LTPP Traffic QC Software
Volume 1: Users Guide

LTPP TSSC

November 1, 2001

Software version 1.61

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Table 1-1 Software modifications since version 1.5

Version Implemented	Changes
1.51	Limited number of continuation cards to 1 and set software to load sets of 2 or more but flag as a critical error. Incoming record storage modified to accommodate the change. Tightened validation on continuation card values and sequencing. Year, month, day and hour checked on all records not just the first in a file. Check added for constant or increasing date and hour. Printing routine modified to insure data always prints. Edit flags changed to record rather than vehicle basis.
1.52	Graphs per printed page increased from 2 to 4 and titles shortened to accommodate the change. Changed WIM line type on graphs to be able to more easily differentiate it on printouts. Insured storage of comments longer than 255 characters in LTPPFILETRACKER.
1.53	Created QC cover sheet version 1.0 to summarize data in terms of quantity and errors by site, lane and direction. Modified AVC and WIM types to correct a printing problem. Sorted graph output so that graphs, when printed, appear in chronological order for classification errors. Included ability to restrict graphs printed for this error type to a single year. Corrected mixed case problems in path names.
1.6	Modified QC cover sheet to remove site statistics and do all reporting on a by lane and direction basis.
1.61	Modified Daymaker to account for missing hours or days which might otherwise create a continuously increasing sequence for the purposes of error graphing. Corrected AVC and WIM labeling errors. Corrected process for counting classification errors. Corrected loading process to account for orphaned continuation cards. Corrected loading to handle errors in counting 8+ consecutive zero hours

Document Modifications

1. Converted to Word and removed line numbering. Changed line spacing to 1.2 and placed page numbers in header rather than footer.
2. Added change lists for software and document.
3. Modified the document to reflect the software changes in user notes sections as applicable.
4. Added process flow charts to section 2.
5. Modified section 3.5 and replaced figure 3.14 to reflect capability to select 4-card error graphs by year.
6. Replaced section 3.8 to reflect new QC cover sheet report including replacement of figure 3.27.
7. Added a new subsection to section G to describe a new table, LTPPERRORCOUNT. Labeled the subsection G.7 and renumbered previous sections G.7 and G.8.
8. Replaced section H.3 since analysis software as designed is indifferent to the QC software used to initially review the file.
9. Removed Section N on Data Management. The material is now part of the LTPP directive on traffic data processing.
10. Added purge codes to Table I.2.
11. Added ORACLE codes for purges to section G.8.

LTPP Traffic QC Users Guide

1. Software Overview

The Long Term Pavement Performance traffic quality control (QC) software is designed to load, process, and produce reports on monitored traffic data submitted to the LTPP program. It is divided functionally based on the flow of data through the system to ultimately produce a data review report and data for loading into the analysis software. Eight program functions (buttons) are available from the main control panel for use by the program operator as data are loaded, processed, and analyzed for reports. The software uses an ORACLE database to store summaries of data and writes processed data to text files for use in the LTPP traffic analysis software.

The program has 4 basic types of files: input files, reference files, summary files and output files.

The input files consist of volume, classification, and weight files. The file formats are those of the Traffic Monitoring Guide (TMG) 2nd and 3rd editions. The latter uses S.I. units for weight data. Volume files are not supported by the program nor are HELP files. Reference files contain site specific and file details. Input files and reference files must be correctly prepared as discussed later in this document (sections B, C, D, E, and F).

ORACLE tables include a file tracker, error summaries for classification and weight data, daily volume tables for classification and weight data, and monthly summaries of gross vehicle weight (GVW). These tables, particularly the file tracker, are essential for program functions. The routine backup of these tables is suggested. A daily backup is strongly recommended and weekly backup is essential for good practice. The tables themselves are discussed in detail in section G.

Summary files are created within the QC software. The summary files serve as the basis for creating the various ORACLE tables. They are not modified by the purge process.

The output files are the processed files which have completed QC. They are the direct inputs into the analysis software (formerly referred to as Level 3-2-1 processing). There is a one to one correspondence between input and output files.

2. Program Usage Flow

The QC software is designed with an expected program sequence procedure in mind. This design is reflected in the position of the main options on the control panel. In the first position is the "DB Connect" button, which allows the user to make a connection to the database. A database connection is a fundamental requirement of all operations within the software. The following steps are a general guideline for operating the software. A series of flow charts illustrating the process are found at the end of this section. Processing requirements for the LTPP program are addressed by directives issued to FHWA LTPP contractors.

1. Create NEWSHT.DAT after locating all files to be loaded in the current session including at a minimum filename, start date, end date, start time and end time. Transmittal sheet comments may be entered here but will need to be reentered in the File Tracker portion of the process.
2. Verify that SHRP.DAT, NEWSHT.DAT, DEFSHTDAT and FUNCLASS.DAT are in the DAT subdirectory of the director(ies) to be used in PREFS.
3. Start the software and set preference options in the PREFS menu to the root directory for the data outputs.
   Refer to section 3.1 or section B on DAT files information regarding this feature.
4. Identify the connection to the database: DB Connect
5. Invoke the data loader option to load LTPP data files: Data Loader
   Select the files to be loaded and load them. Check the log file after the load is completed according to the on screen message to verify that all files did in fact load. Correct and try to load again any file that did not load the first time.
6. Utilize the file tracker to determine the processing status of loaded files: File Tracker
   For each file that had transmittal sheet comments, enter them in the View/Edit files comments box and apply to entry to save the information.
   Review the Plett-plots for the sites.
   For files that are thought to be missing check the log files and look for a state XX unusual values for subdirectories.
7. Utilize the card statistics option to view in depth details about loaded files: Card Statistics
   Check the counts in both the card statistics and data view portions.
8. Utilize the graph manager to view graphical information about selected data: Graph Mgr.
   Use the relevant templates to review and print the necessary graphs. (The templates will need to be created the first time the software is used by each user.)
9. Print selected graphs for reporting and agency review.
10. Prepare a list of potential purges for review: PRF Editor

Chapter 5 discusses conditions where purges may be appropriate.

Save the recommended purge lists WITHOUT applying them. Print a copy for inclusion in the QC packet if needed.

11. Invoke the QC reporting menu to produce summary statistics on data loaded and file errors.

    At this point the QC report block needs to be checked in the File Tracker.

12. Forward the QC packet for agency review.

    The date the report was generated should be included in comments for the File Tracker for at least one of the files of each type for each site included in the report. The date the report is being sent should also be entered.

13. On receipt of QC packet comments, invoke the purge recommendations file editor to apply approved purges to loaded data for subsequent processing in the analysis software: PRF Editor.

    Open up the File Tracker and check report received for at least one file of each type at each referenced site. The date the report was returned should be entered in the View/File Edit Comments section.

    Retrieve the saved PRF files, modify them to reflect the accepted purges. Apply the purges and save the modified purge file for reference.

Unfamiliar users should read the following sections before running the software:

3.1 PREFS
3.2.2 Data Source Selection
3.4.1 Plett-Plot
3.5 Graph Manager
3.6 PRF Editor
3.8 QC Report
B. DAT File Requirements
E NEWSHT.DAT
F.1 File Naming Raw Data Files
F.3 File Naming Extensions for Data Files
J.2 Log File Contents

Installation instructions accompany the software and are found in section A.

