7928	7568	7505	7543	7522	9917
9934	9960	9972	9949	9885	

Figure A6.1 — Node Distances

for each node on every run, you will have several measurements for each node distance, one for each run. The software finds the average of the individual node distances and makes that distance the node distance which is used in the rest of the program. The assumption is that the average of the individual node distances should be more accurate than any one set of distances from just one run. Averaging will help correct for the error associated with the way the data is stored in the TDC-8, as well as the error associated with trying to push the New Link button at exactly the same place each run while you are driving.

Normally, the error in the node distance measurements is small enough to ignore, especially if you do collect node distance information for each run. The only time when the distances may not be completely adequate is when two nodes *(signals, typically)* are very close together on a high-speed arterial. Say, for example, that the speed on a street is 40 MPH *(about 60 ft/sec)* and two signals are only 200 feet apart. The software may inaccurately report the distance between these two signals by as much as 60 feet, though it will accurately report the travel time between them. Again, the inaccuracy will not affect operational analysis, but you may not like the look of it. In this case you can manually edit one of the distances on the Node Distances screen so that the distance between the two signals is what you and others who know the road would expect to see.

If it is important that the Node Distances are very accurate, you have at least two choices *(we don't recommend either of these since normally the distances are fine, but we like to be thorough)*:

> 1 – **Use a true distance measuring instrument like the Ridge Engineering RAC to measure the distances accurately**. This involves driving the route with the RAC connected to the transmission sensor either before or after you collect the travel time data. Then manually enter the distances into the **Node Distances** screen. There is no need to collect any node information during the travel time runs if you find the distances with a RAC.

> 2 – **Use the TDC-8 to measure the distances accurately** by driving the route and slowing the vehicle down as slow as possible *(to a stop is best)* before pressing the New Link button. Since the error in the distance measurement is proportional to the speed of the vehicle when you press the button, slowing to a low speed will make the measurement more accurate. Of course, this may not be possible or practical to do; you can't always slow down at will. However, it is an option if you don't have a RAC distance measuring instrument and want very accurate node distance information *(Hey, just go out at 4 in the morning. The traffic is light and you get too much sleep anyway).* Don't use this run in your travel time study, since it doesn't represent true driving behavior. Just use it to find the distances and then manually enter the distances into the Node Distances screen. As with the DMI option there is no need to collect any node information during the travel time runs if you find the distances with a separate run.

Warning: Avoid the temptation to use your GIS database *(if you have one)* to measure the distances between nodes. GIS maps don't usually accurately represent the up and down motion of the vehicle as it drives up and down little hills or grades on your route. The result is that the distances you get from your GIS measurements are usually shorter than the distances measured with the transmission sensor in your vehicle. The nodes won't be where they should be on your plots and the node-to-node statistics won't be correct.

Appendix 7 — Utilities

This appendix describes three utilities included with PC-Travel to help you organize your data. The first lets you edit runs on your computer whether they are included in studies or not. The second lets you delete temporary runs that may accumulate in your Temp folder. The third lets you delete TDC data files that you read from your TDC hand held counters and no longer need after you have processed the data into runs.

Select Run and Edit Run Details

When you read a TDC counter with travel time data the software creates temporary runs from the data. These temporary runs are then renamed and moved to their own Study Groups in the ***Process Runs in Temp Folder*** screen. The runs contain most of the information needed by the software to process the run data into study statistics, but not all. For example, the date and time of the run is already known, but the node names are not. At some point you need to edit the information in each run. There are two ways you can do this.

One way is to create a study with the new runs and then edit each run in the study to complete the information. The sequence would be as follows:

1 – Read the TDC and process the runs. You'll end up with the runs from the data in their own Study Groups.
2 – Create a new study *(Click on the icon labeled **New** on the toolbar)*
3 – Add the runs for that study. *(Click on Add Run(s) button and select the runs for that study)*
4 – Show the Run Details screen for each run in the study. *(Click on the Run Title and then click **Show Details**)*
5 – Edit the run as needed and then save it. Do this for each run in the study.
6 – Process the study as usual.

This is the sequence you normally would follow if you process your runs and create and print your studies all at the same time.

