GUIDELINE

for

COLLECTING AND ANALYZING OF TRAVEL TIME STUDIES DATA OF FLORIDA ROADWAYS USING GPS TECHNOLOGY

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12. Abstract

This project represents an effort to develop a fundamentally sound data-acquisition procedure that permits the Florida Department of Transportation to collect meaningful travel-time data, accurately and efficiently, in a systematic manner. In addition, an analytical software tool is developed to perform statistical analysis on the travel-time data.

Objectives:

1. To evaluate the potential of a portable GPS device as an effective research tool for conducting moving vehicle studies.
2. To evaluate or develop applications programs for reading and subsequently compiling the raw data acquired by the GPS unit.
3. To evaluate or develop application software for computing the distance, travel time, delay, stops, and fuel consumption based on the data collected by the GPS unit.

The chapters of the guideline are as follows: Chapter 1: Introduction; Chapter 2: Developing and Implementing a travel time data collection plan; Chapter 3: GPS hardware installation and usage; Chapter 4: Travel time data analyzer software tool usage; Appendix A: Travel time data collection quick checklist; Appendix B: Travel time data collection logbook sheet for data surveyors; Appendix C: Time Manager GPS software manual; Appendix D: Time Manager GPS product overview; Appendix E: Time Manager GPS specification.

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1 INTRODUCTION

The traffic flow in the roadway system has enormous impact on the society in terms of public safety and health, the natural environment, and the economy at large. It is of paramount interest to the transportation engineers and regional planners to monitor the traffic-flow conditions on the roads.

In any roadway system, the traffic flow is affected by many factors. The key factors include road capacity, traffic volume, occurrence of traffic incidents, and traffic management scheme. Travel time represents a fundamental measure of traffic-flow conditions. Travel time is a simple concept understood and communicated by a wide variety of audiences, including transportation engineers and planners, business persons, commuters, media representatives, administrators, and consumers. It is taken to be the time required to traverse a route between any two points of interest. The travel time, however, must be properly measured in order to gauge traffic conditions in a truly meaningful manner. Further, appropriate statistical analysis should be performed on the travel-time data to mine information relevant to traffic management as well as economic planning and development. In essence, an up-to-date and accurate measure of travel time for a geographical region enables the public transportation engineers and planners to implement schemes and policies that will improve public safety, public health, the environment, and enhance economic growth as well.

Florida DOT is seeking some analysis techniques and measures that are simple and easy to understand, yet rigorous enough for technical analyses for transportation facilities and plan improvements evaluation for State of Florida roadways. It is proven that travel time and delay studies are reliable and effective methods for this purpose. Besides, travel time studies might contribute to the evaluation of the Congestion Management System which is mandated by the Intermodal Surface Transportation Efficiency Act (IETEA) of 1991.

1.1 Objectives of the Guideline

- ✓ Develop a fundamentally sound data-acquisition procedure that permits the Florida Department of Transportation collect meaningful travel-time data, accurately and efficiently, in a systematic manner.
- ✓ Develop an analytical software tool to perform statistical analysis on the travel time data.

1.2 Definitions

Travel time is the time taken by a vehicle to traverse a given segment of street or highway.

Running time is the time a vehicle is actually in motion (or moving faster than a predesignated speed) while traversing a given segment of street or highway.

Speed is the rate of movement of a vehicle in distance per unit time.

Travel speed is the distance traveled divided by the travel time.

Running speed is the distance traveled divided by the running time.

Space-mean speed or *mean travel speed* is the segment distance divided by the men travel time over the segment of several vehicles or of a single vehicle completing several trips.

Mean running speed is the segment distance divided by the mean running time over the segment of several vehicles or of a single vehicle completing several trips.

Delay is the time lost by a vehicle due to causes beyond the control of the driver.

Operational delay is the component of delay caused by the presence and interference of other traffic. This type of delay may be in the form of side friction where other traffic interferes with the traffic stream (e.g., parking maneuvers) or in the form of internal friction, where the interference takes place within the traffic stream. (e.g., encountering a reduction in capacity)

Fixed delay is the component of delay caused by traffic control devices that is independent of traffic volume and operational delay.

Stopped-time delay is that part of delay when the vehicle is not moving (or moving slower than a pre-designated speed).

Travel-time delay is the difference between the actual travel time and the travel time based on a vehicle traversing the study segment at an average speed equal to that for un-congested traffic flow on the segment.

1.3 Architecture of the Guideline

The guideline is divided into several parts based on the requirement of the research:

- **Chapter 1: Introduction** – contains an overview of the guideline and an introduction to methods and approaches used to collect and analyze travel time data. Some definitions of travel time parameters are also included in this chapter.

- **Chapter 2: Developing and implementing a travel time data collection plan –** contains information and guidance on developing and implementing a data collection plan for travel time studies.

- **Chapter 3: GPS hardware installation and usage –** provides step-by-step instructions on installation of the product and how to operate the GPS portable unit.

- **Chapter 4: Travel time data analyzer software tool usage –** provide step-by-step instruction on installation of the tool for analyzing the travel time data.

- **Appendix A:** Travel time data collection quick checklist

- **Appendix B:** Travel time data collection logbook sheet for data surveyors
- **Appendix C:** Time Manager GPS software manual
- **Appendix D:** Time Manager GPS product overview
- **Appendix E:** Time Manager GPS specification

2 DEVELOPING AND IMPLEMENTING A TRAVEL TIME DATA COLLECTION PLAN

This chapter provides guidance and information on developing and implementing a data collection plan for travel time studies using portable GPS devices according to the guidelines from 'Travel Time Data Collection Handbook' (Report FHWA-PL-98-035).

2.1 Establish Study Purpose and Objectives

The purpose of this study is to determine travel time information on major Florida roadways including streets and highways. The information (travel time, delay time, maximum speed, average speed etc.,) collected will be used to establish a database of current roadway operation conditions which enables the public transportation engineers and planners to implement schemes and policies that will improve public safety and operation of the roads. The traffic signals, speed zones and congested locations could be determined by this study as well.

2.2 Understand Uses and Users

The users of travel time data are the public transportation engineers who evaluate the quality of traffic movement along major Florida roadways, to compare operational condition before and after and develop recommendations for improvements such as traffic signal retiming, safety improvements, turn lane additions, and channelization enhancements, and planners who monitor level of service for local government comprehensive plans.

Travel time data could be collected for the Planning and Design to assist in developing transportation policies and programs, for Operations to aid on real-time freeway and arterial street traffic control process, for Evaluation to measure congestion management system and performance, to identify congested locations and bottle necks, to measure effectiveness and benefits of improvements etc.,

2.3 Define Study Scope

This is very important step. A well-defined study scope that is clearly linked to the study objectives ensures that the travel time study will produce the necessary data.

2.3.1 Geographic Areas

The geographic scope defines the boundaries of the study. Examples of geographic scope include:

- A short section of roadway in the vicinity of a planned or implemented transportation improvement (e.g., before-and-after study);
- A transportation corridor between defined points, perhaps including a freeway, frontage roads, and parallel arterial street(s) (e.g., major investment study);
- Several transportation corridors that service a central business district or an activity center; and
- All major transportation corridors within a defined zone, sub-area, or region (e.g., congestion management system).

If a study's geographic scope only includes a selected number of corridors or roadways, travel time data would most likely be collected on each facility (i.e., no sampling). However, if the geographic scope encompasses an entire urban area or region, sampling procedures may be applied to achieve cost-effective data collection. Sampling procedures consist of collecting data for a statistically significant percentage of the entire roadway system being considered, then drawing conclusions about the entire roadway system from the sampled percentage. Sampling is most applicable for planning applications in which the required accuracy is typically less than that required for design or operational analyses.