Table 2-1 Initial File Preparation

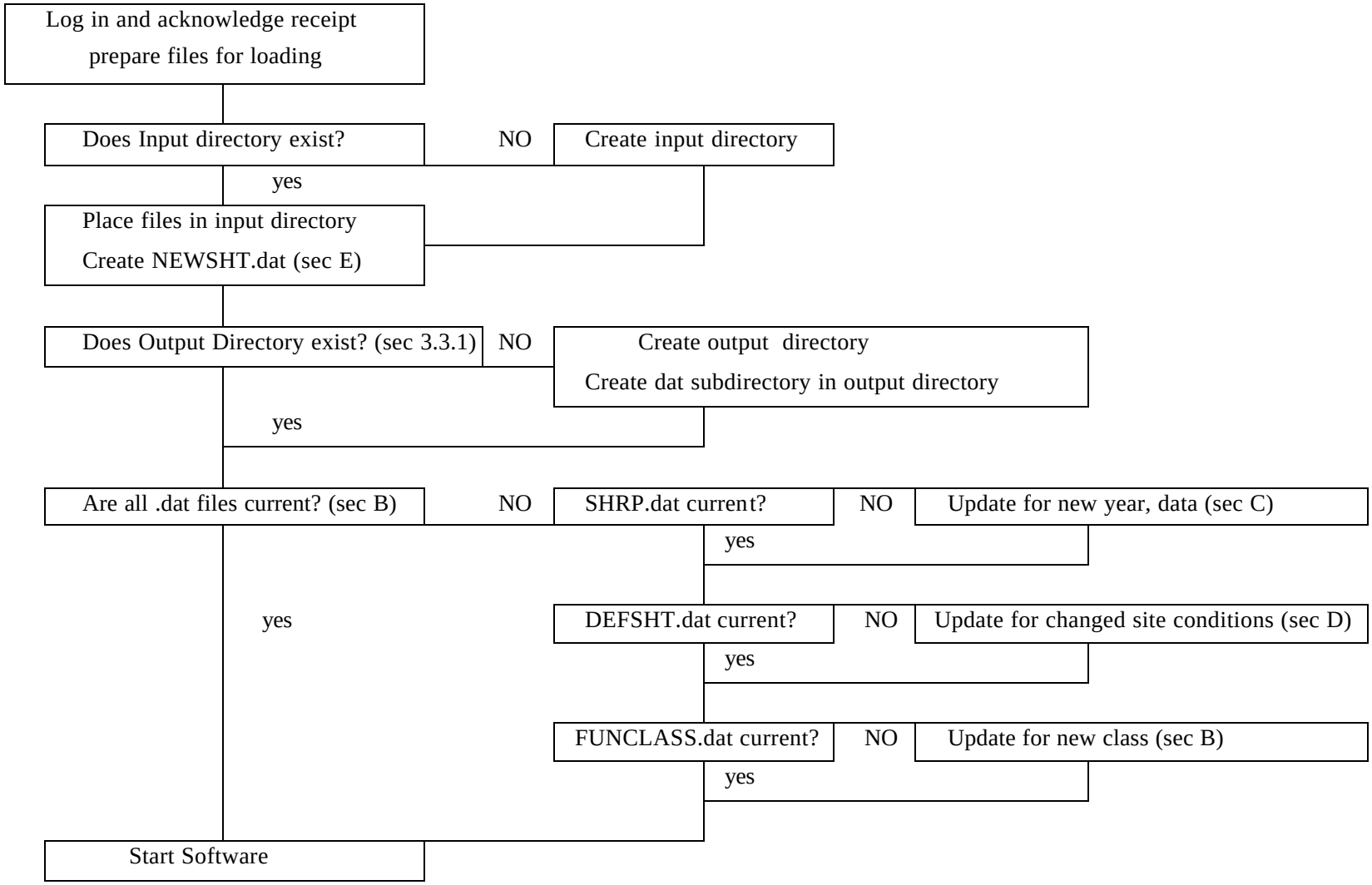


Table 2-2 Starting Data Processing

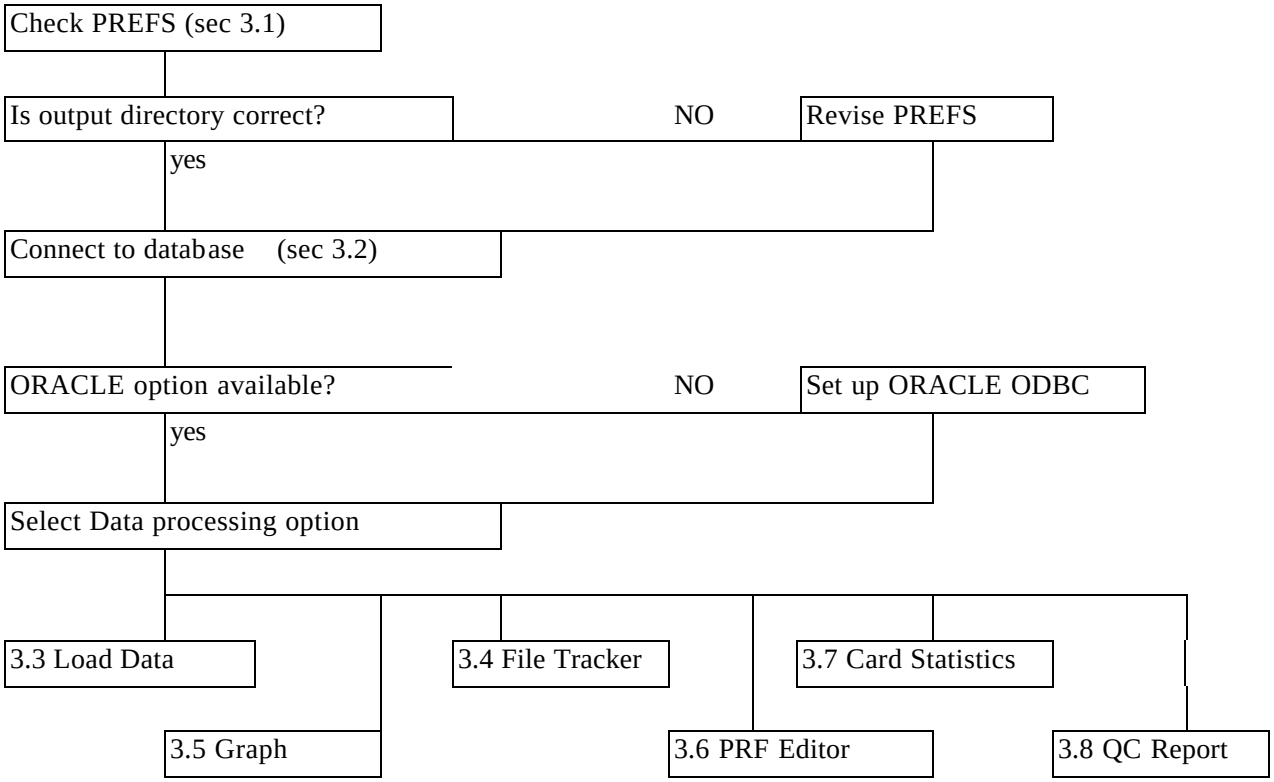


Table 2-3 Loading Data Files

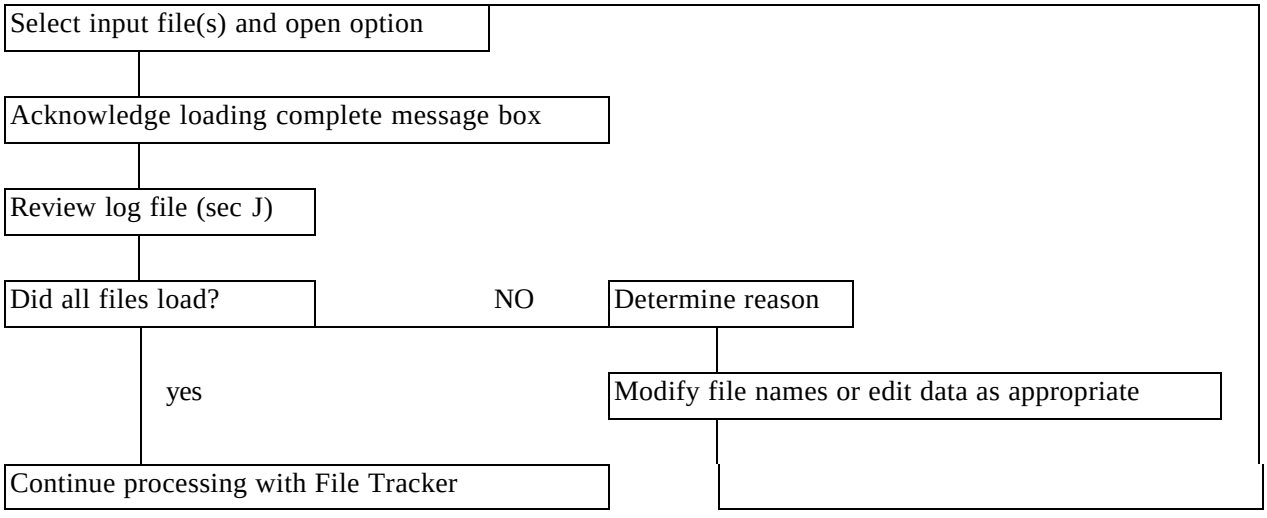


Table 2-4 File Tracker Options

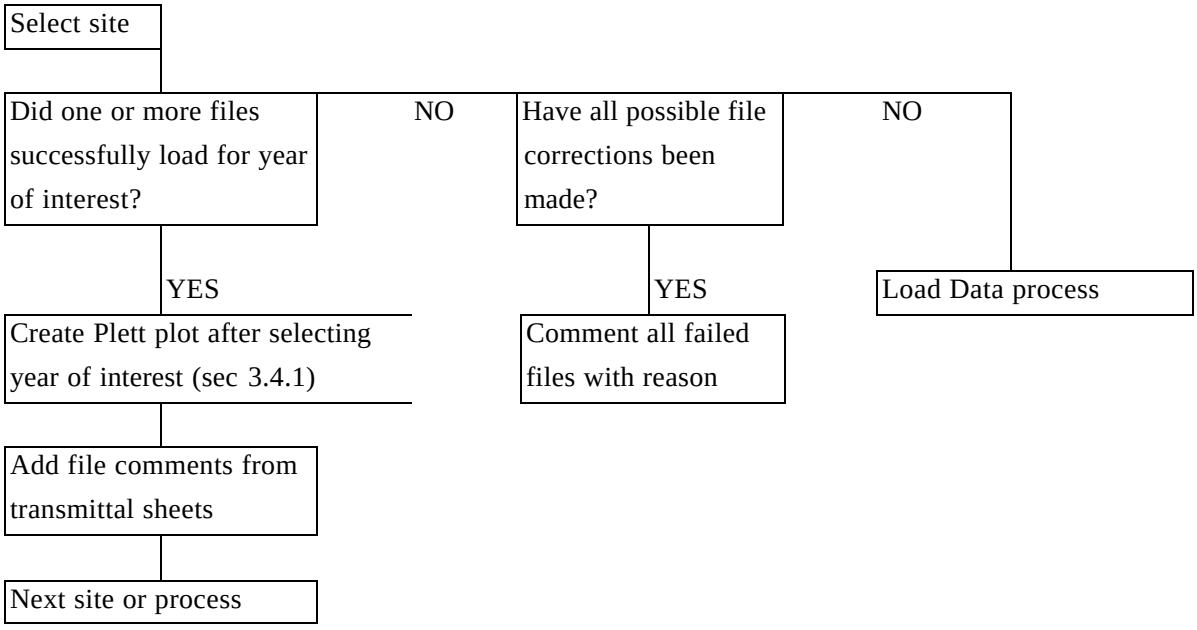


Table 2-5 Purge File Editor

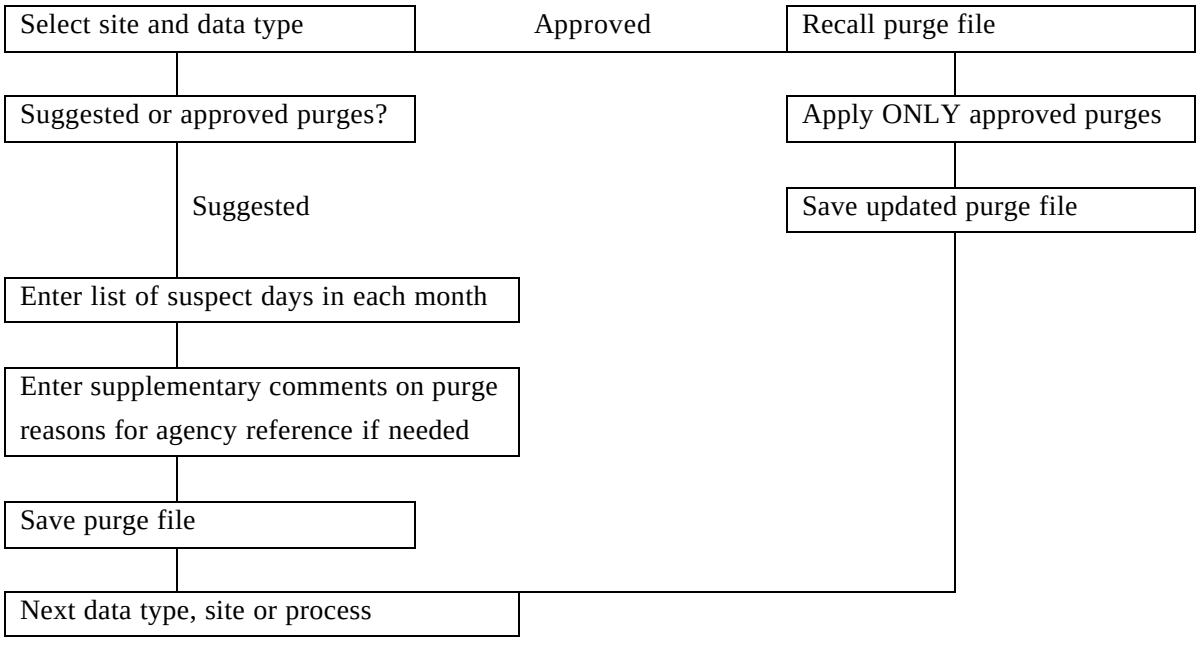


Table 2-6 Suggested Selections for Graphing Options

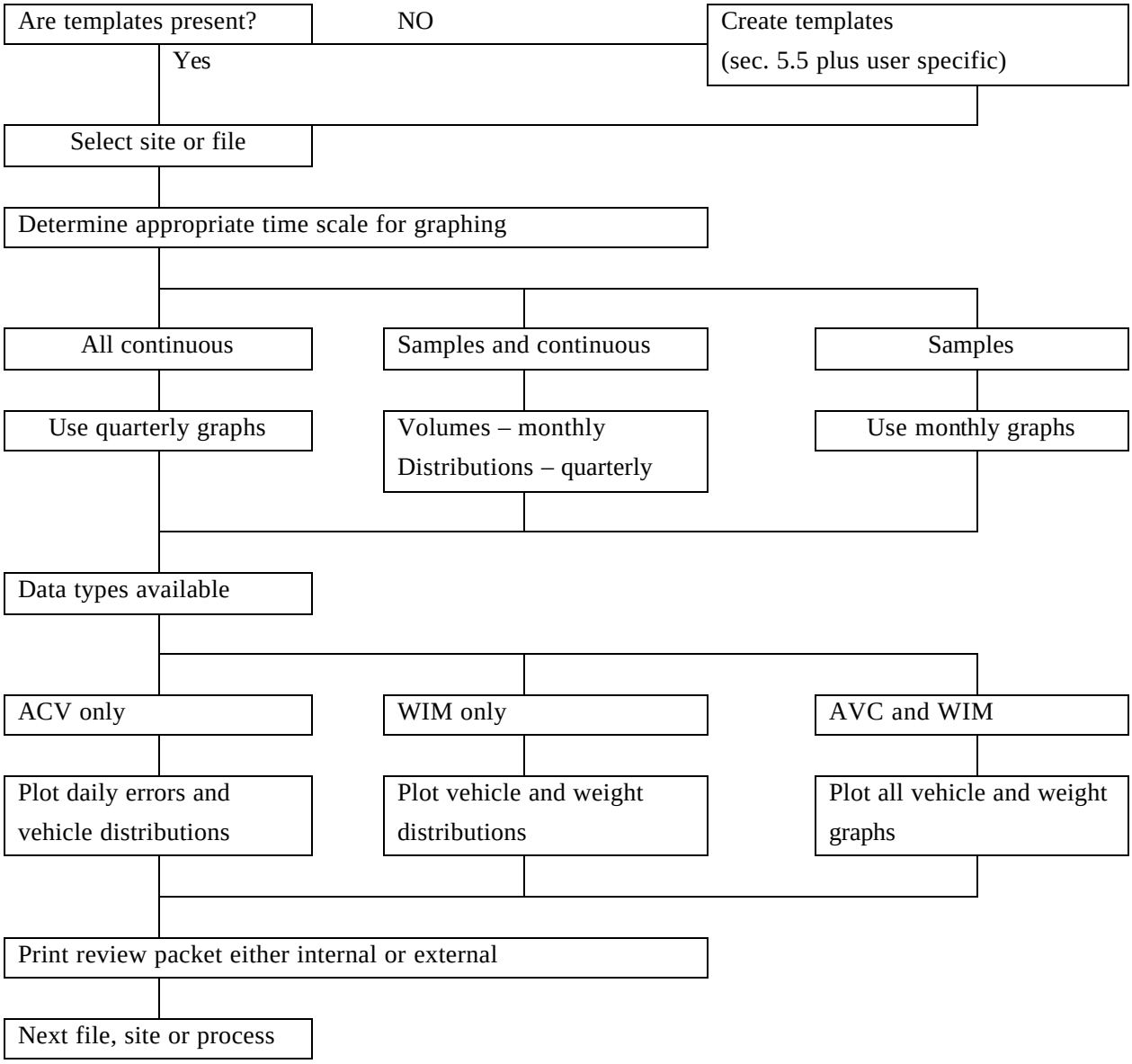


Table 2-7 Card Statistics – Record Level Errors

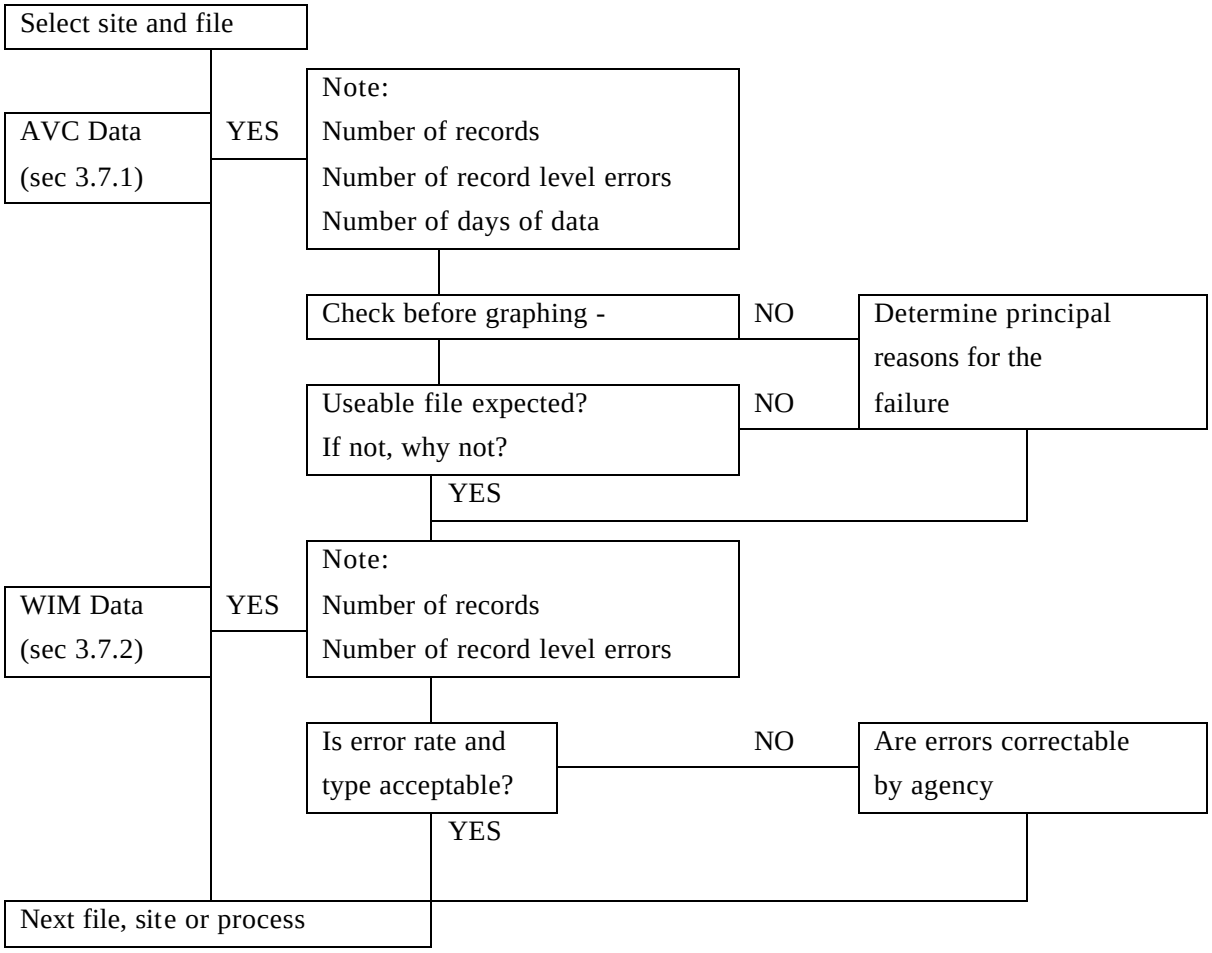
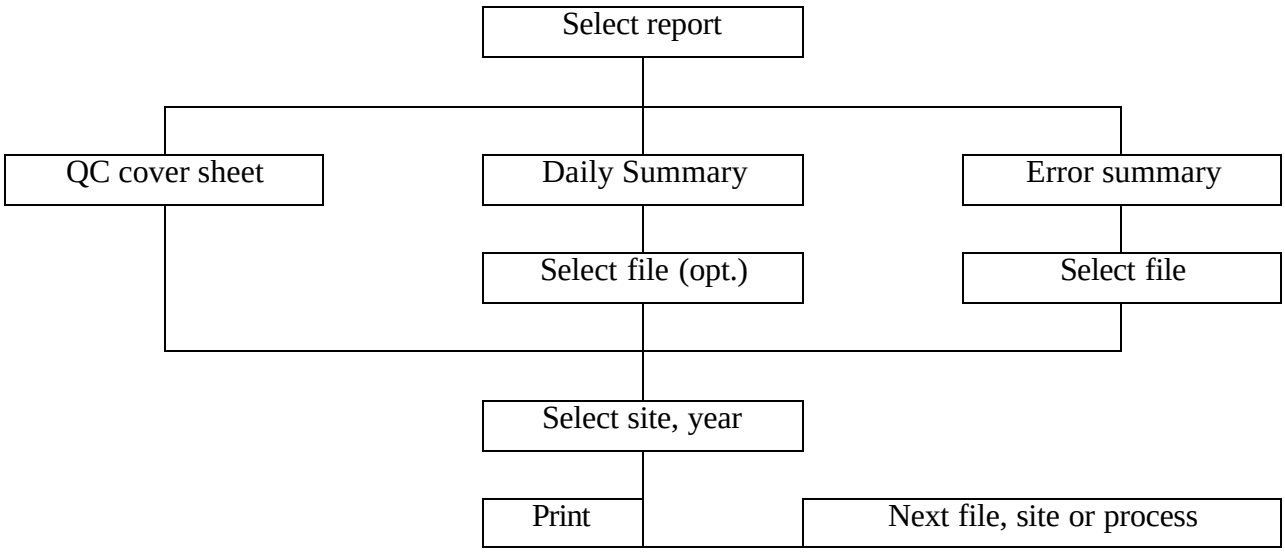


Table 2-8 Options for QC reports



3. Control Panel

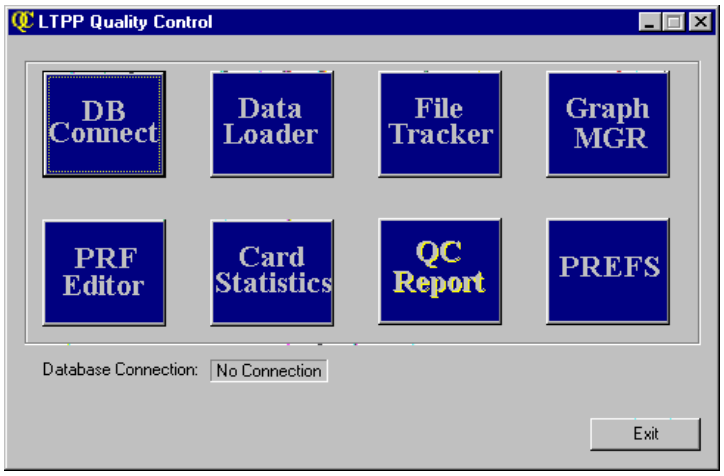


Figure 3-1 Control Panel

The control panel, or main menu, shown in Figure 3-1 contains eight functional buttons, a database connection indicator, and an exit button for exiting the program. The version number can be found under About after clicking on the QC in the upper left-hand corner.

3.1 PREFS

The user preferences menu provides the ability to customize the behavior of the program. Currently, only one option is available: base data location. This location is very important to the behavior of the program and must be set to a location the output files and reference files are to be or have been stored. Many directories and files are generated by the QC software during the data loading process, and most of these are used in the analysis software. Except for tables generated in ORACLE, files and directories are created in a consistent structure under the Base Data Location. Set this directory to a location with ample space to store data and that is designated for the archival and processing of LTPP data.

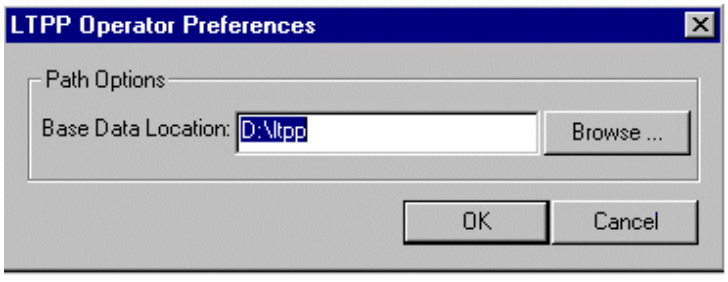


Figure 3-2 Sample operator preferences dialog box

All directory and subdirectory names in the path must be 8 characters or less.

Figure 3-2 shows the PREFS dialog box.

Selecting BROWSE brings up the

currently accessible directories for user selection in lieu of typing in the directory name as shown in Figure 3-3 Results of Browse Selection. Open and close perform that function for the selected directory. OK selects the directory name to be used for PREFS.

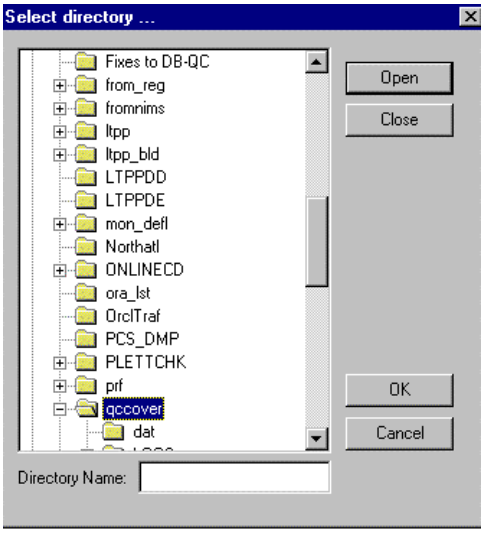


Figure 3-3 Results of Browse Selection