Alternatively, you can edit the run information without creating any studies. Then when you create the studies you won't have to deal with the runs; you'll know they are already complete. The sequence for this method would be:

1 – Read the TDC and process the runs. You'll end up with the runs from the data in their own Study Groups.
2 – Show the Run Details screen for each run. *(Click on the **Edit Run** toolbar and select the run)*
3 – Edit the run as needed and then save it. Do this for each run you processed from the TDC data.
At some later date:
4 – Create a new study. *(Click on the icon labeled **New** on the toolbar)*
5 – Add the runs for that study. *(Click on Add Run(s) button and select the runs for that study)*
6 – Process the study as usual.

With this sequence, you completely take care of all of the runs after you read them from the TDC before you worry about putting them into studies. This is a good sequence to follow if you don't necessarily create and print your studies immediately after you read the data from the TDC.

Which of these two sequences you use is completely up to you.
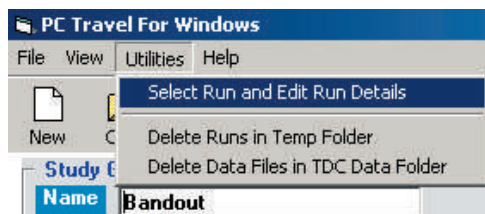
How to Select a Run to Edit

Figure A7.1 — Select Run

You can edit any run on your computer at any time. From the main screen *(it doesn't matter what study is currently visible)*, click on **Select Run and Edit Run Details** from the **Utilities** menu, as shown in the figure here. This will bring up the screen shown in Figure A7.2.
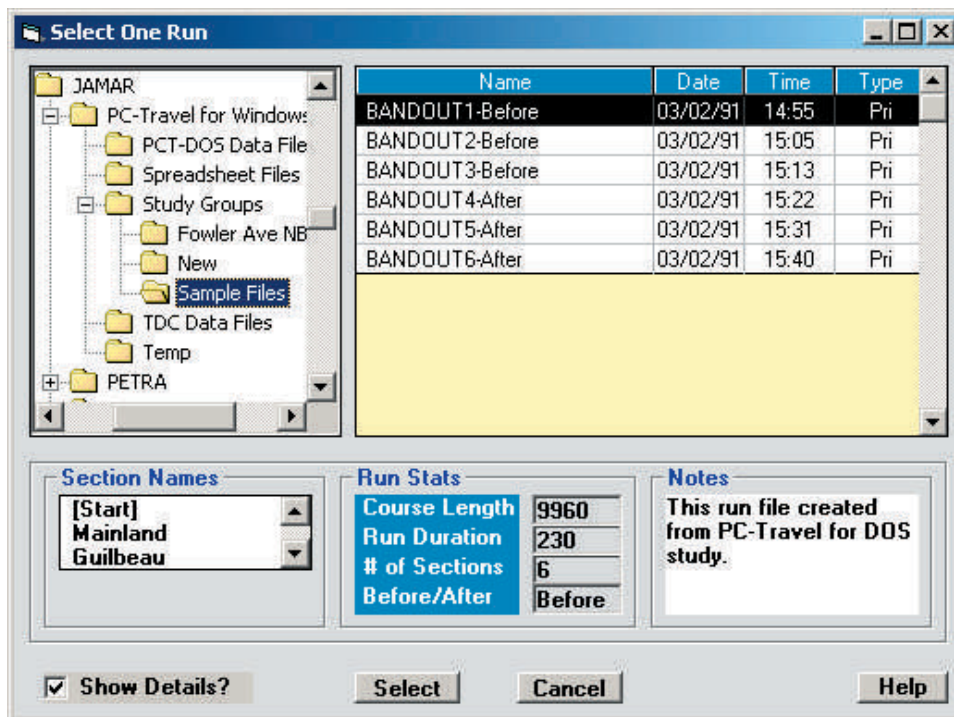

Figure A7.2 — Select One Run Screen

This screen has three main sections. The upper left shows the familiar tree structure, with the current Study Group highlighted. You can navigate to other Study Groups if necessary. The upper right shows the runs in the highlighted Study Group, along with the Date, Time, and Type of run *(Primary or Secondary)*. The lower portion of the screen shows details of the run that is highlighted in the upper right window.