2.3.2 Facility Types

The next step in defining the study scope is specifying the transportation facility types or functional classes of roadways. Like the geographic scope, the facility types considered in a travel time study should be based upon the study objectives. Facility types or classifications can be based upon different schemes, like those used in travel demand forecasting models, traffic operations models, or roadway inventory data bases.

In this guideline, roads are grouped into different classes and the traffic-flow data will be sampled and studied for each class of roadways. Specifically, the roads are categorized according to the *Highway Functional Classification System*. The classification scheme is shown graphically in **Figure 1**.

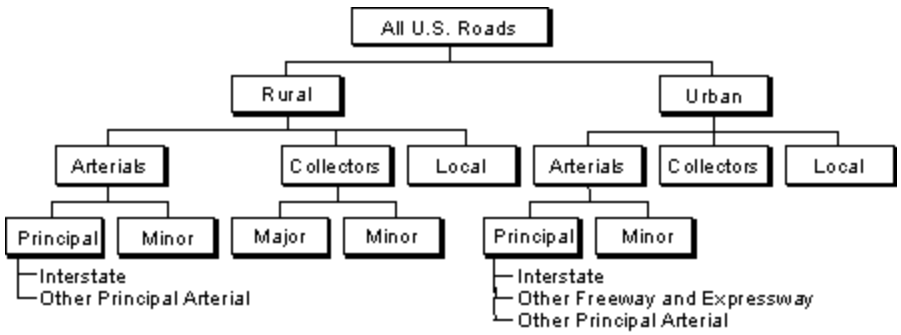


Figure 1: *Highway functional classification system*

Functional classification focuses on describing roads by the role that they play in the network of public roads. All roads have two major functions: They provide local *access* to a particular location, and they provide *mobility* between separated locations. A road that emphasizes the mobility function is called an *arterial*; and a road that is mostly for local access is called a *local* road.

Arterials are further subdivided between *principal arterials* and *minor arterials*. Principal arterials provide long-distance mobility and very little local access, whereas minor arterials connect closer areas and provide some access. Principal arterials include interstates, freeways and expressways. Between minor arterials and local roads is another class called *collectors*. Collectors provide significant access while still providing mobility by connecting different nearby areas or roads. Collectors are further divided in rural areas between *major collectors* and *minor collectors*.

2.3.3 Time Elements

There are several time elements that must be considered in establishing the scope for this travel time data collection activities:

- Month of the year
- Days of the week
- Time period or time of day

❖ Month of the year

There is no specific month for collecting data. However, as the general rule of thumb, the spring time (i.e., March, April and May) and fall months (September, October, and November) are commonly considered "average" or "typical" annual conditions. For special studies that seek to examine congestion associated with non-work trip, one may wish to look at specific times of the year in which traffic patterns differ from typical or average months. Examples include (but not limited to): summer months where large universities or schools in the designated areas are not in session; holiday shopping season (late November and December). However, if travel time data are desired for typical traffic conditions, these times of the year should be avoided.

❖ Days of the week

Data collection efforts for this project should be focused on the middle weekdays (i.e., Tuesday, Wednesday, and Thursday). Monday and Friday should be excluded from data collection because a small number of weekdays are sampled and these days' high variation from conditions during the middle of the week would necessitate a much larger sample of weekdays.

Recurring holidays or events should be considered when scheduling the specific days for data collection. These days are avoided when sampling a small number of weekdays

because of the variance from "typical" day-to-day operating conditions. The following times should be avoided when sampling weekdays:

- Established holidays (e.g., Memorial Day, Independence Day, Veteran's day);
- Other celebrated days (e.g., St. Patrick's Day, Valentine's Day)
- Changes in local school schedules (e.g., Spring Break, summer recess)
- Day after time changes (e.g., Daylight Savings, Standard Time changes)
- Special events (e.g., professional sports games, school football games, regional festival)

❖ Time periods

The time periods define the ranges in the time of day that travel time data will be collected. In this project, the morning and afternoon peak hours are considered.

- Morning Peak Period: between 6 a.m. and 9a.m.
- Afternoon Peak Period: between 4 p.m. and 7 p.m.

The extension of the project might include the data collection for other time periods such as Off-Peak Period, typically between 10 a.m. and 11 a.m. and 11 a.m. to 3 p.m. or after 7 p.m. The hours before and after 12 noon (11 a.m. to 1 p.m.) should be avoided if the "lunch hour" traffic is significant in the data collecting areas.

The time period for data collection should be matched to local traffic condition and congestion patterns for the geographic area under consideration.

2.4 Select Data Collection Technique

The data collection technique used in the project is potable Traffic Flow GPS unit. Traffic Flow GPS is an efficient and cost effective vehicle tracking system. The Traffic Flow GPS under-dashboard mounted vehicle units and the portable Nomad GPS vehicle units record the date, start time, stop time, mileage, location (by address) travel time, duration of stops and traffic idle duration on removable tamper resistant memory modules. These reusable modules can log between 240 and 2,040 records depending upon configuration.

There are some advantages of this technique including the moderate initial cost, data easily integrated into GIS with detailed map representation, the availability of detailed speed/delay data which provide useful information for travel surveys. However, some drawbacks of this technique are the reception problem in urban "canyons" and tree and some limited sample of motorists.

2.5 Develop Data Collection Schedule

A schedule of data collection activities should be developed once the study scope, data collection technique, and other major parameters have been determined. A schedule is particularly helpful with implementing the data collection effort and in informing data

collection personnel of their specific responsibilities. The content of the schedule includes the specific days and time of day that data is to be collected. The schedule should also contain the names of persons assigned to specific duties or stations for each day of data collection.

2.6 Conduct Training

The attitude and knowledge of data collection personnel play a major role in the quality of collected data. All data collection personnel should be adequately trained on the travel time data collection technique to ensure a consistent level of knowledge. The training or briefing may be best accomplished in small groups in which each person has the ability to ask questions and practice using the data collection equipment. A training session should include the following key points:

- Purpose(s) of the data collection, including sponsorship, analysis goal, and end uses of the data;
- Step-by-step details of the data collection technique and equipment operation;
- Trouble shooting technique to fix equipment problem in the field;
- Specific procedure or requirements for canceling data collection because of weather, traffic incidents, or equipment problems.

2.7 Perform Pilot Studies

Pilot travel time studies or trial runs should be conducted before the actual data collection begins. If the data collection personnel are experienced, pilot studies may be considered optional. Pilot studies can be performed over several days on a sample (approximately five to ten percent) of the facilities that will be included in the data collection effort. The purposes of pilot studies or trial runs are the following:

- Become intimately familiar with the data collection equipment and process;
- Become familiar with data collection corridors and cross streets;
- Perform corridor or site surveys and measure exact distances; and
- Identify problems or necessary resources as early as possible.

Also, travel time variability data obtained during pilot studies can potentially be used to check and/or adjust previously calculated sample sizes. After the pilot studies have been completed, all data collection personnel should provide feedback about the ease and utility of the data collection process. The feedback can then be used to modify the data collection procedures to ensure quality data.

2.8 Collect Data

Depending upon the scope of the study, data collection may extend through several months or even throughout the entire year. A manager of data collection activities should

be assigned to track the progress of data collection, troubleshoot equipment and personnel problems, and supervise the data reduction and quality control measures.

The data collection supervisor should establish clear policies and procedures for canceling data collection in the field because of extreme or unusual conditions. Such extreme or unusual conditions that could merit field cancellation of data collection include:

- Severe weather (e.g., heavy rain, tornados, ice);
- Unusual traffic conditions (e.g., severe accidents, police chases); and
- Equipment malfunction (e.g., dead batteries, broken video camera lens).