Multiple data locations for PREFS may be used within a processing session. It should be noted however that using anything other than the drive name and regional abbreviation for the path will result in work to relocate files for use by the analysis software.

3.2 DB Connect

A database connection to ORACLE is required for most of the functionality within the software. This is due to the fact that data are loaded from files into the ORACLE database and stored there for graphing and file tracking. Tracking information is also stored within a table in the ORACLE database, LTPPFILETRACKER[1].

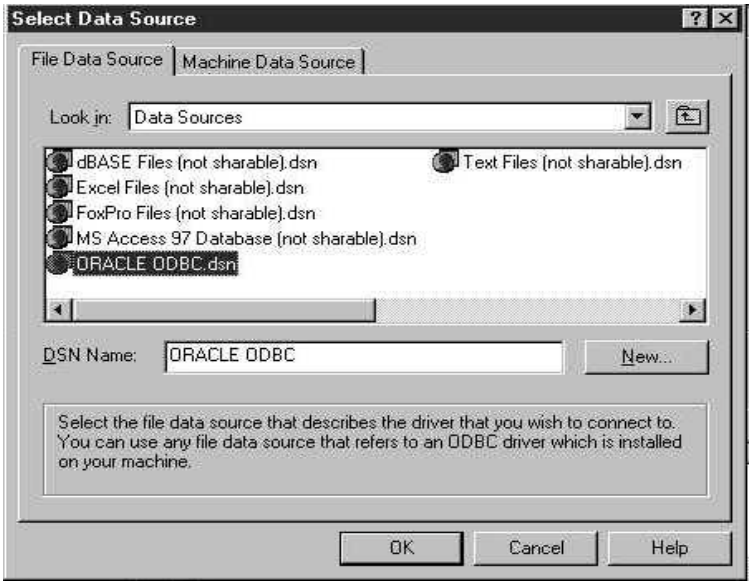


Figure 3-4 Data Selection Screen

To make a connection to the database, select the “DB Connect” button on the main control panel. This will invoke a “Select Data Source” window, which expects the user to select the method through the database will be accessed.

There may or may not be any data sources listed in the selection window. If an ORACLE ODBC option is not available in the white selection window, continue with section 3.2.1, Setting up a Data Source. If there is a choice available like the example in Figure 3-4 for

[1] See section G.1 for a discussion of this table.

connecting to ORACLE, skip to section 3.2.2, Data Source Selection. The software will not recognize anything but an ORACLE ODBC connection.

3.2.1 Setting up a Data Source

To make a database connection to any database available, the user must identify a method for the software to make this connection. On the "Select Data Source" menu, click the "New…" button, which invokes a "Create New Data Source" window.

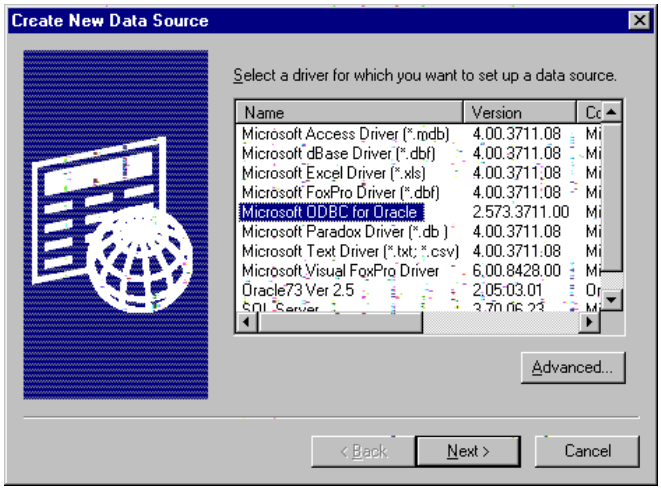


Figure 3-5 Driver selection when setting up new database

This window provides a list of data base drivers that may be used to connect to a database. Figure 3-5 shows an example. In the list select Microsoft ODBC for ORACLE. The software will only recognize this ODBC option. If this option is not available, contact the system administrator to have the driver installed on the computer. After selecting this driver from the list, click "Next>@ at the bottom of the menu. An input window, should now be available that asks where to save this driver configuration.

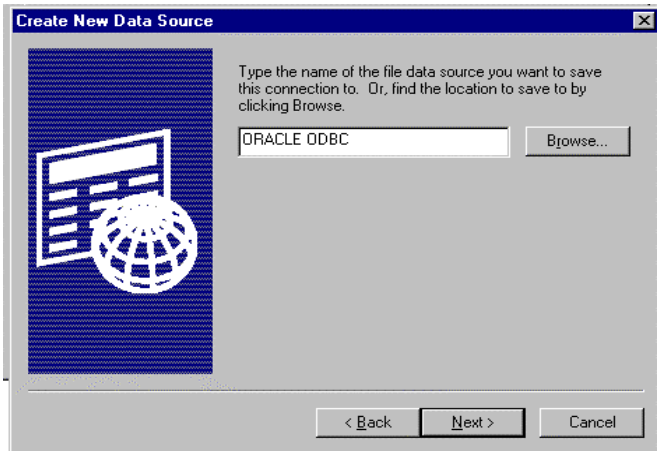


Figure 3-6 Creating a new data source

Type "ORACLE ODBC" in the window like the example in Figure 3-6, and click the "Next >" button. A final window (Figure 3-7) provides some information about the driver.