Navigate, if needed, to the Study Group that has the run you want to edit. Click on the run in the upper right window. Check the details and make sure it is the run you want, then click **Select**. You can click **Cancel** to exit at any time. When you click **Select**, the **Run Details** screen for that run is displayed.

The **Run Details** screen shows just about everything we know about this particular run. This screen is described on page 1.15 of this manual so that information won't be repeated here.

You want to edit the information on this screen so that all of the information shown is correct. Normally, this just requires you to edit the node names *(this is described in detail in **Tutorial 3 — How to Edit Nodes in Individual Runs**)* and possibly enter some notes from your field notes. You can check the data by looking at the Stats and the Plot to see if there are any obvious problems. You may occasionally need to edit the sensor data to get rid of little problems you find *(this is described in **Tutorial 5 — How to Edit Sensor Data**)*.

Remember to edit all of the runs you created from the TDC data. Normally, the runs are in two separate Study Groups for each route, one for each direction. Don't forget to do the runs in the second direction after you finish with the runs in the first.

Delete Runs From Temp Folder

When you read a TDC counter with travel time data the software creates temporary runs from the data, which are stored in the Temp folder that has been set in the Preferences screen. These temporary runs are then normally renamed and moved to their own Study Groups in the **Process Runs in Temp Folder** screen, which empties the Temp folder. Occasionally, however, runs may accumulate in the Temp Folder for a variety of reasons. You may have some bad runs that you don't want to use in studies. You can delete these one at a time in the **Process Runs in Temp Folder** screen, but you may forget. Or, you may read a TDC count board twice for some reason and create duplicate runs that you have already processed. Whatever the reason, if you find your Temp folder has files you don't want then there is an easy way to get rid of them.
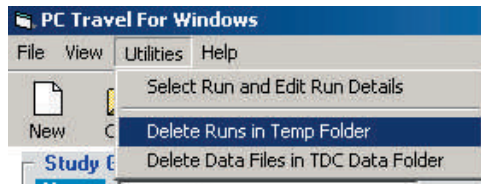
From the main screen, select **Delete Runs in Temp Folder** from the **Utilities** menu, as shown here. This will bring up the **Select Temp Runs to Delete** screen shown in Figure A7.4.
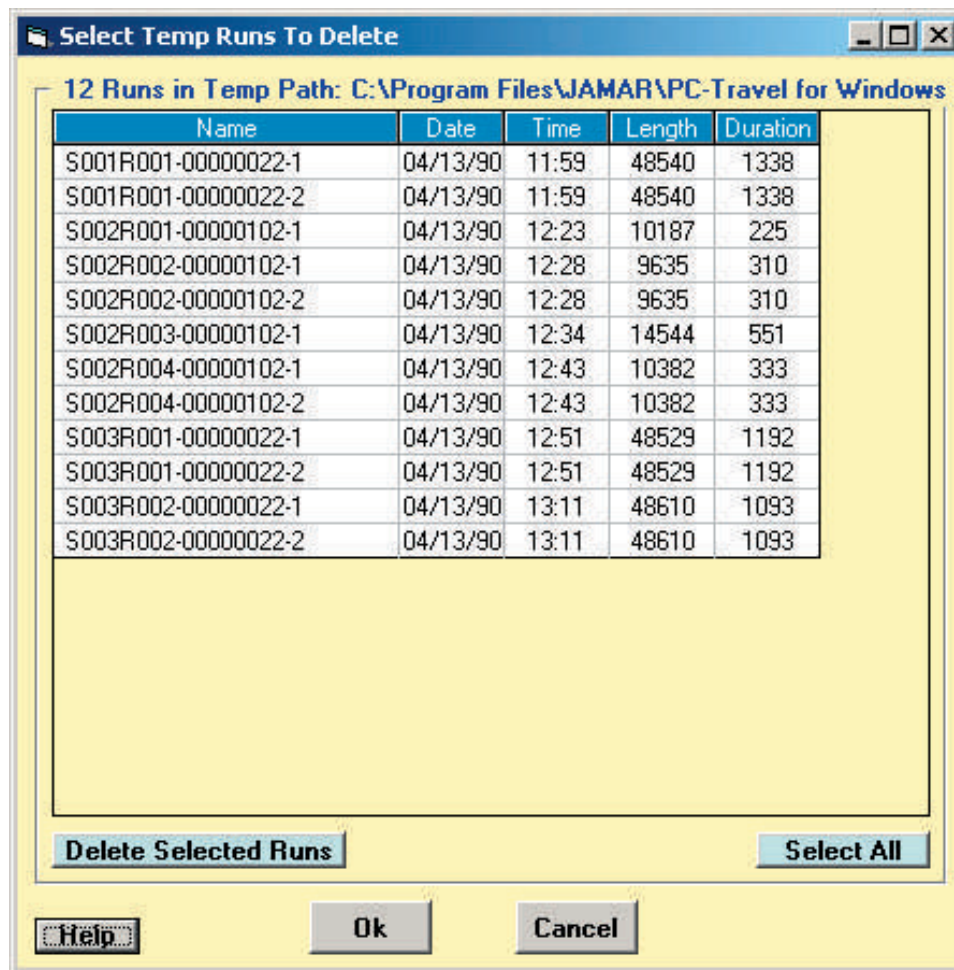