Several other types of qualitative information should be gathered during data collection that could prove useful in the data reduction and analysis stages. Useful qualitative information includes:

- Weather conditions (e.g., sunny, rain, foggy);
- Pavement conditions (e.g., dry, wet, icy);
- Observations about unique traffic conditions or incidents; and
- Media reports about construction closures, incidents, or other special events that may affect traffic conditions.

Information that may be roadway or site-specific, such as weather or pavement conditions, should be recorded on data collection sheets or summaries. General area or regional information, such as special events, should be recorded in a common file location.

2.9 Sampling method

In order to determine the number of runs required for statistical significance, the engineer/analyst should use the following method:

(a) Estimate the number of runs required by using **Figure 2**.
(b) Conduct the runs.
(c) Calculate the average range in running speed (R) using the equation below.
(d) Using the average range in running speed as calculated, again use **Figure 2** to determine the number of runs required.
(e) Make additional runs if required.
(f) Engineering judgment should also be used in applying this procedure to fit the purpose of the study.

To elaborate on **(c)**, after the first group of running speeds has been computed, the absolute differences between the first and second values, the second and third values, etc., are obtained. These differences are summed and the total is divided by the number of differences (N-1) to provide the average range in running speed for the initial data.

This procedure is represented by the following equation:

$$R = \frac{S}{N-1}$$

Example:

APPROXIMATE MINIMUM SAMPLE SIZE REQUIREMENTS FOR TRAVEL TIME AND DELAY STUDIES WITH CONFIDENCE LEVEL OF 95.0 PERCENT					
Average Range in Running Speed (mph)* R	Minimum Number of Runs for Specified Permitted Error				
	± 1.0 mph	± 2.0 mph	± 3.0 mph	± 4.0 mph	± 5.0 mph
2.5	4	2	2	2	2
5.0	8	4	3	2	2
10.0	21	8	5	4	3
15.0	38	14	8	6	5
20.0	59	21	12	8	6
*Interpolation should be used when R is other than the numbers shown in column 1.					

Figure 2: *Minimum sample size requirement with confidence level of 95.0 percent*

Run #	RS	Absolute Difference
1	**38**	**0**
2	**35**	**3**
3	**32**	**3**
4	**33**	**1**
5	**36**	**3**
		10 (Total = S)

$$R = \frac{S}{(n-1)} = \frac{10}{(5-1)} = 2.5$$

where

RS = average running speed in mph
R = average range in running speed in mph
S = sum of absolute differences
N = number of completed test runs

The approximate minimum sample size is selected from **Figure 2** for the calculated average range in running speed and the desired permitted error. If the required sample size is greater than the number of runs made, then additional runs must be performed under similar traffic and environmental conditions to reach the minimum sample size.

The specified permitted error for traffic operations studies involving efficiency (i.e., timing studies) should be ± 3.0 mph.

The specified permitted error for before and after studies should be ± 3.0 mph for studies predominately involving efficiency, and ± 2.0 mph for studies predominately concerned with safety.

Figure 2 also includes ranges for specified permitted errors of ± 4.0 mph, and ± 5.0 mph. These data are provided as background information for the traffic engineer. There may be special projects where the traffic engineer would deem it appropriate to use one of these other specified permitted errors. Any exceptions to the previously noted standards should be approved in writing by the District Traffic Operations Engineer on a project by project basis.

2.10 Reduce Data and Perform Quality Control

The first several days of travel time data should be reduced and analyzed soon after it has been collected to ensure that field personnel are collecting quality data. This early data reduction and quality control can potentially identify equipment problems or data discrepancies that are not obvious, particularly in electronic data collection systems.

2.11 References for chapter 2

[1] Travel Time Data Collection Handbook
Federal Highway Administration Report FHWA-PL-98-035)
(Link: http://www.fhwa.dot.gov//ohim/start.pdf)

[2] "Highway Functional Classification System"
(Link: http://www.fhwa.dot.gov///////policy/1999cpr/ch_02/cpm02_4.htm)

3 GPS HARDWARE INSTALLATION AND USAGE

3.1 GPS receiver device components and installation

The vehicle unit comes with 5 components:

- GPS antenna holder with suction cups
- GPS antenna
- GPS receiver with power cord
- Memory module
- Pendant and its holder

GPS antenna holder with suction cups should be installed on the windshield inside the vehicle. Place a GPS antenna on top of the holder facing up to the sky. The GPS magnetic mount antenna must be mounted horizontally on a flat metal surface of the suction cup with a clear view of the sky.

Connect power cord to the cigarette lighter of the vehicle. Place the device close to you but not distract to your driving so that you can see the LEDs on the device. The pendant should be placed within the reach of your arm.

Turn on the vehicle engine. Do not drive until the **GPS Locked** LED on the pendant lights Red.

Satellite acquisition will occur anywhere from 15 seconds to 120 seconds after the vehicle engine is turned on. If no signal is acquired, the antenna may not be connected properly or may not have adequate view of the sky. Make certain that the antenna is connected and has no overhead obstructions. In this case, power the GPS receiver OFF then ON by unplug and plug its cigar lighter switch and wait for satellite acquisition or drive the vehicle to the other location. A signal acquisition period of up to 5 minutes or longer is possible.

If after a while you can still see that the **GPS Locked** LED does not change to RED or your vehicle is on the garage or under the shadow of the big tree, the GPS receiver might not be able to get the signal from the satellite, drive your vehicle to the area with clear view of the sky.

Memory module installation: when the **Memory Full** LED is illuminated, stop the vehicle (if driving), replace with the new one by simply pulling the full module out, and plug the new one in. If you can not press the new one all the way in, turn the piece over so that the "Time Management Top" is face up.

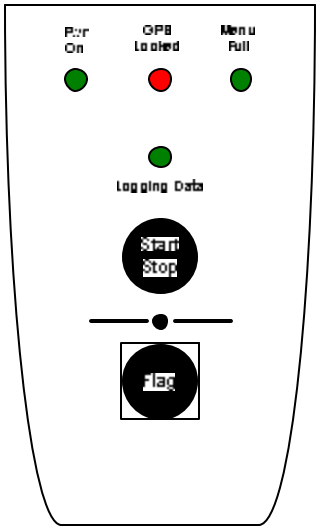
3.2 GPS receiver pendant layout

There are two (2) switches:

- Flag (mark) Location
- Start / Stop Data Collection

There are four (4) LEDs

- Pwr On (Power On)
- GPS Locked (with audible confirmation)
- Memory Full (with audible confirmation)
- Logging Data



In addition, there is an audible sound (confirmation) when the switch buttons are pressed.

The top rows are LEDs. When the **PWR** and **GPS Locked** lights are illuminated, you are good to go. When the memory is full, the center **Memory Full** light goes on.

The **Logging Data** light is illuminated after pressing the **Start / Stop** button. If the **Memory Full** light is on, the **Logging Data** light will go out.

There is a ridge between the **Start/Stop** button and the **Flag** button, so you can find the correct one without looking.

3.3 Data Collection

When you reach at the designated point as start point, look at the LEDs on the pendant, make sure that the Power **PWR** LED is ON (Green), the Memory is NOT full (Green), the **GPS Locked** is ON (Green) and press the **Start/Stop** button. Drive along the assigned road (see driving technique). When you reach the stop point, press the **Start/Stop** button on pendant again to record that event.