On this window, click the "Finish" button. At this point, a log in dialog box for the database appears as illustrated in **Error! Reference source not found.**. For ORACLE, there are three inputs: User Name, Password, and Server. Type the required information into the spaces for the relevant ORACLE database. The established Traffic User Account should be used to connect to the database. If the account has not been established or the required user name/password is not known, contact the

local database administrator (DBA). After entering all of the information, click the “OK” button. “ORACLE ODBC” selection should now appear on the “Select Data Source” menu.

3.2.2 Data Source Selection

In the “Select Data Source” window, select the data source which allows a connection ORACLE database. A dialog box like Figure 3-8 will appear to enter a user name, password, and server. Enter the required information to connect as the established Traffic User. (See the DBA if necessary.)

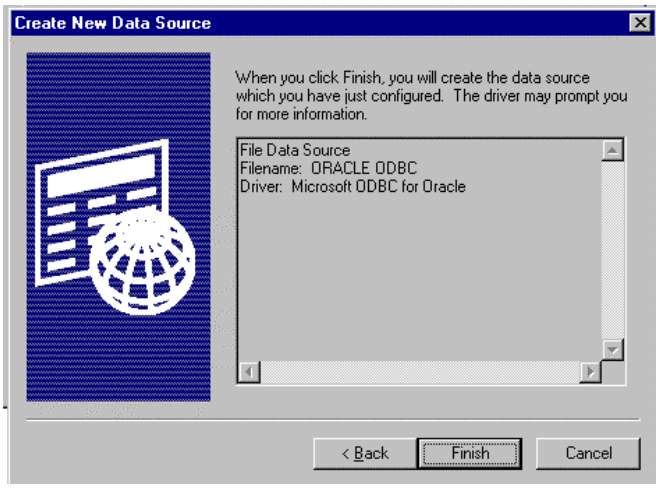


Figure 3-7 Configuration of data source selection

Assuming all information is correct, and the database is available, the connection will be established and the Database Connection message box updated to ‘Connected’ on the control panel of the LTPP QC software. The software may or may not recall the items User Name and Server from session to session.

To disconnect from the database, or re-establish the connection, click again on the “DB Connect” button. If currently connected, the program will request confirmation to disconnect. Selecting “No” will leave the database connected. On selecting “Yes”, the program will terminate the database connection. If the software is not closed, clicking on “DB Connect” will bring up the query “Do you want to make a new connection?” To make a new connection or reconnect, select “Yes”. It is not necessary to disconnect from the database before exiting the program.

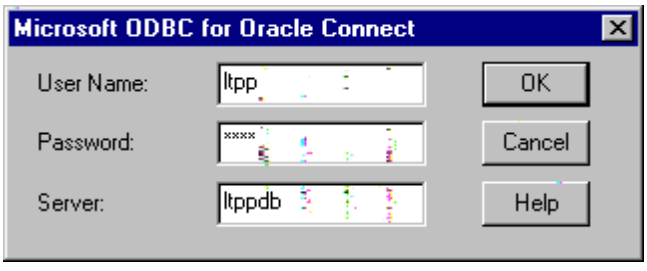


Figure 3-8 ORACLE log in screen

The first time the software is used, a message box will come up with a Yes/No query - "Your file tracking table does not exist. Create one?" Click on “Yes”. (Clicking on “No’ disconnects the database.) If this message ever appears again, it indicates that the ORACLE file tracking table has been renamed or dropped from the database. If

this was unintentional, restore the table from the most recent backup.

3.3 Data Loader

The data loader permits loading of 4-, 7-, C-, and W- card files as well as 7-card files with as many as eight 2-card header records into the program[2]. 3-card files will not load. HELP data files (a prefix of H) will not load. While data are loaded, they are checked for errors at the file, record and daily (if applicable) levels. They are consolidated into daily summary records for reporting purposes, statistics and errors are stored in the ORACLE database, and a corresponding text data file is written for use with the traffic analysis software. Days of data are counted and summarized by calendar days. This does not depend on whether collection equipment is permanent or portable. This is the way the original LTPP traffic QC software counted days.

To load a data file, select the Data Loader button on the main control panel. The window that appears is used to select the files to load from any input source available as shown in Figure 3-9.

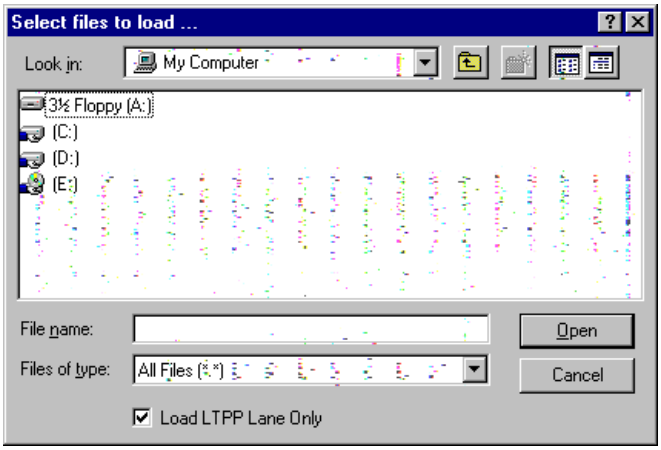


Figure 3-9 Sample screen for selecting files to load

It is possible to switch between drives during a loading session as well as switch floppy disks or CD-ROMs as needed.

Double-click on the file to be loaded. To select multiple files, press the CTRL key and single-click on each file to be loaded. Alternately, press the SHIFT key, and click on the first and last file for a group of files to be loaded. All files in between will be selected. Depending on the length of the path for the input files, up to 70 files can be loaded at a single time. If more than 70 are selected, NONE are loaded and no record of the loading attempt will appear in the log. When satisfied with the selection, click the Open button on the menu. The data is not loaded by the program in alphabetical order by filename. The loading success or failure of each file is written to the log file. For failures, a reason is identified as well. (See section A.)

[2] See section F for a discussion of the card types.

The option to load only the LTPP lane is provided, which results in the program loading only data from the LTPP lane and direction as defined in the SHRP.DAT[3] file. The option selected is retained from load selection to load selection. This selection is also used in other portions of the program. Turning it on in one section will affect the others (Graph Manager, PRF Editor and Card Statistics.) To see other lanes later, the file will need to be reloaded in its entirety. Reloading the IDENTICAL file to obtain the information on all lanes will not require the processing described in section H. However, going from all lanes to LTPP lane only in all the output files needs to be addressed per section H.1.

A "Loading LTPP Card File" message box (Figure 3-10) appears to indicate the processing status of the file. To cancel the loading process at any time, click the "Cancel" button. Canceling the loading process stops processing of the current file for the current step only. The cancel feature does not erase any subdirectory structures or temporary files that have been created for the file being read at the time of cancellation. It can damage summary.dat[4] files leaving a summary.tmp file instead and may remove any output file with the same extension as the input file. Canceling the loading process is not encouraged or recommended. If loading must be cancelled, treat the file as if the raw data is being reloaded per section H.1.

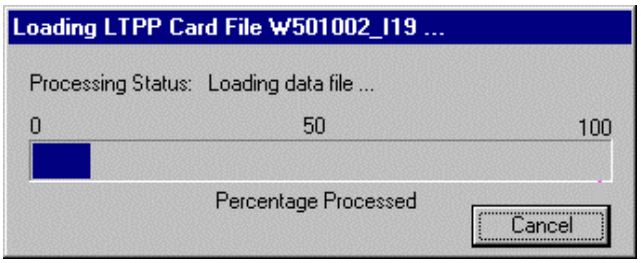


Figure 3-10 Reporting loading progress

At this point in the loading procedure, the data file is being checked at the record level for data errors. Incoming data is separated into monthly files for more efficient summarization in the QC software. For each file loaded, a record-by-record table is created within the database to store records containing errors. The errors can be viewed with the Data Viewer. (See section 4 for a detailed explanation of the function.)

Once the file is loaded and saved, the daily processor loads summary files for months of input data that have been updated. Only months containing altered data are loaded so as to reduce redundant processing and increase program efficiency. During this process, multiple status bars will appear to show the processing status of each monthly file that contains new data. Upon completion of processing for all files selected to load, the status bars will disappear and either the

[3] See section C for a discussion of this file.

4 See section 3.3.2 for a discussion of this file type.

next file will be processed or a “Load Completed” message box will appear. The process may take a considerable amount of time when loading weight data since the summary.dat files are not indexed.

It is CRITICAL to note that when data is resubmitted for a site, old data must be removed prior to processing. This includes information in both the summary files and ORACLE tables. If this is not done there will be problems with creating ORACLE tables, their contents, and the QC graphs. See section H on processing resubmitted data for details.

3.3.1 Post-Processing File Location

ORACLE tables are stored in the Traffic User account, as established by the ORACLE DBA. The remaining files are stored in the directory which was identified when selecting PREFS. The traffic data and working files are discussed here. Purge recommendation files are discussed in section 3.6, PRF Editor. ORACLE tables are discussed in section G. Log files are discussed in section J.

A working file called workindx.$$$ is used as a scratch file for data processing. It is located in the directory identified in user preferences. If processing terminates normally the file will be empty or non-existent.

Scratch files for converting C-card and W-card files are written to the root directory of the drive identified in PREFS. If processing terminates normally, there will be no trace of these files. Otherwise files with a S prefix will be found.

The new software creates a somewhat different directory structure than the old software. There are more levels and differentiation between the traffic file types. As a result, the base directory should be the root directory on the drive with the region name. (See section 3.1, PREFS.)

The first level of the directory structure is region. The second level is state as identified by its 2 character alpha abbreviation. The third level is the 6 character STATE_CODE, SHRP_ID combination. The fourth level is LEV4 or LEV5[5]. The subdirectory structure below LEV4 has a subdirectory DATA which is split into a subdirectory for each YEAR. A YEAR subdirectory is split into a subdirectory for AVC (AVC4) and a subdirectory for WIM (WIM7). When volume data can be loaded, an ATR3 subdirectory is created. The processed data files are stored in the

[5] Lev1, Lev2, and Lev3 are created as a function of the analysis software.

data type directories. Additionally, the type subdirectories are split in up to thirteen additional subdirectories, one for each month of the year and (Non) one for any data with an invalid month value. A sample of a partial, post QC subdirectory structure appears in Figure 3-11.

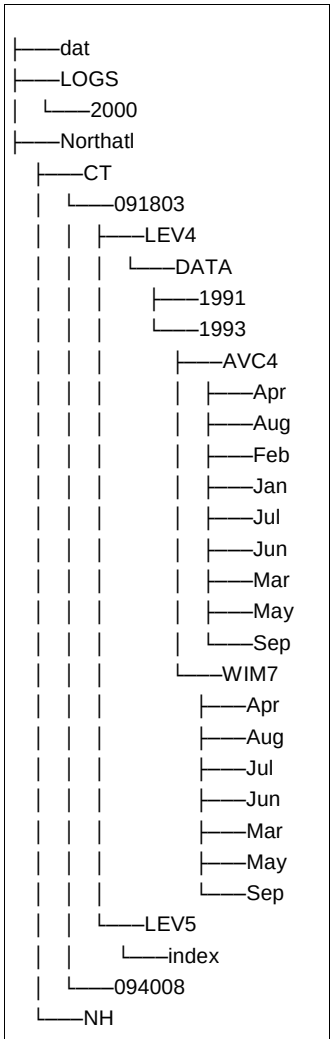


Figure 3-11 Sample output directory structure

The first and last character of the file extension, not file content, is used in determining the year for a given site. The month and year of the file extension must match the month and year of the first record in the data file in order for the file to be loaded.

3.3.2 Summary Data

Each data type has two groups of summary data: ORACLE tables and summary. The ORACLE tables are discussed in section G. The input files for the ORACLE tables are created one per month for any month with data. There is a set for classification (under AVC4) and one for weight (under WIM7). They are all called summary.dat. They are text files which group all of the data for a month together in chronological order. Each record indicates the file which supplied the data. The exception is continuation cards (for weight data) which are not labeled in this fashion. These files include most QC flags. Daily level classification errors are omitted. The records do not include purges. Graphs for counts after purging must be done with other tools (spreadsheets or the LTPP traffic analysis software). See Section 5.4.7 for a description of a possible process. The flags on the records in summary.dat files determine what information is added to the ORACLE tables. Data with critical errors is excluded from the total counts of vehicles and weights. Data associated with critical errors is identified in section I.

3.3.3 Output Files

Output data files are renamed using the existing file naming conventions for such processed files. (See section F.) They are stored in the AVC4 or WIM7 subdirectories by data type for the site and year under evaluation. They include the error information and are the only files to which the purge flags are applied. They are used as input to the LTPP traffic analysis program. Output files, like input files, are in ASCII fixed column format. All output files are either 4-card or 7-card records.

3.3.4 Transmittal Sheets

The QC software will automatically create the transmittal sheets[6] that are required for each QC'd file. Transmittal sheets are written to the Index subdirectory of the LEV5 subdirectory. There is only one such file for the site for all years. The name for this file is xxxxxx5.inx where xxxxxx is the STATE_CODE, SHRP_ID for the site. This is a binary file with visible ASCII characters. This file is an artifact of the original LTPP traffic QC software and is not used in the ORACLE based traffic analysis software. Comments that would have appeared in the electronic version of the transmittal sheets are not entered in the 'View/Edit File Comments' box in the File Tracker module (section 3.4).

Writing correct transmittal sheets requires that two files be present in the DAT subdirectory: DEFSHT.DAT and NEWSHT.DAT[7]. If the state code, SHRP ID combination is missing from DEFSHT.DAT, the information will default to blanks. If the input file is missing from NEWSHT.DAT, the QC processing will occur but a note will appear the log file.