Figure A7.3 — Delete Runs in Temp

Figure A7.4 - Select Temp Runs To Delete Screen

This screen shows a list of runs in your Temp folder. The number of runs and the path to the Temp folder are shown at the top of the screen. The Name, Date, Time, Length, and Duration of each run are shown on each line in the list. If you click on a line then that line is highlighted. If you click on the line again, the highlight disappears.

Below the list are two buttons, one labeled **Delete Selected Runs**, the other **Select All**.

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Click on each run you want to delete to highlight that run. If you want to select all of the runs, then click on **Select All**. You can click on any selected run to un-select it. When all of the runs you want to delete are highlighted, click on **Delete Selected Runs**. Those runs disappear from the list.

The runs aren't actually deleted from your computer yet. That doesn't happen until you click the **OK** button. If you select one or more runs by accident and click the **Delete Selected Runs** button *(so they are no longer listed on the screen)*, you can just click on **Cancel** to return to the main screen without deleting any runs. Then you can return to this screen and select the runs you meant to select the first time.

Continue to select runs to delete and click the **Delete Selected Runs** button. When all of the runs you want to delete are gone, click on the **OK** button. The runs are permanently deleted from your computer.

You may never need to use this utility, but it is there if you do.

Delete TDC Data Files From TDC Folder

When you read a TDC counter the software first creates a copy of the data from your TDC counter and then stores that data in your TDC Data folder in a file. The path to this folder is set in your Preferences settings. The file is automatically given a name based on the current date and the number of times you read a TDC counter that day. For example, if you read a TDC counter on Dec 4, 2000 then the file would be given the name **!PC-Travel-12-04-00-1.tdc**. If you read another TDC counter that day, the second file would be **!PC-Travel-12-04-2.tdc** (*the ! is a convention some people use for temporary files*).

The .tdc file is immediately and automatically processed into runs which are stored in your Temp folder, without you ever interacting with them at all.

Normally, you don't ever need to think about these files. The files are not automatically deleted, however, so over time you may accumulate a number of these files on your computer. They don't do any harm, but after you have processed the data, they don't do any good either. If you want to, they are easy to delete.
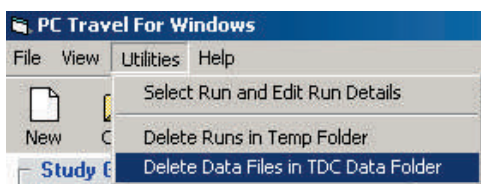