Note: ***For the first run, press the Flag button on the pendant once every time you pass any signalized intersection on your route even when you do not stop at that intersection. The ideal spot where you should press the Flag button to record that event is when you are driving through the middle of intersection.***

After each driving session, do not forget to fill in information on the logbook sheet.

3.4 Driving Technique

It is important to maintain a consistent driving style. In general, the driver should match the flow of traffic. If no traffic is present, the posted speed limit should be followed. Pass about the same number of cars that are passing you. Do not block traffic in the left lane. In other words, if no one is in front of you and there are cars behind you, move to the right lane. If the group of cars is going over the speed limit, stay with the group, but do not pass anyone. A good technique is to pick a vehicle and match its speed or follow it at a close, but safe distance. Do not drive aggressively or follow too closely. To avoid distractions to the driver, a second person can operate the GPS unit (if possible).

4 TRAVEL TIME DATA ANALYZER TOOL USAGE

4.1 Installation (*requires Windows 2000 or later*)

Run *gpsbinstall.exe*

It has a dependencies page that will detect if any of the dependencies need to be installed. These are provided with this copy of GPS BREAKFAST, or you may use a newer version from the Internet.

4.2 How to export from Traffic Flow Mapping software (come with Traffic Flow GPS)

GPS BREAKFAST works off of databases exported from Traffic Flow Mapping software. The Traffic Flow Mapping software must be used in a specific way to get the intersection names to appear in the database it exports, the way that GPS BREAKFAST requires:

(*These instructions were tested on TMMS v 3.0*)

Insert the module containing collected data.

Start Traffic Flow Mapping software.

Menu Module ? View Module Information.

Uncheck **Save to Database**, Check **View Module**, Uncheck **Clear Module**.

Press **Execute**.

This step takes a while for databases with over 1000 records.

After Traffic Flow Mapping software is done reading module records, press **Save To Database** on the View Module window.

Choose '**Yes**' to enter a name for the database. This is the name that will appear as a heading for the runs graphed with GPS BREAKFAST.

If it says that most of the data consisted of "duplicate records", then you must clear the database first:

Menu Database ? **Delete records**

Now export the TMMS database to an Access database:

Menu Database ? **Import/Export Records**

Press **Export Records**.

It will create a .mdb Access database file for you.

Traffic Flow Mapping software can now be closed.

4.3 How to import a database into GPS Breakfast

Start GPS BREAKFAST.

When you first start GPS BREAKFAST, it will load the MATLAB component, which might take a few seconds. Then it drops you at the Database selection page. Here you must browse for an Access database which was created by TMMS. Follow the instructions on that page and press Graph It when finished.

If the database is being read for the first time, GPS BREAKFAST will delete data from the database that doesn't satisfy the following criterion:

(1) Records must be part of a Run consisting of at least 5 records. To be considered part of a Run, the timestamp on the record must be within 2 minutes of the previous or next one.

So note, this means that if the GPS device is disabled for 2 minutes in the field, a new Run is created.

(2) T-type Records are erased from the database.

The importer will also number the Runs in the MainRecordID column using consecutive numbers starting from 1.

You may add new records to the Access database by just appending more records to the end or however you like.

Next time GPS BREAKFAST imports the database it will re-assign the run numbers and filter out bad data.

The importing only needs to be done once, and it doesn't take very long. Be aware that it does modify the database that you give to it.

Appendix A

DATA COLLECTION QUICK CHECKLIST

1. **Install and inspect equipment**. Check the following:

- The antenna for the GPS receiver should be checked that it is securely placed on the suction cup, with the clear view to the sky.
- The suction cup is securely "sucked" to the windshield of the vehicle.
- All connections between the GPS and antennas, power supply and pendant should be checked to ensure they have not become unattached.

2. **Turn on equipment**. The operator then turns on the GPS receiver. The **PWR** LED on the unit and pendant should be green.

Wait a couple of minutes until the **GPS Locked** lights are illuminated on the pendant, then you are good to go.

Check whether or not the memory is full: the center **Memory Full** light goes on. In this case, change to the new memory module (provided).

The **Logging Data** light is illuminated after pressing the **Start/Stop** button. If the **Memory Full** light is on, the **Logging Data** light will go out.

3. **Prepare log sheets**. Fill out the log sheet describing the travel time including the driver's name, date, time, and other relevant information.

4. **Begin to drive the travel time route**. The driver can then begin to drive the travel time route and press the **Start/Stop** button of pendant to start the run. The GPS unit will collect the time and position information.

5. **Check the LEDs while driving.** Occasionally check the LEDs on the pendant for power connection, **GPS locked** status, **Memory full** capability.

6. **Complete log sheet**. After the travel time run, press the **Start/Stop** button of pendant to stop the run, complete the log sheet with further relevant information describing the travel time run (e.g., weather changes, incidents).

7. **Put data collection equipment away**. After finishing the run, place cables, antenna, and other equipment into proper storage for the next travel time run.

Appendix B

GPS BASED TRAVEL TIME DATA COLLECTION LOGBOOK SHEET FOR DATA COLLECTORS

Surveyor's Name:

Corridor or Route Name:

Date(mm/dd/yy)	Weather Condition	Road Conditions	Road geography	Notes
/ / ❒ AM ❒ PM	❒Sunny/Normal ❒Foggy ❒Heavy rain ❒Light rain ❒Other………………..	❒Normal ❒Slippery ❒Lane closed ❒During maintenance ❒Construction	❒Normal ❒Steep, uphill ❒Steep, downhill ❒Curly ❒Other ………………..	
/ / ❒ AM ❒ PM	❒Sunny/Normal ❒Foggy ❒Heavy rain ❒Light rain ❒Other………………..	❒Normal ❒Slippery ❒Lane closed ❒During maintenance ❒Construction	❒Normal ❒Steep, uphill ❒Steep, downhill ❒Curly ❒Other ………………..	
/ / ❒ AM ❒ PM	❒Sunny/Normal ❒Foggy ❒Heavy rain ❒Light rain ❒Other………………..	❒Normal ❒Slippery ❒Lane closed ❒During maintenance ❒Construction	❒Normal ❒Steep, uphill ❒Steep, downhill ❒Curly ❒Other ………………..	
/ / ❒ AM ❒ PM	❒Sunny/Normal ❒Foggy ❒Heavy rain ❒Light rain ❒Other………………..	❒Normal ❒Slippery ❒Lane closed ❒During maintenance ❒Construction	❒Normal ❒Steep, uphill ❒Steep, downhill ❒Curly ❒Other ………………..	
/ / ❒ AM ❒ PM	❒Sunny/Normal ❒Foggy ❒Heavy rain ❒Light rain ❒Other………………..	❒Normal ❒Slippery ❒Lane closed ❒During maintenance ❒Construction	❒Normal ❒Steep, uphill ❒Steep, downhill ❒Curly ❒Other ………………..	
/ / ❒ AM ❒ PM	❒Sunny/Normal ❒Foggy ❒Heavy rain ❒Light rain ❒Other………………..	❒Normal ❒Slippery ❒Lane closed ❒During maintenance ❒Construction	❒Normal ❒Steep, uphill ❒Steep, downhill ❒Curly ❒Other ………………..	

Officials Use Only

❒Transferred to PC ❒ Post Processed ❒Complete Intersections ❒Done! **Memory Module**: FDOT

Associated Filenames: File location:

Processed by Date: / /

Appendix C

TMMP HELPDESK

TMMP Software Installation

1. Office Unit Installation

Connect the cable provided with your Office Unit to an open Serial COM port on your PC. Connect the other end to the back of the Office Unit. The cable ends will only install one way. Do not force them on upside down. (See **Troubleshooting** for more assistance)

2. Software Installation

Before installing the software, shut down all other Windows application programs that you are currently running. This includes any Automatic Backup or Anti-Virus Programs. Virus checking programs can interfere with the installation process.