3.3.5 Processing Outcomes for Bad Data Files

The processing of various types of data errors is discussed in section J.2, Log File Contents. If a file fails to load, the error message in the log should be sufficient to indicate what actions are required to correct the problem. Section J has more details on the log file and its messages.

3.3.6 User Notes

To maximize the number of files which can be loaded, path names store used to input data should be kept as short as possible.

- A 4-card file loads as long as all lines are the same length as the first card in the file and that length is at least 51. If a 4-card file has data beyond column 51, the processing software reads it assuming that the additional columns are to be split as 2 columns per additional class. This is true whether or not these are actually vehicle records. The existence of a sheet 7 is not checked in reading such files. It was not checked in the old software.

---

[6] Transmittal sheets are used to catalog what data has been submitted on a file by file basis. The originals are paper forms completed by the states and sent with the data submission. There is a different format for each type of data. The information on the sheets includes beginning and ending dates and times, classification scheme, equipment type, and any comments on the data collected. This information is used in creating or modifying the DEFSHT.DAT and NEWSHT.DAT files. (See sections D and E for more information on these files.)

[7] See sections D and E respectively for a discussion of these files.

- If duplicate records (more than one record with the same date, time, direction and lane for a given site) were encountered in 4-card data, the old software would not use them in QC graphs. The QC software still does not recognize duplicate records as an error. This error is not detected until daily summaries are created in the analysis software.
- In the old software, days of data that fall on daylight savings time are deleted because they have too few or too many hours of data. The new software behaves the same way.
- The software is not smart enough to deal with resubmitted data whether modified files have less data, more data, or the same name with different data. IF AN INPUT FILE MUST BE REPLACED, PROCESSED FILES, SUMMARY FILES AND ORACLE RECORDS WILL NEED TO BE DELETED OR MODIFIED. See section H.1 for the instructions on this process.
- If a file does not meet LTPP lane only criteria, an error message comes back "Input file contains no loadable data". A record is written to LTPPFILETRACKER with a 1/1/2025 processing date. The relevant subdirectories for the site, year and data type are created.
- If multiple years are loaded in a single file, the data will be loaded but not split by year. It will all be included as data for the first year in the file.
- In reloading data, the index file is not updated. When replacing or reloading files, the index file does not show a file creation/revision date consistent with the file reloading. This is a non-fatal error.

3.4 File Tracker

The LTPP File Tracker is a partially automated feature within the QC software. It is the user=s responsibility to maintain some information contained within the file tracker. The purpose of this tracker is to maintain information about the status of data from loading through applying purge recommendations. The file tracker provides the ability to monitor the processing status of files loaded into the software by state and site and contains the capability to graph data received from a given site (Plett-Plot).

Select the "File Tracker" option on the control panel to invoke the LTPP File Tracker. A window appears with a variety of information as shown in Figure 3-12. PREFS may be set to any location without affecting the operation of this module.

Much of the information pertains to the currently selected file, and some of the information can be changed. For this reason the file tracker is considered Apartially automated.@

Two selection lists, state and site, are provided to specify the site for which loaded files should be displayed. File loading failures result in a state XX with a SHRP ID of 0000. Loaded files will be displayed in the "Available Files" selection list **B** an empty list indicates no files were loaded or a selection has not previously been made to view files. The file lists contains information about the file name and the versions loaded. The file name is displayed first with the period replaced by an underscore and the version of the file is in parenthesis. The first time a specific file is loaded, version A will be assigned. If a file with the same name is loaded at a later time, the next version (B) will be assigned and so on.

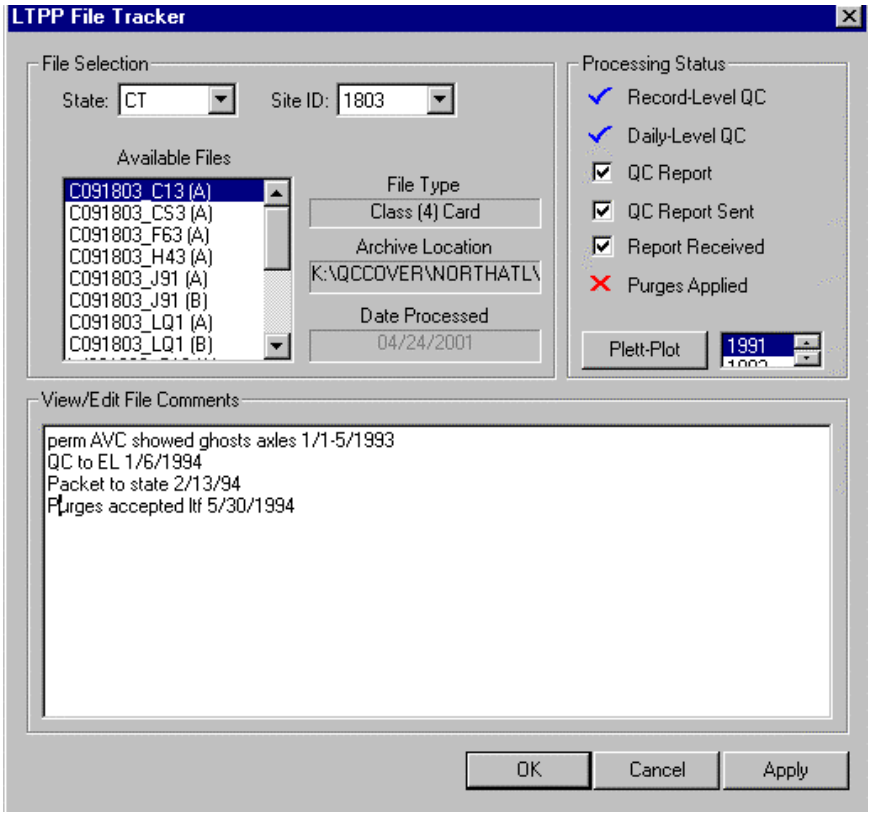


Figure 3-12 File Tracker screen

The file type (data and format), archive location (to locate processed data), and date processed are displayed next to the file list for each file selected. On the right side of the menu are the processing steps that have been completed for the selected file. Steps marked with a red X are not yet completed, while steps with a blue check mark are completed. Steps with an empty check box next to them are provided for the user to check off when the step is completed.

Figure 3-12 illustrates the results of a file which has completed the QC process.

A white, text input box, labeled "View/Edit File Comments" is provided. The user can enter comments regarding the selected version of the data file. Up to 2000 characters of information can be included containing any notes the user considers relevant. This is where any comments from the transmittal sheets should be stored electronically. This information is not carried

forward to the QC report. It is stored in the LTPPFILETRACKER[8] table in the COMMENTS field. To print it out an extraction must be made from that table. Standard copy and paste commands (Ctrl+C and Ctrl+V respectively) work if comments need to be repeated for multiple files or imported from other files. To electronically store notes on a site the user may also use the commenting capability in the purge file. (See section 3.6.1, Purge File Structure).

Note: Any changes made on this menu must be "Applied" before changing the selected data file or exiting the menu. Failure to apply the changes results in the loss of changes. The Apply button greys out after changes are applied. Any revision to the comments reactivates the Apply button.

3.4.1 Plett-Plot

The ability to plot a graph of data received from a given state/site is provided by the file tracker for years in which data have been received and processed to date by the software. Displayed on the right side of the file tracker menu below the processing steps list is the Plett-Plot button. Beside the button is a selection list of years for data already processed for this state and site.

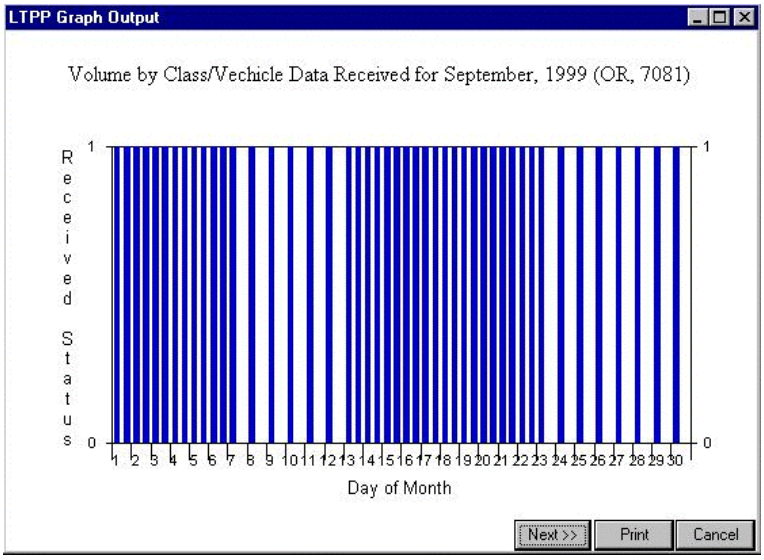


Figure 3-13 Sample Plett-plot

To produce a Plett-Plot:

- **$** Select the site and year to be graphed. It is not necessary to select a file.
- Select the Plett-Plot button next to the list of years to produce the graph.

For each of the months in which data have been received, a graph is displayed with values of 1 (received) or 0 (not received) for every day. The plot is produced for all data received with AVC showing as the left hand bar for a day and WIM data graphing on the right side of the interval. All bars are currently the same color so the results will be similar to Figure 3-13. The graphs are labeled with site, month and year. The text at the top of the graph indicates the relative positions

[8] See section G.1 for a discussion of this table.

of the data types. The software goes through the entire calendar year in sequence whether or not any data was received for a month. Any month's plot may be printed.

3.4.2 User Notes

$ On occasion, thick lined boxes in varying colors will appear around the processing status boxes which can be checked by the user. The outlines are erratic in both presence and color even for the same files. This does not affect program function.

WARNING: The option to delete files exists through this module. Selecting a file from the Available Files list and pressing the delete key on the keyboard will delete knowledge of that file from the ORACLE database. It will not, however, affect either the summary files used for graphing or the output files used for analysis even if the last version loaded is selected. Deleting files here can produce erratic results in further processing activities. The **user** is solely responsible for dealing with any consequences of deleting files here. Reloading files from scratch is generally the only corrective action.

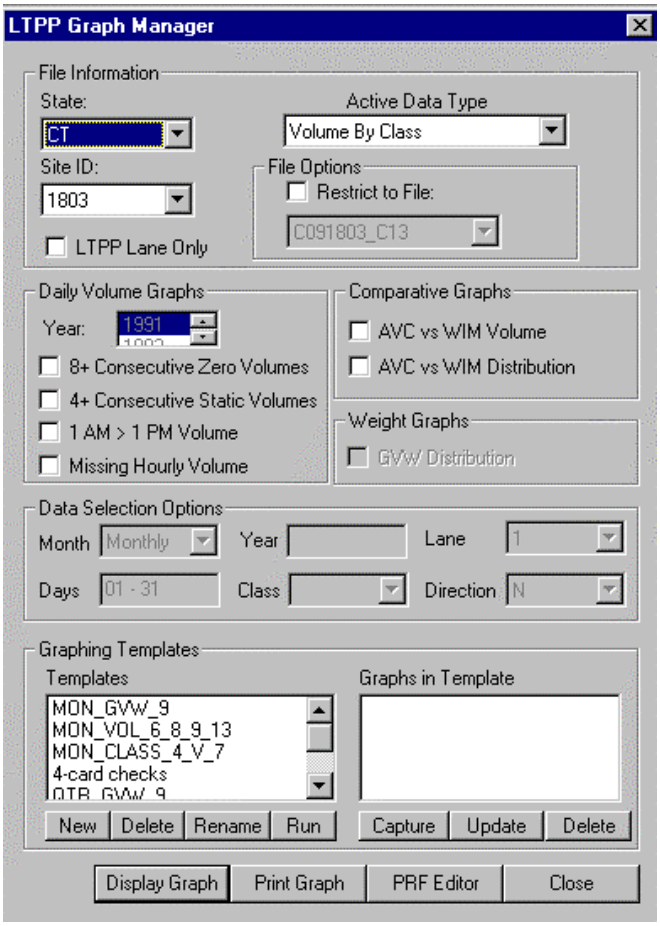


Figure 3-14 Graph Manager Screen

3.5 Graph MGR

The graph manager produces graphics of data containing errors, gross vehicle weight (GVW) plots, and comparisons of volume and weight data over a given time period within a year. The graph manager includes a template manager to set up predefined graph sets. The template can then be run for the selected state, site, and year to produce the series of graphs saved within that template. (See section 5.5 for a set of recommended templates.)

Graphs can be printed from the Graph Manager.

The purge file editor can be accessed from the Graph Manager without having to exit it and enter the PRF module.

The Graph Manager selection screen is divided in to three main sections, beginning with the site selection criteria, followed by the graphics options and the template manager as shown in Figure 3-14.

If more than one output location has been defined for a site for a year, the graphs will be wrong since the ORACLE tables will be incomplete. It is the **user's** responsibility to ensure that all data files processed for a site for a year are output to the same place as defined by PREFS and the standard subdirectory structure. Failure to do so will prevent the QC software from producing accurate results.

3.5.1 Site and Data Selection

The entry in PREFS affects the functioning of this element of the software. The graphing requires access to the SHRP.DAT file since LTPP Lane Only is an option. If multiple PREFS have been adopted for processing (i.e. separate state subdirectories) and the current selection does not contain a SHRP.DAT entry for the currently selected state and site, the error message "Unable to find SHRP entry for the state and site." will appear. Either change the site or change the PREFS entry before continuing.