From the main screen, select **Delete Data Files in TDC Data Folder** from the **Utilities** menu, as shown here. This will bring up the **Select TDC Data Files to Delete** screen shown in Figure A7.6.
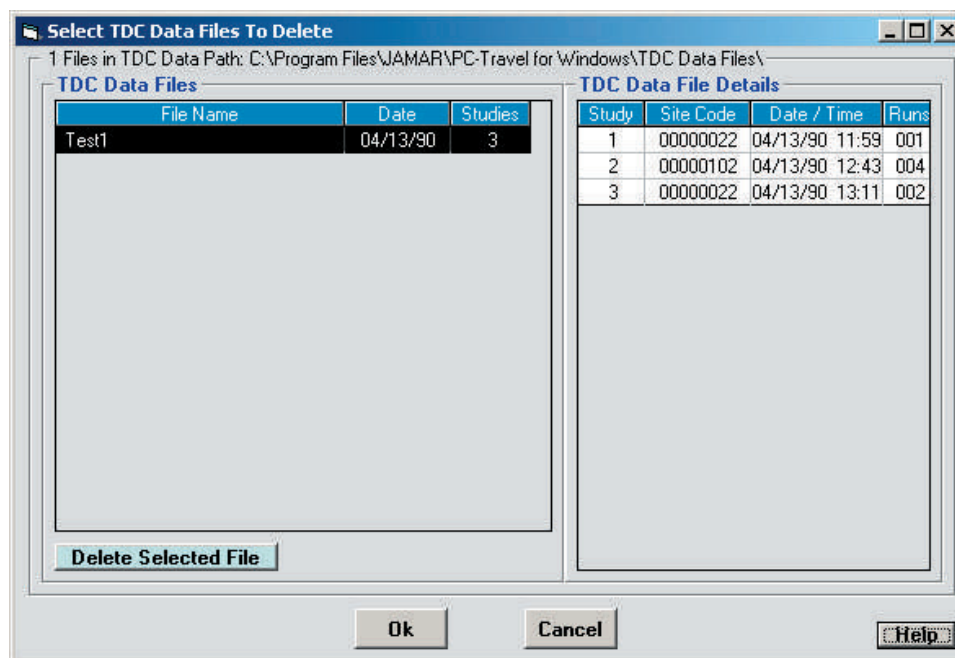
Figure A7.5 —
Delete TDC Data Folder Files

Figure A7.6 - Select TDC Data Files To Delete Screen

There are two main sections to this screen. The left side, labeled **TDC Data Files**, shows a list of the data files in the TDC Data File folder. The list shows the name of the file, the date the file was created *(not when the data was collected)*, and the number of studies in the data.

The right side, labeled **TDC Data File Details**, shows details of the studies found in the highlighted data file, including the Site Code entered in the TDC counter when the study was done, the date and time of the first run in the study, and the number of runs in that study. The intent is to give you enough information about the data so that you can make an educated decision about deleting that file.

Click on a data file in the *TDC Data Files* window. Check the *TDC Data File Details* window. If you want to delete this file, click on the **Delete Selected File** button. The file disappears from the list.

The file isn't actually deleted from your computer yet. That doesn't happen until you click the **OK** button. If you select one or more files by accident and click the **Delete Selected Files** button *(so they are no longer listed on the screen)*, you can just click on **Cancel** to return to the main screen without deleting any files. Then you can return to this screen and select the data files you meant to select the first time.

Continue to select a data file to delete and click the **Delete Selected File** button. When all of the files you want to delete are gone, click on the **OK** button. The files are permanently deleted from your computer.

Why Doesn't the Software Automatically Delete the TDC Data Files?
As explained above, you normally never see the TDC data file. The software creates the file when you read the TDC counter and then immediately processes the data into temporary run files, which is where you first see the data from the TDC counter. In theory, we could delete the data file as soon as it is processed into temporary runs.

We don't do that in case there is some sort of problem with processing the runs. You may run into a problem that requires us to send you updated software. If you have the TDC data file, you don't need to have the TDC counter available. Or we may ask you to send us the TDC data file so we can see what problems you are having. This probably won't be necessary, but just in case, we don't delete the file — you do, and only when you are sure you'll never need that data again.

Appendix 8 — Notes on Fuel and Emissions

The Fuel and Emission statistics in PC-Travel uses the same microscopic simulation models as in PC-Travel for DOS. This was done for two reasons. First, it allows continuity between the two programs. If you are comparing data from studies done with the two programs the calculations will compare easily. Second, it was easy to do since all of the information needed to do the code was available.