2.1 Installing for the First Time

This software is self-installing software. Simply insert the CD-ROM into the drive and follow the on screen instructions.

This software uses the latest available installation software, which sometimes requires adding system files to your computer. This will not affect the operation of your computer. If your computer requires an upgrade, the software will do so and then prompt you to restart your computer. Once your computer has restarted, re-insert the CD-Rom to continue the installation process.

2.2 Re-Installing

If you are re-installing the software over the SAME version of software, it will not self start. The software only runs the auto setup program for upgrades or new installs. If this is your case follow the directions below.

1. From the '**Start**' Menu, select Run.

2. Type **D: SETUP** and select OK. If the CD drive is not drive D, then substitute your drive letter.

3. The software will analyze your system and begin to copy files. It utilizes the latest installation software and may prompt you to upgrade some of your system files. If this occurs, click OK and your system will automatically be upgraded. This upgrade will not affect the operation of your computer. It only adds system files necessary to load the software.

Once this is complete, repeat steps one through four to complete the installation.

4. You will receive a message indicating that the software is about to install. Click OK.

5. The next prompt will allow you to reassign the directory were you would like to install the software. If you are not sure or it is not important, click OK for the default assignment.

6. The next prompt will allow you to choose the program group were you would like to install the software. If you are not sure or it is not important, click OK for the default assignment.

7. The software will now complete the setup.

3. Creating a Desktop Icon

Windows 98/2000/XP

1. Click on the '**Start**' button and then the '**All Programs**' button. You will see that your Icon is now in the start menu.

2. Place the mouse cursor on the TMGPS Icon and click the right mouse button. A pop-up menu will appear.

3. Click on the '**Send To**' button on the pop-up menu and select '**Send to Desktop as a Shortcut**'. Windows will then send a copy of the icon to the desktop.

4. Return to the desktop and you will find your new icon.

Setting Software Options and Preferences

1. Options

Options allow you to customize how TMGPS operates for you. To access the Options menu, click **View** at the top of the TMGPS main screen and open **Options** to select your software settings.

2. Preferences

1. **Include Location Text** displays the location name and the stop number with the stop sign on the map. If it is off, then only the stop number is displayed on the map.

2. **Enable Block Address Lookup** allows TMGPS to auto-search GPS coordinates for the closest available street address. If this feature is turned off, only GPS coordinates will display for locations that have not been previously named.

3. **Display Trip Length** inserts an additional column into the report that gives the total time from the trip start to the trip stop.

4. **Display Average Speed instead of Max** converts the Maximum speed column of all reports to average speed.

5. **Strip !,*,P,W for Clipboard Copies** removes all of the code symbols from the copy clipboard functions. This is helpful when pasting into Excel or other spreadsheets. By removing these symbols, numerical functions are easier to use.

6. **Display Weak Satellite Signals (W)** Displays a W next to trips or events that lost data due to weak satellite signals.

7. **Highlight Speeds Exceeding** allows you to clearly see excessive speeds on all reports. Select a maximum speed setting and any speed on a report exceeding this setting will be highlighted in red.

8. **Stop Length** calibrates the stop length to match vehicle units. **WARNING:** The setting for this preference **MUST** match that of **ALL of the vehicle units** in order to obtain accurate time and idle readings. If it does not, your reports will be inaccurate. NOTE: The default setting is 120 seconds OR 2 minutes for both TMGPS and for all vehicle units.

9. **Time Format** allows you to view time in either military or standard time format.

3. Selecting a COMM Port

The **Module** screen in the **Options** menu allows you to select the COMM port to which the Office unit is attached. See *Office Unit installation*.

To select the correct COMM port, install the office unit and attempt to view a module. If you get an error indicating that the office unit hardware could not be located, then select a different COMM port setting and try again. Repeat this process until the COMM port has been selected.

4. Database Preferences

Setting Path to Database File

The Path to the Database File is selected by the software upon the original installation of the software. If you operated an earlier version of software, the new version will find the existing database and use it if it is listed in your computer's registry. If your original database cannot be located by the new version, click the **Browse** button next to the Default Database Path field to find your old database if you wish to continue its use.

The database file for versions 1.2 and older was contained in the **Program Files** folder inside the **TMMAP** folder. Version 2 stores the database in the Program Files folder inside the TMMS folder. Version 2.1.4 and newer store the database in the Program Files folder inside the TMGPS folder.

The file name for the database is TMMAP.mdb. It is the same name for **ALL** software versions 1.0 and newer. If you want to use the old database, browse for the TMMap.mdb file and click **Select** to set it as the default path.

Setting Default Import Path

The Default Import Path is the path you select for TMGPS to search for new import data. Click the **Browse** button to set a new path over a network, email file, etc. The pop-up screen to the left will appear. Select the path of your choice and click **Select**. TMGPS will store you new path. If you do not select a path, the default is the **A:** drive.

Setting Default Export Path

The Default Export Path is the path you select for TMGPS to export database information. Click **Browse** to set a new path to a local hard disk, over a network, email file, etc. Select the path of your choice and click **Select**. TMGPS will store you new path. If you do not select a path, the default is the A: drive.

5. Map Preferences

Map Options allows you to customize the Map and grid settings to correspond with the time and distance scales used in your area.

1. **Path to Map Data**: If you load the Maps to a local hard disk or a location other than the CD ROM using the TMGPS Map installation function, then your path will automatically be updated.

2. **Scale**: Select either Miles per Hour or Kilometers per Hour for your distance and speed calibrations.

3. **Coordinate Display Mode**: Select either Decimal measurements (DD.DDDDD) or Degree Measurements (DD.MM.SS.S).

6. Location

The location field allows you to add custom office information or location information to your printed reports. Three lines of text are available for whatever information you desire.

For Example: Bud's Wholesale Nursery Co.

West 54th Street Office

The location field also allows you to adjust your time zone settings. TMGPS automatically sets itself by your computers time settings. If you would like to manually select your time settings, simply turn off the automatic feature and select your time zone from the drop down list.

Viewing, Understanding, and Editing Memory Module Reports

1. Viewing a Module

Insert a Memory Module into the Office Unit and click **View Module** under the **Module** menu at the top of the screen. The Action Screen will appear.

Select Action

The Select Action box gives you module-viewing options. Select the task you wish to perform. You can select any of the three at the same time or separately. Once you have made your selections, click **Execute** to perform all of the actions you have selected.

Clearing Module

If you selected clear module only, the Module Functions Screen above will stay open, allowing you to clear more Memory Modules. If you want to clear another Memory Module insert the next module and click **Execute** again. If you want to see if the module contains any data, then click **Refresh** first. The data fields will list EMPTY if there is no data present.

If you selected **Clear module** with other tasks, such as **Save** or **View** or both, TMGPS will save or view and then clear the module.

WARNING: YOU CANNOT RECOVER DATA FROM A CLEARED MODULE THAT YOU DID NOT SAVE TO THE DATABASE.

Save to Database

You can copy a Memory Module to the database before or after you have viewed it. Either way, it is advisable to always save Memory Module data to the database before clearing a Memory Module.

To save the data, click **Save to Database** before viewing a Memory Module or before clearing it. You do not have to view a Memory Module in order to clear it or save it to the database.

If you have already viewed a Memory Module and have not saved it, then click on the **Save to Database** button at the top of the Grid screen. The Memory Module will then be saved to the database by vehicle number unless you specify a driver name. Either type in a driver name or select one from the drop down list of driver names.