The file information section in the Graph Manager consists of a state and site to identify the data sets to be used, a data type, and a file restriction option. Selecting the active data type determines the graphing options available. For example, the weight graphs are not available when the Volume By Class data option is selected. Daily volume graphs cannot be produced without classification data being loaded.

It is possible to restrict graphs to a specific file or to the LTPP lane data. The former can be useful for plotting only errors or statistics from that file and not all files loaded for the site. By selecting the "LTPP Lane Only" option, the direction and lane should automatically be filled in under "Data Selection Options" when a new site is chosen.

Graphing is not restricted to the data for the LTPP lane if multiple lanes of data have been loaded for a site.

3.5.2 Graph Selection

A variety of graphs are available through the graph manager to plot errors and comparison values. For Volume by Class data, four graphs are available. They are based on LTPPRC tables. To limit the number of graphs produced by the software the year of interest is one of the

selection options for “Daily Volume Graphs”. These graphs do not exist for volumes derived from weight data.

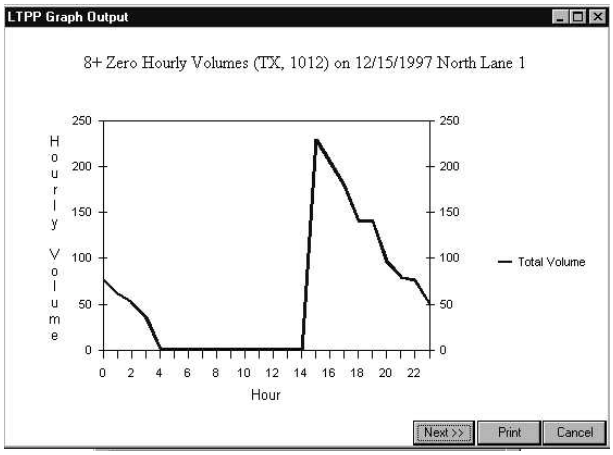


Figure 3-15 Sample 8+ consecutive zero volumes graph

- 8+ Consecutive Zero Volumes

Produces a graph for any day containing eight or more zero hourly volume counts. Zero hourly volume counts are not the same as missing hours. In this case the volume recorded for the hour was zero as evidenced by the fact that a record exists in the file for that hour. An example is shown in Figure 3-15.

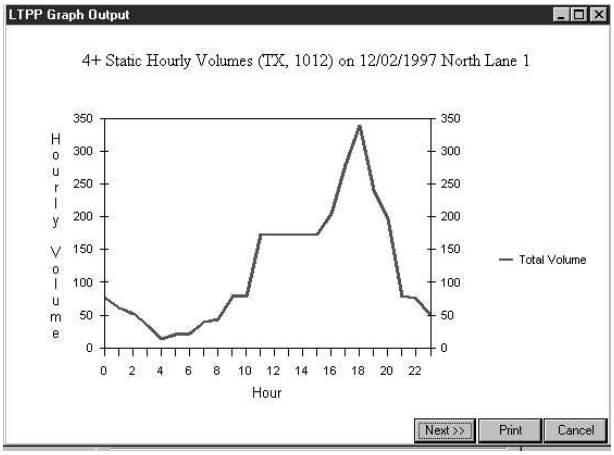


Figure 3-16 Sample 4+ consecutive static volumes graph

- 4+ Consecutive Static Volumes

Produces a graph for any day containing four or more identical hourly volume counts. Four consecutive zero volume hours do not count as 4+ consecutive static volumes. An example is shown in Figure 3-16.

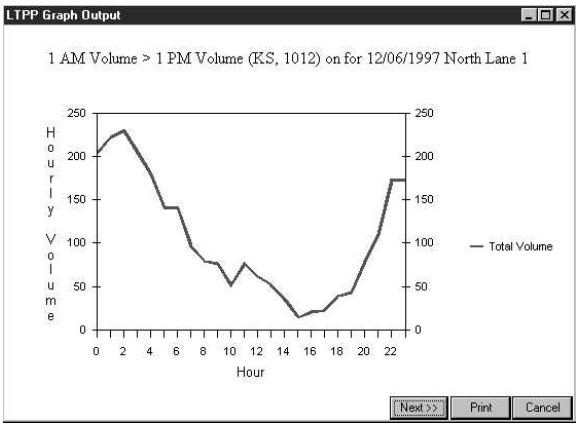


Figure 3-17 Sample 1 a.m.>1p.m. volume graph

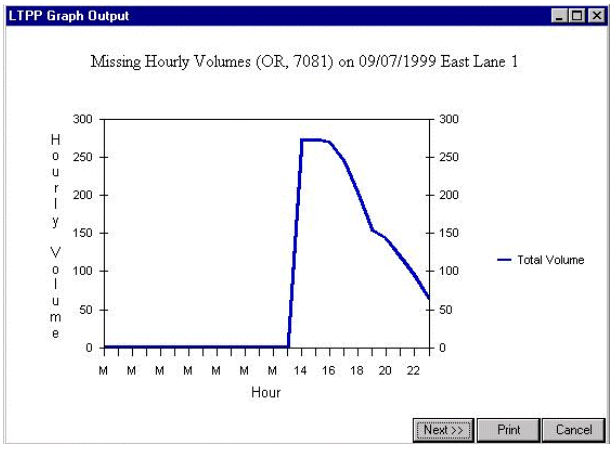


Figure 3-18 Sample Missing Hourly Volumes graph

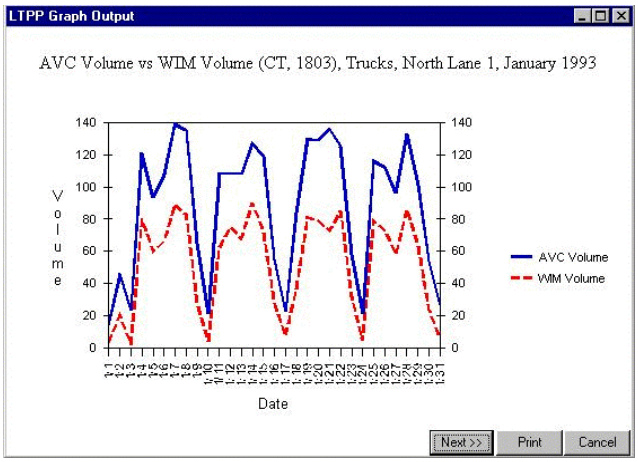


Figure 3-19 Sample AVC vs. WIM volume graph

- 1 AM > 1 PM Volume Count

Produces a graph for any day containing a volume count at 1 a.m. that is greater than the observed volume count at 1 p.m. 1 a.m. is the hour starting at midnight. 1 p.m. is the hour starting at noon. An example is shown in Figure 3-17.

- Missing Hourly Volume

Produces a graph for any day in which one or more an hourly volumes was not present during loading. Figure 3-18 has an example.

These four types of plots are created only from 4-/C-cards. They can be obtained if any classification data exists even if 'Weight by Vehicle' is selected as the active file type.

The following graphs are available to display AVC versus WIM data and require information be set in the “Data Selection Options” of the Graph Manager (see section 3.5.3.)

- AVC vs. WIM Volume

A graph comparing observed daily AVC volume counts versus WIM data converted to volume counts for a given class or for all trucks as shown in Figure 3-19.

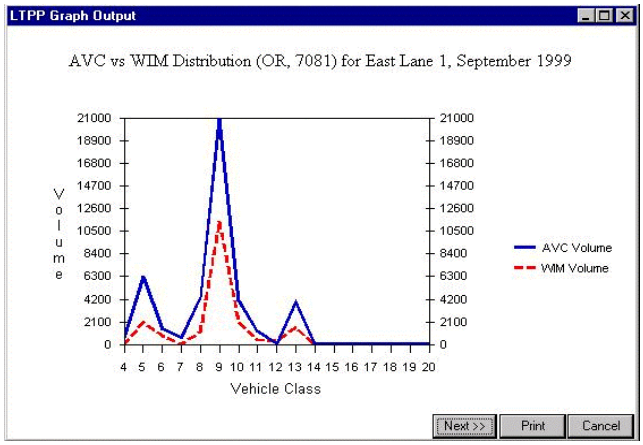


Figure 3-20 Sample AVC vs. WIM vehicle

- AVC vs. WIM Distribution

A graph comparing the total volume for AVC versus WIM data for each day in the date range selected similar to the example in Figure 3-20. This will print even in the absence of one of the two types of data. These values are not adjusted for count duration which may severely distort the comparison if weight data is sampled and classification data is continuous.

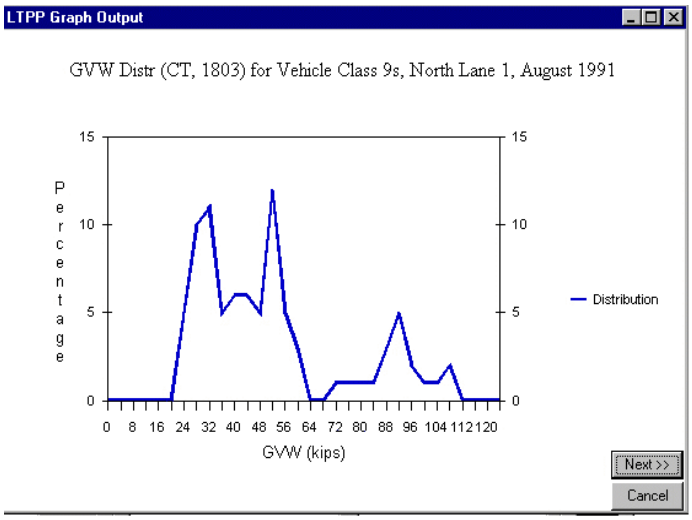


Figure 3-21 Sample GVW graph for a vehicle class

- GVW

For the “Weight by Vehicle” data selection, the additional option of a GVW graph is available. This option produces a distribution graph for the date range selected in the “Data Selection Options” with percentages of vehicle weights observed in each of the vehicle weight bins as shown by the example in Figure 3-21. This graph can only be produced for individual vehicle classes 4-20. If ‘All Trucks’ is selected, the error message “GVW requires a single class” appears followed by “Nothing to graph.”

3.5.3 Data Selection Options for Vehicle Based Graphs

Various data selection criteria in the graph manager are required for the comparative and GVW graphs. Date ranged, class, lane, and direction information must be specified to produce the comparison desired graphs. While the comparative graphs require that a day range be specified, the GVW graph does not, (it is either a monthly or quarterly graph). The following criteria are available:

$ Month

The option to produce 12 monthly graphs or 4 quarterly graphs for data that are available for the specified period of time.

- **$** Days
  The range of days for which the graphic should be produced, in the format of ##-##, where each ## is day to indicate the beginning and ending day. For each of the months or quarters graphed, only days specified in this range will be displayed. For quarterly graphs, specify 0-31 for days to insure the graph makes sense. Leading zeros are not required. At least two days must be specified.
- **$** Year
  The year for the data to be graphed. This value must be typed in as there is no pick list provided.
- **$** Class
  The vehicle class for which class specific data will be plotted. 'All Trucks' is an option for comparative graphs. The AVC vs. WIM distribution graph does not use this information when plotting but one of the class options must be selected.
- **$** Lane
  The lane of interest for which data will be plotted. (It should be automatically set if LTPP Lane Only is selected and must be selected again if the LTPP lane is desired or after the lane value has been changed.)
- **$** Direction
  The direction of interest for which data will be plotted. (It should be automatically set if LTPP Lane Only is selected and must be selected again if the LTPP lane is desired after the lane value has been changed.)

After the graphing options are selected (one or many may be selected, but changes can be made to produce graphs with other options), click the "Display Graph" button at the bottom of the menu. If any data meet the selection criteria specified, a "LTPP Graph Output" menu will appear with the desired graph. If no data exist which meet the graphing criteria, a message – "No data available which match your criteria or graph selection" will appear. Selection of the "Print Graph" button will generate a copy to a printer.

If multiple graphs are generated by the criteria selected, click the "Next >>" button, to display the next graph for the criteria used. Once all graphs have been viewed, clicking "Next >>" brings back the graphing options menu. The "Cancel" button may be selected at any time to terminate the viewing process. It is not possible to go backwards through a series of graphs.

3.5.4 Graph Template Manger

The graphing template manager allows for the setup a set of templates, each containing a set of graphs that can be saved and run at any time with the specified state, site, and year. This is useful

to consistently produce the same set of graphs for different sites. Daily graphs (4-card errors) cannot be in the same template as monthly/quarterly graphs which may use WIM data.

Two windows are displayed in the template manager, the left displaying saved templates, and the right displaying graphs saved within the selected template. Begin by creating a new template with the “New” option under the “Templates” window. A new template is created with a default name, which can be changed with the “Rename” option.

To save a new graph to the new template, setup the graphing options on the graph manager menu, including desired data type, graphs to produce, and data selection options. Once set, select the “Capture” button under the “Graphs in Template” window of the template manager. A new graph will appear, numbered consecutively, in the graphs window. A user may store up to 30 templates, each with 10 graphs.

To run a template at any time, select the state and site for the data to be graphed, and specify the year of the data to graph. Select the template containing the graphs to be produced, and select the “Run” button under the “Templates” window. To view any of the saved graphs, select the graph in the “Graphs in Template” window, which will update the Graph Manager screen to reflect the settings of the saved graph.

Templates are user specific. The instructions for each are contained in a file - templates.dat. This file is saved in WINNT\Profiles\user name\LTPP. Procedures for setting up a minimum recommended set of templates are contained in section 5.5.