Figure A8.1 — Fuel and Emissions

This is the Preference screen showing the Fuel and Emissions constants. The values shown are the default values used in PC-Travel for DOS. You can edit them if you want to and know what you are doing. I'd leave them alone unless you are sure.

The Fuel and Emissions statistics show up in a variety of places in the program.

1 – Run Stats You can see the Fuel and Emissions calculations for any single run.

2 – Study Stats You can see the Fuel and Emissions calculations for the entire study.

3 – Reports You can print summary reports or individual run reports showing total Fuel and Emissions.
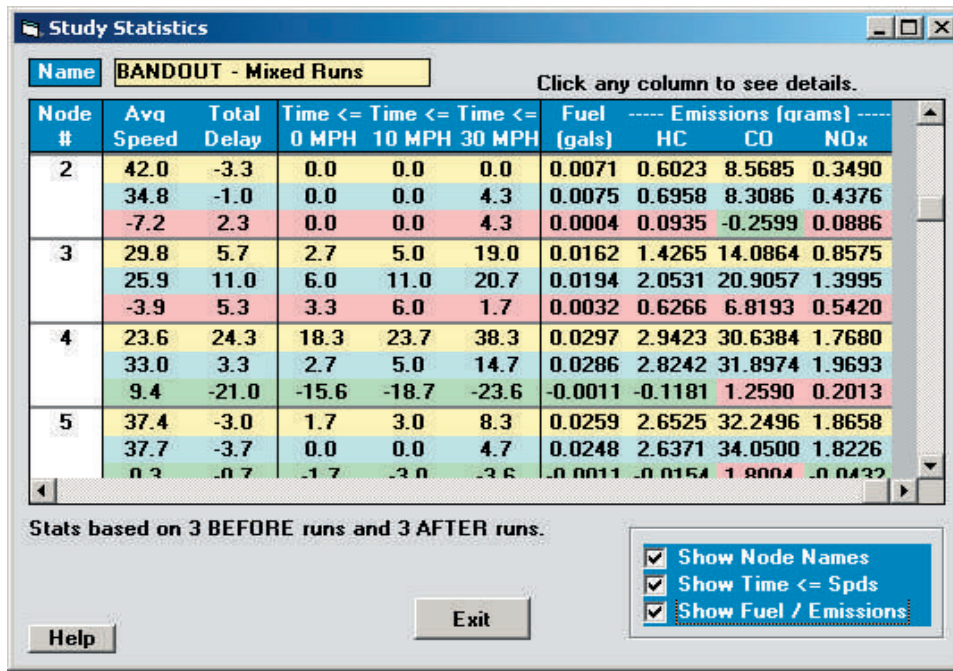
Figure A8.2 — Fuel and Emissions Stats

This screen shows what the Fuel and Emissions statistics look like on the *Study Stats* screen. Select the **Stats** icon from the toolbar to see this screen.
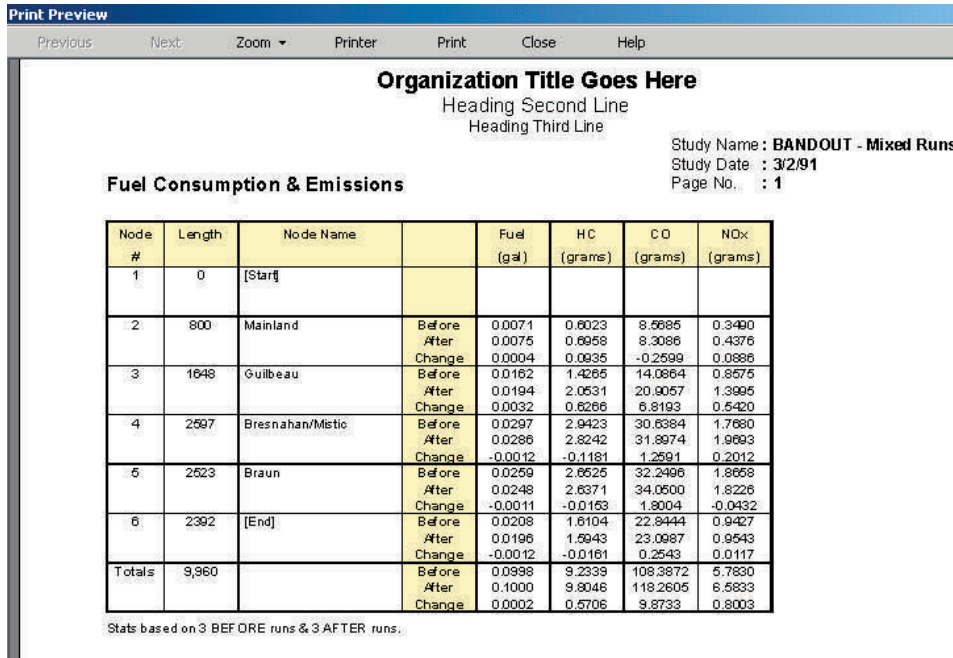