2. Understanding a Report

Once you have viewed a Memory Module, your screen will appear with the map on top and the grid on the bottom. There are several buttons across the top of the grid. They provide enhanced functions to the grid and its map.

1. **Print Grid**: Allows you to print the active grid instantaneously.

2. **Copy to Clipboard**: Allows you to capture the grid information and paste it into other windows applications. You can customize the clipboard feature in your Options settings.

3. **Show/Hide Flags**: Enables or disables the display of location text on the map. This is helpful if stops are numerous and overlapping.

4. **Show/Hide Events**: Enables or disables the Extra Events on the map.

5. **Show/Hide Locations**: Enables and disables the display of database locations.

6. **Show Symbol Legend:** Displays a legend for the symbols that appear on the grid.

7. **Show Local Stops:** Displays all stops around a selected location without zooming in or out.

8. **Show All Stops:** Displays all stops on the query or module report.

9. **Clear Module:** Clears the module after you view it.

10. **Save to Database**: Saves the module to the database after you view it.

Column Headings

1. **Stop #:** The first line is always Zero. It indicates the stop at which the module was inserted. E-On E-Off indicates that an extra event occurred.

2. **Start Date:** The date the trip or event occurred.

3. **Start Time:** The starting time of the trip or event. Start time can be triggered many ways. If the vehicle idles for more than 4 consecutive minutes after being started, the start time will be logged. If the vehicle exceeds 20 mph or drives under 20 mph for more than 2 minutes, the start time will be logged.

4. **Stop Time:** If the vehicle is turned off, the stop time is logged. Also, if the vehicle comes to an idle stop and does not move for more than 2 minutes, the stop time is logged.

5. **Moving Time:** The amount of time the vehicle was in motion during the trip.

6. **Miles (Kilometers) Driven:** The distance traveled during the trip.

7. **MPH (KPH) Max/Average:** The maximum or average speed driven during the trip.

8. **Traffic Idle:** Traffic idle records when the vehicle idles for less than two minutes and then moves again. Traffic idle is useful for determining routing to avoid stop and go traffic or slow moving streets. Once the two-minute mark passes, the vehicle unit begins to record Stop Idle.

9. **Stop Idle:** If the vehicle idles for more than two consecutive minutes, stop idle records. Stop idle is useful in tracking unnecessary idle time, which leads to fuel loss. The two-minute stop marker can be increased or decreased to accommodate different vehicle needs. If the setting is changed, then software preferences must be adjusted to match. (See Chapter 2 page 16)

10. **Stop Length:** The length (in minutes) of the stop.

11. **Trip Length:** (enabled in Preferences) shows the time from the start time of the trip to the stop time of the trip.

12. **Location:** The location of the Stop or Event occurrence.

Vehicle Codes

! Indicates Ignition power failure, tampering, or blown fuse. Shorts or a blown fuse are usually indicated by several ! marks on the same report. Check ignition connections (green wire) in the vehicle unit. If the fuse is

not blown, then check for a short in the circuit. If only one ! appears, there may have been tampering.

P Indicates main power failure, tampering, or blown fuse. Several power failures on the same report usually indicate shorts or a blown fuse. Check main power connections (red wire) and ground connection (black wire) in the vehicle unit. If the fuse is not blown, then check for a short in the circuit. If only one P appears, there may have been tampering.

***** The Memory Module was removed and replaced without clearing.

Satellite Codes

W The vehicle unit lost signal for up to 10 seconds during the trip.

NS The vehicle unit had a blocked signal during this trip or stop.

? The vehicle unit did not have a definite satellite fix at the time the stop was logged. The vehicle unit lists the last available location. (Usually very close, but should be verified on the map)

3. Editing Memory Module Reports

Adding or Changing Stop Names

Click on the Location Column on the Report screen and the **Edit** screen will appear. To change the name of the location, type your new location text in the bottom highlighted text field. If you have named this location in the past, click **Show Other Locations** to select the previously named location. If you position (see Below) the new stop inside the black squared of the existing location, it will default to the existing location name.

If you have a new stop that is overlapping an existing location, but you want to give it a different name, simply drag the location out of the black box surrounding the existing location. When you click **Save** you will be given the option to create a new location or adjust the existing one.

Adjusting Stop Positions on the Map

Click anywhere within the red square surrounding the location and the stop position will move to the new position. You cannot move the location outside of the red square. Click **Save** in the **Edit** Screen to keep your new location.

Query Reports

TMGPS has numerous detail, summary and exception reports available. These include the following:

1. Detailed Reports: Vehicle Number or Driver Name

Detailed Reports are the most commonly used reports. They can be edited in the same fashion as Memory Module reports. They display the driver or trucks entire daily activity for each trip of the day. They can be viewed for specific dates and times making it easy to view only certain days of the week, specific drivers, or specific trucks.

To view a Detailed Report, click on **View** at the top of the screen and select **Query by Name** or **Query by Vehicle Number**. A pop-up screen will appear allowing you to customize the search by selecting dates and times.

2. Summary Reports: Vehicle Number or Driver Name

Summary Reports summarize an entire day's activity into one line. It allows the user to see active stop length versus driving time. It provides total operating hours of the vehicle for a given day which allows time sheet comparison. If gives a total idle time summary, which helps in controlling fuel cost. Like the Detailed Report, a Summary Report can be date specific.

To view a summary report, click on **View** at the top of the screen and select either **Query by Name** or **Query by Vehicle** Number. The pop-up screen will default to Detailed. Select Summary to view a summary report.

3. Exception Reports

Exception reports allow you to find even more specific information. These four reports allow you to find out which trucks stop the longest, which ones idle the most, which ones drive the fastest, and which ones were operating extra events, such as doors, lights, vacuums, etc. All of these reports will lend to reducing cost and liability in the fleet.

Exception Reports are viewed like detailed and summary reports. Simply click on **View** at the top of the screen and select **Exceptions**. The pop-up screen will appear allowing you to select the exception report you wish to view. Select the report and then select the value you wish to query for. For example, if you select **Maximum Speed** as your report, you can specify a 'greater than' speed and/or a 'less' than speed. The report will query for all drivers or vehicles that drove faster than your specified speed or you can query specific vehicles and/or drivers.

Database Functions

1. Adding a Location

Adding a location to your location database is a simple process. First click on **Database** at the top of the screen and select **Edit Locations**. Next click anywhere on the map where you wish to place a new location. A blue X will appear at the new location. Once you have selected the location, click the highlighted button below the map labeled **New location at "X"**. Type in the text name for the location and hit Enter. The new location will be saved to the database.

If you do not know where a location is but have an address, you can search for the location by using the **Find Street** window. The Find Street window can be accessed by clicking the small green street sign at the top of the map screen. Type in the address you are looking for and select the closest match from the list. Once you have located the address you are looking for place the blue X where you would like the new location and follow the directions above to label your new location.

2. Editing Locations

The location database stores all location records with names attached to them. The more locations you name, the larger your database will be. If a location is not named, TMGPS will either display a block address for that location or GPS coordinates, depending on your Preferences settings.

The location database screen is used for editing the size, location and name of stored locations. If you have a customer with a large property and wish to only name it once, the location database will allow you to do so by increasing the size of the location to accommodate for all stops in the area. If you have a location that is no longer needed or incorrect, it can be deleted from the location database screen.

To access the location database screen, click on Database at the top of the screen and select Edit Locations.

Editing a Location Size

Find the location that you wish to edit in the list and double click on it. At the top of the edit screen you will see two buttons that say **Reduce Area** and **Enlarge Area**. Click on the appropriate button to adjust the location to the desired size. You will see the black square around the location increase and decrease appropriately.