3.5.5 Printing Graphs

The option to print graphs is provided within the Graph Manager. Graphs must be printed individually whether defined and selected individually or produced using a template. Graphs are printed one or four per page. Printing directly from the screen display produces one graph per page. Printing using the Graph Manager “Print” button results in four graphs per page. All graphs on the page are the same type. If fewer than four of the type exist, a new page is started for the next graph type. Any available printer can be used or the graphs may be printed to a file. The latter course is not recommended since the files contain all of the printer control characteristics. For the most readable graphs, printers should be set in landscape mode prior to printing.

3.5.6 User Notes

$ It is not possible to select a single day of data to graph on a monthly graph for AVC vs. WIM volume graphs. At least two days must be specified.

- If the full month is not specified when selecting the quarterly option for AVC vs. WIM volume graphs, the only labels on the x-axis are the first day of the first month in the quarter and one or more intervals later.
- When graphic AVC vs. WIM volume graphs restricting the graph to a specified file restricts only the data of the type in the selected file. Thus, if a classification file is the restrict to selection, all WIM data for the year will be graphed as part of the comparison. If a WIM data file is the file to which the graph is to be restricted, all of the class data for the year will be presented.
- The color of the data line for AVC or WIM may change when the data type under the “Restrict to File” option is classification and there is a gap in data for AVC vs. WIM distribution graphs. The reviewer should pay careful attention to the individual graphs and highlight the data of interest when comparing a series of graphs.
- If the year of the restricted file and the data selection option don't match for AVC vs. WIM distribution graphs, the graph still plots if data exists for the relevant file type in the year selected. For example, restriction to a 1991 class file with the 1993 year to plot, gives 1993 WIM graphs with no classification data.

3.6 PRF Editor

The Purge Recommendations File (PRF) Editor is used to enter purge recommendations into the software. These recommendations instruct the software to purge (exclude) data in the given data file from inclusion in the daily summaries and annual estimates. The data will still exist in the output file used by the analysis software. To accomplish this, the PRF Editor provides a graphical interface through which to exclude data within specific date ranges.

The editor is started with the “PRF Editor” button on the control panel. A “PRF Editor” screen is presented with variety of input windows to specify which data should be excluded for the given state and site as shown in Figure 3-22. The PREFS selection will affect the function of this element if the user intends to have the LTPP lane selected automatically for the lane and direction entries.

Select the state and site for which to purge data as well as the data type to be affected by the purge. Checking the AUse LTPP Lane Only@ checkbox should result in the LTPP lane and direction being automatically be filled for the lane and direction boxes for rows with a date range to purge.

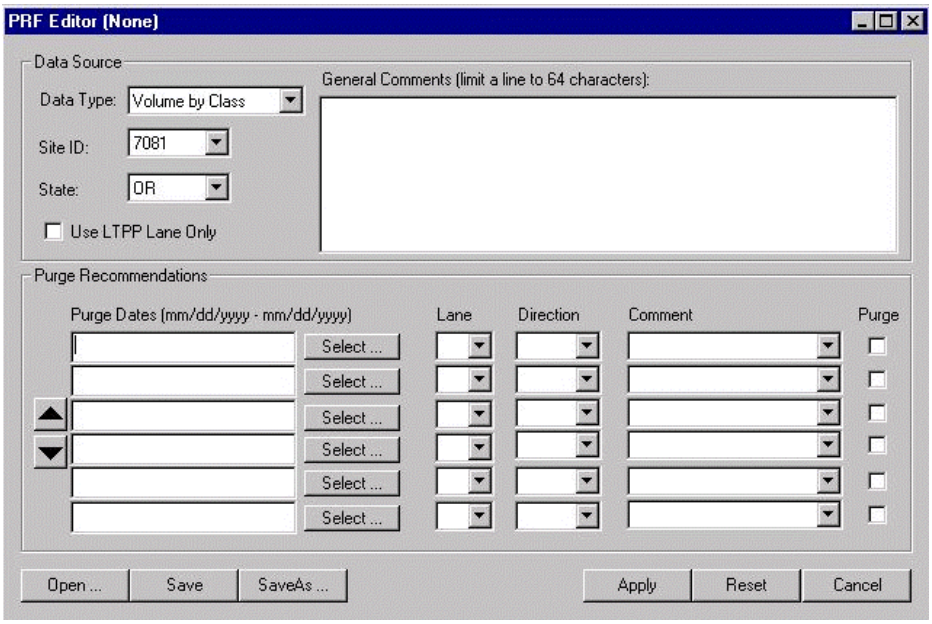


Figure 3-22 Screen for the purge file editor

To begin entering purge recommendations, start with the Purge Dates column of the menu. Dates can be entered by typing or point and click. When typing dates a range must be entered even if only one day is to be purged. To graphically enter a purge date range, click the "Select…" button next to the date input window. Each window requires using the accompanying "Select" button. A calendar appears that allows selection of the date range to be purged.

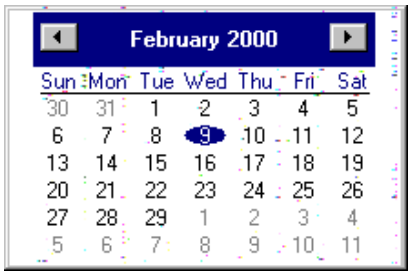


Figure 3-23 Calendar example for purge date picks

The calendar will start by displaying the current month and year. The month and year may be rapidly changed as follows. Click on the year to get a list of years that may be scrolled through to pick the desired year. Click on the month to get a pick list of months. The months may also be changed by using the arrows or clicking on the greyed out dates of the previous or following months. To select a range of dates, simply click the mouse on the starting date and move the mouse, holding down the button, across the range of dates within a month. Hit Enter to accept the date(s) selected. Up to 31 days can be selected at a given time. Entering a range of dates longer than a month will not be accepted by the software. Date ranges for purges do not have to match the range of dates associated with an individual file(s). To dismiss the calendar at any time, press the Esc key.

For the given date range, select the lane and direction (if the “Use LTPP Lane Only” option was not selected). Each lane and direction affected must be purge separately. It is recommended that each lane and direction be saved in a separate file.

A list of standard comments is presented to choose from or another reason may be manually entered for the purge recommendation.

The checkbox listed under the Purge column indicates whether the data should actually be purged (an X in the box), or whether this recommendation identifies a potential problem (an empty box). In the latter case, DO NOT check the Purge box with data matching the specified criteria. This is to prevent accidentally applying the purge which CANNOT be undone. Up to 53 purge recommendations may be entered by clicking the up or down arrows on the left hand side of the dialog box to scroll through the input windows. Multiple purge files may be created for a data type for a year.

To save the current recommendations to a file select the “Save” or “Save As” buttons at the bottom of the menu. The name of the *.prf file currently being used is shown in parentheses at the top of the dialog box. A file name and location must be entered. A .prf extension is automatically added to the file. A systematic file naming and storage convention is suggested. Year and data type may be sufficient as a file name if the file is located in the site-level subdirectory and only a single lane and direction is affected. If the file is located in the year level subdirectory, file type may be sufficient. At a later time, this file can be loaded with the “Open” button to recreate the exact purge recommendations that were entered for the specified data file. If the purge recommendations file is not saved, the purges applied will need to be determined by manual inspection of the analysis files or the ORACLE tables, LTPPD4 and LTPPVOL7.

To return the window to all blank entries select the “Reset” button at the bottom of the menu. Saving the .prf file at this point will erase all information previously stored in it.

Identify accepted purge recommendations by checking the associated purge box(es). To implement the purge recommendations select the “Apply” button at the bottom of the menu. The program will prompt for confirmation to apply the current purges. Once purges are applied, they **CANNOT** be removed. New purges can be added or existing purge reasons can be modified. Purges are applied to the data tables in ORACLE and the output data file used for processing in the analysis software. To be able to see that purges have been applied by viewing the purge file itself, the file must be saved when the purge boxes are selected (preferably immediately after applying the purges.)

A comments section is included in the PRF screen. Comments entered in this box are restricted to 64 characters per line. This is where any comments on the purge recommendations that should be seen by reviewers are saved. There is no limit on the number of lines allowed. The comments are saved in the purge file and will be printed out when the purge file is printed.

3.6.1 Purge File Structure

The purge file is an ASCII text file. While separate purge files must be generated for class and weight files, the structures are similar as shown by the two following examples. There may be up to 53 lines beginning PURGE in each file.

```
#
# LTPP Purge Recommendations File
# Generated on 03/24/2000 at 23:16
#
# PURGE entry format is:
StartDate-EndDate,Lane,Direction,Reason,Purge (1=Yes,0=No)
#
STATE 9
SITE 1803
COMMENTS STATE CONCURRED WITH RECOMMENDATIONS 7/31/94
END*COMMENTS
DATATYPE Volume by Class
PURGE 01061991-01091991,1,1,"sample for manual",0
....

#
# LTPP Purge Recommendations File
# Generated on 03/24/2000 at 23:16
#
# PURGE entry format is:
StartDate-EndDate,Lane,Direction,Reason,Purge (1=Yes,0=No)
#
STATE 9
SITE 1803
DATATYPE Weight by Vehicle
COMMENTS The data is considered suspect because previous data
COMMENTS for January have volumes only 1/3 of those shown.
COMMENTS In addition, the average ESAL value has doubled
COMMENTS from the previous month.
COMMENTS
END*COMMENTS
PURGE 01061991-01091991,1,1,"sample for manual",1
....
```

The only extension the program recognizes to retrieve purge files is .prf. The .prf extension on a

system running Internet Explorer may be associated as a PICS Rules file. In this instance it will not be possible to open the file for review directly from Windows Explorer. The file will need to be opened and printed from a text editor or word processor instead.

3.6.2 Standard entries used in PURGE files

The following direction codes are used in PURGE files.

1 - North	2- Northeast	3 - East	4 - Southeast
5 - South	6 - Southwest	7 - West	8 - Northwest

The contents of Reason tell the software what code follows Q at the end of a purged record. The following reasons are provided on a pick list for use in assigning a code to purged records. Other is not provided as an option. The user entering a reason will result in a code of ?. The software will not indicate if the purge being applied is inappropriate for the data type selected.

8+ Consecutive Zeros (r)
Time Check (s)
Missing Data (t)
Zero Data (u)
Improper Direction Designation (v)
Improper Lane Designation (w)
7 Card Greater Than 4 Card Daily Volume by Significant Difference (x)
4 + Consec Nonzeros (y)
Zero Daily Volume (+)
4 Card Greater than 7 Card Daily Volume by Significant Difference (z)
Over Calibrated (&)
Under Calibrated (#)
Large % of Vehicles > 80 KIPS (^)
Large % of Vehicles < 12 KIPS (~)
Lower Volumes Than Expected - Possible Sensor Problem (|)
Misclassification Error (>)
Atypical pattern (<)
user entered (?)

3.6.3 User Notes

The software will not report an error if the lane or direction does not exist in the file.

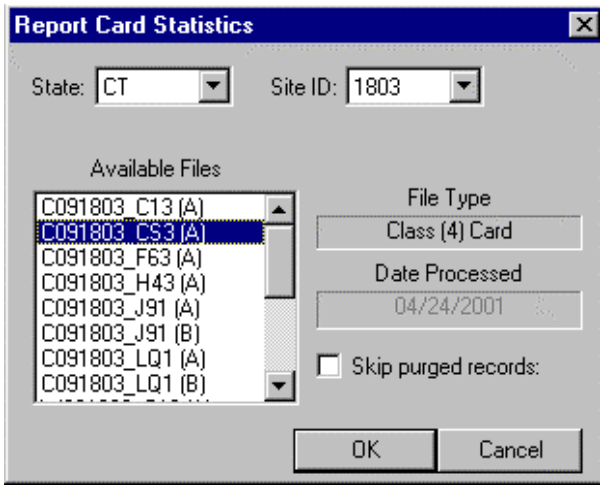


Figure 3-24 Screen for selecting card statistics

3.7 Card Statistics

The Card Statistics menu produces a data statistics report on screen for a given file that has been loaded by the software. This report also includes the Data View option for viewing data records. The Card Statistics window as shown in Figure 3-24 includes an option to exclude purged records from the statistics report. These records are not excluded from the Data View report.

Select the state and site for the statistics reviews. A list of files and versions are displayed in the "Available Files" selection window. Select the file for the data statistics report. General information about the data type in the file and the date the file was processed is shown on the right side of the menu. To exclude purged records from the statistics report (to not see errors for purged records), check the "Skip purged records" checkbox. Different reports are generated for AVC and WIM data.

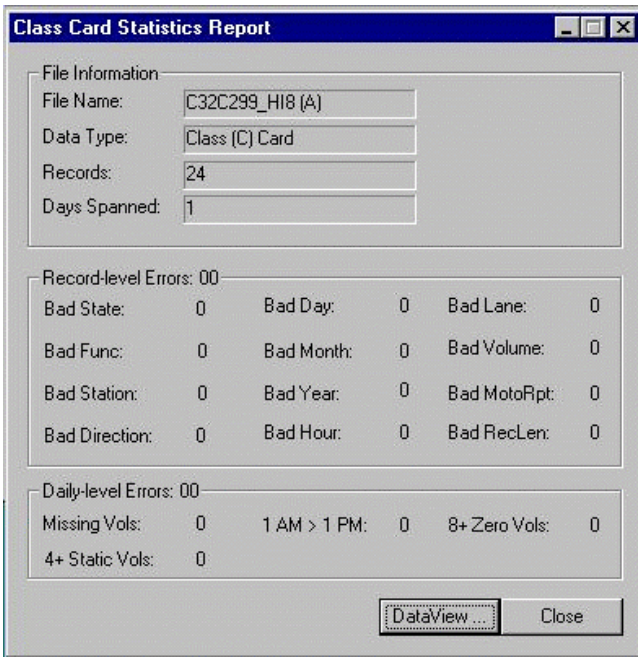


Figure 3-25 Screen for classification data statistics report

3.7.1 AVC Statistics

Selecting an AVC data file produces a screen like the one in Figure 3-25. The information is generated from the LTPPD4 and LTPPRC tables.[9] The number of daily errors and the number of records with errors respectively are summed to produce the totals.