Figure A8.3 — Fuel and Emissions Print Preview

This screen shows the Print Preview of the *Fuel and Emissions Summary* report.

If you have ideas on other ways to present this type of data, or if you have information about these or other models you would like to see a part of the program, then please let us know.

Appendix 9 — Field Worksheet

Fill out the top section and the Node info before you start the runs. Use one sheet for each count.

You could put a rough sketch of the route on the back of the worksheet, especially to show temporary things like work zones.

Reverse the numbering to remind you of the order of nodes in the opposite direction. The numbers match the numbers shown on the TDC-8 during the run.

Mark the End and Start Nodes to remind you to press the DO key at these nodes.

Put the direction and starting time at the beginning of each run.

Add any comments at the end of each run.

PC-Travel Field Worksheet

| Location: | 56th ST | | Date: | 5-11-08 |
| Site Code: | | | Calibration: | GPS |

Nodes:

Start/End		PURITAN			
1	RIVERHILLS		16	
2	BUSCH		17	
3	TEMPLE HEIGHTS		18	
4	MISSION HILLS		19	
5	DRUID HILLS		20	
6	WHITEWAY		21	
7	FOWLER		22	
8	122nd		23	
9			24	
10			25	
11			26	
12			27	
13			28	
14			29	
15			30	

Runs:

	Dir	Time	Comments		Dir	Time	Comments
1	NB	5:21	OK	2	SB	5:30	OK
3	NB	5:39	LINK AT BUSCH?	4	SB	5:45	OK
5	NB	5:55	SLOW TRUCK	6	SB	6:01	NO LINKS
7	NB	6:09	OK	8	SB	6:18	NO LINKS
9				10			
11				12			
13				14			
15				16			
17				18			
19				20			

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Remember: The point of the worksheet is to record what happens during the runs so the information can be entered properly and easily into the software back in the office. Also focus on items that might effect the interpretation of the data---odd traffic patterns, weather considerations, accidents, work zones, etc. Ask yourself, "What do I want to remember about these runs 6 months from now?"

PC-Travel Field Worksheet

Location: _____   *Date:* _____

Site Code: _____   *Cal Constant:* _____

Nodes:

Start/End _____

1 ___ _____   16 ___ _____
2 ___ _____   17 ___ _____
3 ___ _____   18 ___ _____
4 ___ _____   19 ___ _____
5 ___ _____   20 ___ _____
6 ___ _____   21 ___ _____
7 ___ _____   22 ___ _____
8 ___ _____   23 ___ _____
9 ___ _____   24 ___ _____
10 ___ _____   25 ___ _____
11 ___ _____   26 ___ _____
12 ___ _____   27 ___ _____
13 ___ _____   28 ___ _____
14 ___ _____   29 ___ _____
15 ___ _____   30 ___ _____

Runs:

#__Dir__Time_____Comments   #__Dir__Time_____Comments

1 _____   2 _____
3 _____   4 _____
5 _____   6 _____
7 _____   8 _____
9 _____   10 _____
11 _____   12 _____
13 _____   14 _____
15 _____   16 _____
17 _____   18 _____
19 _____   20 _____

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