Once your database begins to grow, you will notice that many locations overlap each other. TMMS determines a stop from the center point of the location. If the stop is closer to the center of one square versus another, it will select the location name of the closest

center. If the locations conflict on a regular basis, then adjust their size so that this is prevented.

Editing a Location Name

To edit a location name, click on the location and the edit screen will appear. The existing name will be highlighted in blue. To change the name, simply type in a new one and click Save.

Editing a Location Position

Let's say you have a location that is too far off the road or on the wrong corner of two streets. Click on the location you wish to edit and the edit screen will appear. If you wish to move the location, click on the map anywhere within the red limiting square and the location will be fixed at the new point.

The red limiting square is a fixed size for a reason. Any location that is off more than the size of the square should be deleted due to that fact that it exceeds the error ratio for GPS coordinate readings. The red limiting square allows for approximately a block and a half radius of adjustment. This will compensate for any map errors, such as streets that are slightly miss-drawn or missing. Due to the ever-changing state of maps in this country, it is likely that a street might not appear on the map as it currently exists in reality.

3. Deleting Database Records

There is sometimes a need for deleting database records. When a driver leaves or a record is saved incorrectly, it is helpful to be able to delete a record. Records can be deleted by driver, vehicle number, by date or by a combination of the three.

To delete a record, click on **Database** and select **Delete Records**. Double-click on the record and it will move to the delete field. You can delete the previous month's records or all records by selecting one or the other in the Delete Range field. If you wish to delete a specific date range, type the date range in the Date Range field.

4. Importing/Exporting Database Records

TMGPS Records can be easily imported and exported from other TMGPS users. This is helpful when building a Location Database or sharing driver information between branches or locations.

Before importing and exporting, set up your **import and export paths**. Once this is done, click on Database and select Import/Export Records.

Importing Database Records

To import a record, click import records. Your default path will be accessed. Select the files to import by highlighting them and then select Open. TMGPS will import these files to the database.

Exporting Database Records

To Export a record, simply double-click on it and it will move to the Export field. You can Export the previous month, week or all records by selecting one in the Export Date Range field. If you wish to Export a specific date range, type the date range in the Date Range field. If you wish to export all records, then click on **Select** all at the top of the screen. Once this is done, click on **Export Records** and your default path will be accessed.

If you wish to change the path temporarily, click the drop down arrow next to **Save In** at the top of this new screen and choose a new path. Be aware that choosing a new path in this window will not change your default path. You must do that under Options. See Chapter 2 for changing Options settings.

5. Copying Map Files to the Hard Drive

The Map files are the files on the CD-ROM that contain the street level detail for the entire United States. The files can be moved to the hard drive. This allows TMGPS to operate faster as well as freeing up the CD ROM drive. It will require approximately 12 Megabytes per state to add the map files to your local hard disk. You can add as few or as many states as you desire. In total, the map files require approximately 550 Megabytes to add all of the map files to your local hard disk.

To add a state or states to your hard drive, click on **Database** at the top of the screen and select **Copy States to Hard Disk**. First, confirm that your source drive is the same letter as that of your CD-ROM drive. Your source drive will provide the map information for the hard disk to copy. Next, confirm your destination drive letter and path. If you would like to select a different drive than the one specified, click **Browse** and search for the drive you would prefer. Once this is done, you can now add your map files.

Adding States

To add a state, click on the state in the left column and select **Add**. Repeat the process until you have added all the states you desire. If you wish to add all of the states, click **Select All**. Once you have selected the states you desire, click **OK** and the files will be copied. This will take some time depending on the number of states that you selected. When you are done, click **Exit**.

Removing States

If you have added too many states to your hard drive, you might find it necessary to remove some in order to free up space. To remove a state, click on the state you wish to remove and select **Remove**. Repeat the process until you have removed all the states you desire. If you wish to remove all of the states, click **Remove All**. Once you have selected the states you desire, click **OK** and the files will be removed. When you are done, click **Exit**.

Printing

1. Printing a Report

Printing the Grid is a simple task. Each active Grid has a Print Grid button at the top of it. Simply click this button and the active grid will print. If your locations are too long to fit on a letter size sheet of paper in portrait mode, you can change your page setup. Click on File at the top of the page and select **Page Setup**. Change your printer's properties to landscape mode. Landscape will print across the page versus down the page, allowing for more column space.

2. Printing the Map

There are two separate ways to print a map. First, under the file menu, select **Print Map**. The second way is to click on the Printer Icon at the top of the Map. Only the active map screen is printed. The active grid defines the map. The grid that is highlighted with a blue task bar at the top is the active grid.

3. Printing the Location Database

Under the file menu, select Print Locations. The entire location database will be printed.

Troubleshooting

COMM Port Problems

- **An error indicating missing hardware appears**: Check the COMM Port settings to make sure that you have chosen the right one. Use trial and error if necessary to determine the correct COMM Port. If the unit does not read from any of your COMM Ports, check to make sure that your COMM Ports are installed correctly in your computer.

- **None of my COMM Ports work**: Just because a COMM Port is on the back of the machine doesn't mean that it is connected inside. Have your local computer shop or in-house technician check your COM Port hardware.

- **My mouse is using the only available 9 pin serial port:** Check to see if there is a round mouse port available on the machine. These Ports are known as a PS/2 port. Many PC's have both. It is usually located next to or near the round port for the keyboard. If a round mouse port is available, replace the mouse or purchase an adapter for the mouse to

free up your 9-pin connector. Windows will automatically re-install your mouse when you restart your computer. If it does not, re-install the mouse, and then the port is either disconnected or incompatible. If this is the case, contact your local computer shop or in-house technician for assistance.

- **I don't have a 9 pin COMM Port Available:** If a 25 pin COMM port is available, try it. It will require a 9 to 25 pin adapter available at most office supply and computer stores. Radio Shack carries this part as well. The part number at Radio Shack is 26-287A.

Make sure that it is not a 25 pin Printer port. The Office Unit only works on Serial ports not Printer ports. NOT all 25 pin COMM ports are configured for the Office Unit operation. If your 25 pin connector does not work, contact your local computer shop or in-house technician for assistance.

Software Problems

- **My laptop won't read the CD-ROM:** Some Laptop CD-ROM Drives won't read CD-ROM's with stick on labels. Contact your distributor for a CD appropriate for you computer.

- **My DVD drive won't read the CD-ROM:** Some DVD drives won't read certain writeable CD-ROM's. Contact your distributor for a CD appropriate for you computer.

- **I can't print anything:** Check your print driver and make sure your printer is installed correctly. Look under Settings on the Start menu to locate your active printer. Consult your Windows Help Files for further assistance.

- **There is no street level detail on my map, only counties and highways:** Make sure you have the CD-ROM in the CD-ROM drive. Look in your Application Setup (Chapter 2, Part II) and make sure that your Path to Map Data Files displays the correct letter for your CD-ROM drive. If your map files have been moved to the hard drive, check the path to make sure that it is also correct.

- **There is no data In the Location Column of the Report Sheet:** SEE DIRECTLY ABOVE.

- **The query for Block/Address takes a long time:** Once a name has been added to your location database, TMGPS no longer searches for the address when that location appears again. Therefore, the more names you add to your database, the less time TMGPS requires searching for unknown locations.

Report Problems

- **The Report only shows a partial listing of the stops and terminates early.**

The module was unplugged after the last stop shown and not plugged back in. As a result, there is no * on the page.

- **The last line has a start time but all other entries are zero.** The Module was unplugged before the truck was turned off. Remove the Module after the truck has been shut off and the Red LED has flashed.

- **The report does not have a date or time on it, only the module number.**

A) The Module was not plugged in or was plugged in upside down.

B) The Vehicle unit has lost power, check the Red and Black power lines.

C) The Vehicle unit is not working. Take a unit from another truck and verify if it is the unit or a wiring problem.

- **P Appears once or every line of the report.**

A) Make sure the main power line is not connected to a power source that has a turn signal or a CB radio attached to it.

B) Check the Ground wire connection.

C) May be a weak battery or a loose connection in the Vehicle unit harness.

Appendix D

TIME MANAGER GPS PRODUCT OVERVIEW

Time Manager GPS is an efficient and cost effective vehicle tracking system. The Time Manager GPS under-dashboard mounted vehicle units and the portable Nomad GPS vehicle units record the date, start time, stop time, mileage, location (by address) travel time, duration of stops and traffic idle duration on removable tamper resistant memory modules. These reusable modules can log between 240 and 2,040 records depending upon configuration.

Installing a Time Manager GPS system in every vehicle, will offer supervisors a vehicle tracking tool equal to their management responsibility. A single office reader/base station /software package can display data showing where all the vehicles have been, and how long they stayed with a minimum of effort.

Time Manager GPS automatically logs the start time of every vehicle. From the first time the vehicle moves in the morning to the last time it moves at the end of the day, every stop is logged, date and time stamped without any driver intervention, and converted to a data file for management review. Individual memory modules can be downloaded once a week at the office, and the fleet database can be queried by any combination of drivers, vehicles, locations and dates.

The G-4 Echo GPS model, available in Q-1 2003, can log 6,000 start and stop records and features a secure Bluetooth link to automatically download data every time the vehicle comes within 300 feet of the base station. The G-4 Echo GPS system will have an option for users to link fueling operation data to individual vehicles through the Fuel Guardian software / hardware interface to the Petrovend system.

Modern tools are needed to track the activities of employees sent into the field to do important work. Time Manager GPS provides the ability to collect usable management data every day, 24 hours a day, 7days a week.

How GPS works

Global Positioning Satellite (GPS) technology is based upon the ability to triangulate locations in longitude and latitude anywhere in the world by reference to continuous stream of signals emanating from a system of twenty-four Department of Defense satellites in orbit above the earth.

The Time Manager GPS vehicle unit is a proprietary, compact system that accepts and records signals from Department of Defense satellites, and requires no expensive active monitoring or two-way real time communications systems. From those signals date, time,

distance, speed and location information is calculated. The GPS locations are industry standard precise to within twelve meters (36 feet).

Data

Data is recorded on removable, tamper-resistant memory modules.

When downloaded through an Office Reader device to a host PC, data is displayed on a map, a grid and a route specific abstract.

- **Map**

  The map, with detail down to $1/10^{th}$ of a mile, offers an intuitive overview of the subject route. Colored arrows can mark the vehicles progress along an entire route at user-defined intervals.

  Every stop is displayed on a map, referenced to data on a grid listing the address.

- **Data Grid**

  Data can be queried by location, vehicle, date, time, or driver and displayed on a grid. For every trip, Time Manager GPS products automatically log:

Date	Location	Excessive Idling
Start Time	Mileage	Stop Length
Stop Time	Speed	Moving Time

Physical Description

The Time Manager GPS is a rugged self-contained vehicle unit, mounted under the dashboard, measuring approximately 7 inches by 4 inches by 1.5 inches. The entire unit weighs less than 2 lbs.

Power is acquired from the ignition harness. A small (1 inch square) magnetic GPS antenna is mounted on the roof of the vehicle.

Installation/Operation Output

Installation, consisting of mounting the unit under the dash, acquiring power from the ignition harness wire, and affixing the magnetically mounted antenna to the roofline, is an easy task for any ASE rated mechanic. Operator input is reduced to swapping memory modules.

User Options

Users can set parameters for recording routing data for the map display as often as every six seconds.

An optional event button can be used to fix locations along the route where a particular event transpired; for example, where the back door on a delivery truck was opened, or where a street sweeper broom or snow plow blade was engaged.

Data Export

Data can be exported to a Microsoft Database file (mdb).

Costs

For quantities under 100 units, the cost is $495.00 per vehicle unit, ($595 per portable Nomad unit). At least one office reader/software package would be required, at a combined (hardware reader/software) cost of $595.00. Upgraded memory modules are available for $50.00. There are no recurring fees.

Time Management, Inc.
Time Management, Inc. is a twelve year old Orlando Florida based R&D / manufacturing company with an installed base of over 20,000 GPS vehicle tracking units nationwide.

Contact

Time Management, Inc., 11 Lake Gatlin Road, Orlando, FL 32806.

(407) 888-9663 / (407) 855-4344 (fax).

Email: Info@vehiclewatch.com.

Website: www.vehiclewatch.com

Appendix E

TIME MANAGER GPS SPECIFICATION

The vehicle monitoring system is a passive GPS tracking system that requires no driver input and no continuous monitoring. All functions of the system are recorded onboard the vehicle and are maintained within the Vehicle Tracking unit until extraction is necessary. Extraction is performed by removing the Memory Module and transferring the data into a PC with an office reader.

A Complete Vehicle Unit System includes the following three components:

1. Vehicle Unit

- 3.75"W x 1.25"H x 7.5"L
- Weight, 1.0 lb.
- Solid aluminum extruded case with black anodized finish
- Aluminum mounting bracket with black anodized finish. Unit is mounted by attaching the mounting bracket to the dash with two self tapping screws
- 1 Green LED display that reports satellite fix
- 1 Red LED display that reports module functions and indicates excessive speed
- Front 9-pin female plug-in for vehicle information Memory Module
- Rear female SMA connection for GPS antenna
- Rear 9-pin male plug-in for power supply
- 9-pin 5 wire cable for power approx. 5 to 6 feet long. Attaches to the vehicles wiring harness or to fuse panel with inline fuses for power and ignition(both supplied)
- 12 volts required power for operation (red wire)
- Ignition source required (green wire)
- Ground source required (black wire)
- Extra event (purple wire) senses 12 volts. Allows for monitoring of PTO (Power Take Off) units, refrigeration units, open/closed doors or other external vehicle operations monitoring (records start and stop times of such events)
- Extra event (white wire) senses ground closure. Allows for monitoring of PTO (Power Take Off) units, refrigeration units, open/closed doors or other external vehicle operations monitoring (records start and stop times of such events)

2. Antenna

- 2" antenna
- Magnetic base
- Weight, 0.5 pounds
- coaxial cable connection (approximately 15 feet minimum)
- SMA male end connection (attaches to vehicle unit)

3. Memory Module

- 1.6" L x 0.6" H x 1.22" W
- Capable of storing 240 trips or events

Office Reader:

Office Reader Hardware:

- 3.75"W x 1.25"H x 7.5"L
- Weight, 1.0 pound
- Solid Aluminum case, black anodized finish
- Front female 9 pin receptacle for Memory Module
- Rear female 9 pin receptacle for 9 pin serial port cable connection
- Rear 12 volt wall adapter jack.
- 12 volt adapter
- 9 pin serial port cable

Office Reader Software Minimum Specifications:

- Works with Windows 95, 98 and NT
- Easy to read database format
- Standard and Summary Reports
- Reports by day, week, and month
- Reports by Driver name or Vehicle Number
- Reports by Maximum or Average speed
- Reports in Miles or Kilometers
- Time calibration features including time zones and daylight savings

- Import and Export Capabilities
- Editable GPS Location Database

The Office Reader requires a Windows based software system that is Year 2000 compliant. See chapter 1 of the TMMS software guide for the current requirements and specifications of the software.