To view data in depth for the site to which this data file belongs, select the DataView option on the menu, which invokes the LTPP data viewer (See Section 4, Data Viewer).

[9] See Section G for information on these ORACLE tables.

3.7.2 Weight Card Statistics Report

For WIM data files the report provides information on record-level errors only since those are the only type the software recognizes for weight data. The report uses LTPPRW[10] tables. In order to view errors on a screen similar to that in the relevant file must be selected. See Figure 3-26 for an example of this screen.

3.8 QC Report

There are three options for QC report generation, a cover sheet, a record counting option and a file level error summary.

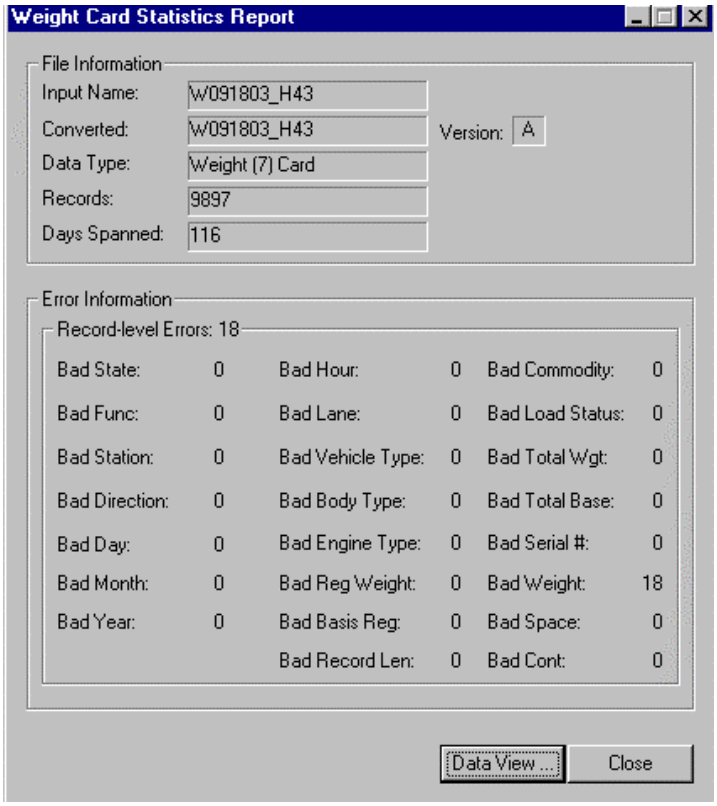


Figure 3-26 Screen for weight records statistics report

The QC cover sheet generation is the most frequently used as it summarizes the data and volumes provided. The report is generated at the site and year level on a by lane by direction basis. All data included in the ORACLE tables for that year is reported as no "LTPP Lane only" option exists. For each lane and direction the report indicates by month the number of days of classification data received and how many of them had no critical errors and are therefore suitable for use in annual estimates. Within the classification section the number of vehicles by class, the total trucks and the total vehicles by month are also reported. The same information is translated into percentages for the truck population only so that the percentage distribution of trucks by class and the percentage of trucks on a monthly basis can be viewed. The end of the classification section indicates the number of days by error type. The second section of the report covers weight data. For each

[10] See section G.4 for a discussion of this table type.

month the number of days of data, the number of record received, the number passing QC and the error percentage are reported. Then the by month, by vehicle class statistics for the classification records are computed for the weight records. The end of the section indicates the percentage of Class 9 vehicles over 80 kips or under 20 kips in each month and tabulates the total number of errors by type observed in the weight records.

The second option is a summary of the total number of records by data type by lane by direction received for the year at a site. Only one year and site are printed per page. Each year and site must be selected separately. This count may also be done at the file level.

The third option is a summary of errors found at the file level. Only one file is printed per page and each file must be selected separately.

Invoke the QC Report Menu with the AQC Report@ button on the control panel. A screen like Figure 3-27 appears with a series of boxes to select report type and its site, year and file where applicable.

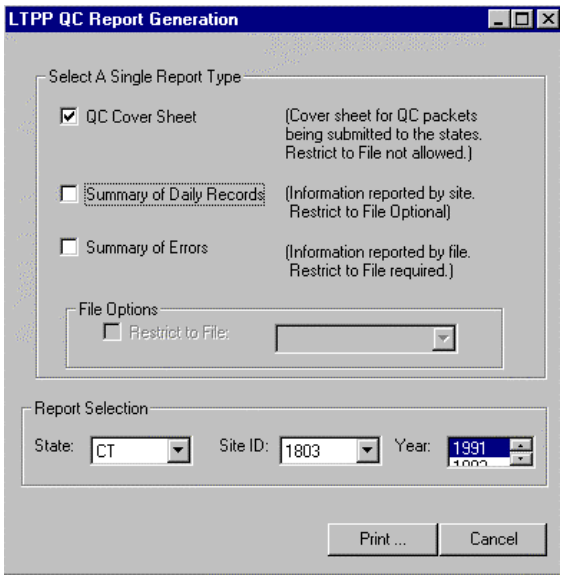


Figure 3-27 QC Report selection screen

After selecting all the options necessary, click the "Print" button to invoke the printer selection menu. Any printers or printing to a file are options. No other options have any affect on the printing process. After selecting the printer, click "OK" to begin the printing process, or click "Cancel" to cancel the process. If graphs have been printed using the selected printer, the layout option, Landscape or Portrait, should be checked before printing.

Any comments and notes to be included in the report should have been entered in the purge file. The purge file must be printed separately as a text file for inclusion in a review packet. If comments to be included in the review are located in the LTPPFILETRACKER an SQL statement must be used to generate the relevant text file.

4. Data Viewer

The Data Viewer allows review of records stored in the ORACLE database after a data file is loaded. It is available through the Card Statistics button on the control panel. It is helpful for

looking at each record to determine what a possible cause for an error may be and what sorts of problems may exist with a given set of data.

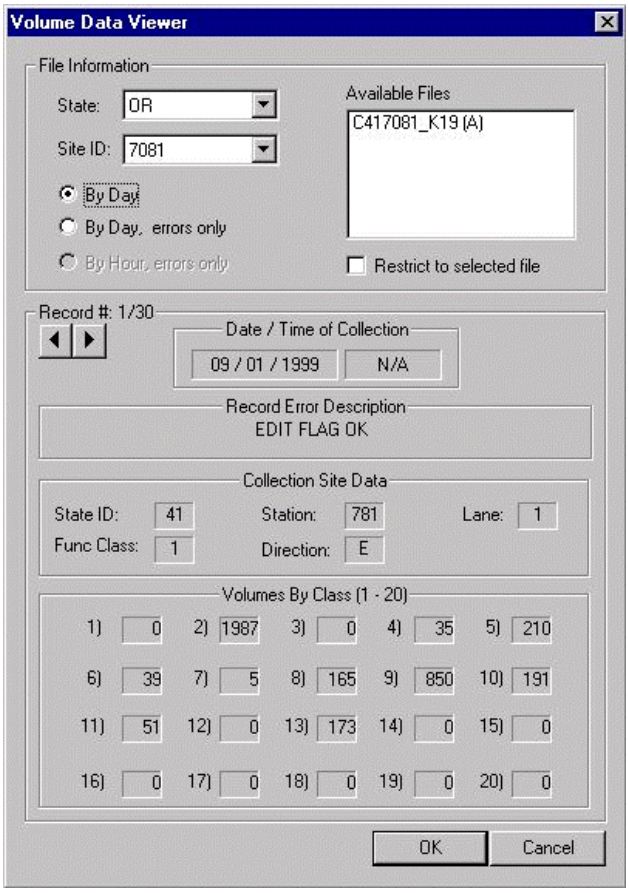


Figure 4-1 Sample classification data viewer

To invoke the Data Viewer, use the Card Statistics button on the control panel. A data file report will be generated with a Data View button at the bottom. Select this button to invoke the Data Viewer.

Depending on the type of data being viewed, the viewer will contain information specific to that data type.

4.1 Viewing Classification Records

The Class Data Viewer shown in Figure 4-1 uses the LTPPD4[11] tables for the site. As can be seen from the figure there are three options for reports: By Day; By Day, errors only; and By hour, errors only. The option to restrict the report to the selected file, changes which reports can be viewed.

If the option selected is ‘By Day’, all days in the LTPPD4 table will be displayed in the order they were loaded into the software whether or not they have errors. The data within a given file will be in chronological order because that is a requirement for successful loading of data. However, the files are not loaded in file extension order and are therefore do not appear in date order in the LTPPD4 table.

In order to restrict the records viewed to a specific file, the ‘Restrict to Selected File’ option must be checked. The file selected here does not need to match the one selected in the Card Statistics dialog box.

[11] See section G.2 for a description of this table type.

When the option selected is 'By Day, errors only' all records with errors in the LTPPD4 table will be displayed in the sequence they are encountered in the table (recall that the loading order is not chronological). To see only the errors in a specific file, the 'Restrict to Selected File' box must be checked.

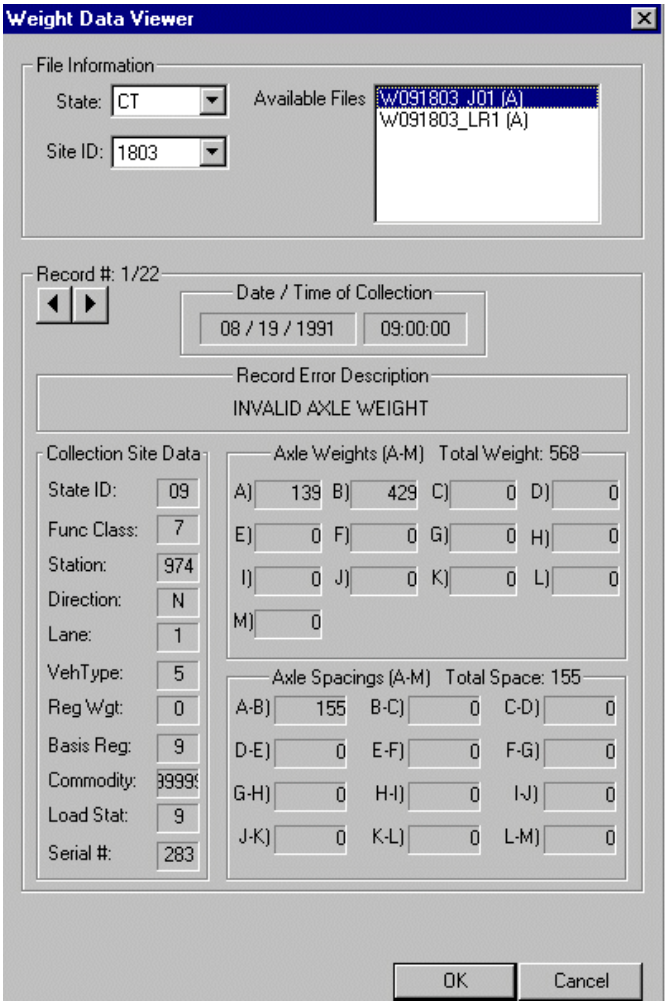


Figure 4-2 Sample weight data viewer

The 'By Hour, errors only' option is only available when the 'Restrict to Selected File' box is checked. The data for this display comes from the LTPPRC [12] table associated with the selected file. It will show all hourly records for a day which has an error whether or not they contribute to the error.

The current record number out of the total number of records is indicated (e.g. Record #: 1/30 in figure 4.1). Use the left and right arrows to scroll through the records to obtain information about the date and time of collection, the error status of the record, and the data on that record.

There is no LTPP lane only option for this review. The user must know that information (lane number and cardinal direction) if that data is of particular interest in reviewing the error information.

4.2 Viewing Weight Records

The Weight Data Viewer illustrated in Figure 4-2 can only be used to view weight data records with errors. It works on a file by file basis using the LTPPRW[13] table associated with a file to obtain the necessary information. The errors are presented in the order in which they are

[12] See section G.3 for a description of this table type.

[13] See section G.4 for a description of this table type.

encountered. It is possible to go both forwards and backwards through the list of errors.

There is no LTPP lane only option for this review. The user must know that information (lane number and cardinal direction) if that data is of particular interest in reviewing the error information.

5. Interpreting Results of QC Processing

This section describes the basic quality control tests the Long-Term Pavement Performance (LTPP) program applies to state and provincial highway agency data. State agencies can use these same tests to help identify potential errors in any weigh-in-motion or vehicle classification data, whether or not they intended for submission to the LTPP program.

Note to the Reader:

The strikeouts in this section are intentional. The items lined out reflect functionality that existed in the SAS version of the software but does not currently exist.

The LTPP QC software automates these checks through a program that uses C++ and ORACLE 8.0 in the WINNT 4.0 environment. Users are able to control the processing through the software's Control Panel. Directions for running these programs are provided in sections 1-5 of this document. The program produces a number of ~~output reports and~~ graphs that require interpretation. Essentially, the LTPP software summarizes a data set in a series of simple graphs that can be used to identify Aunusual occurrences@ in the submitted traffic data. The reviewer must then determine whether these Aunusual occurrences@ are actually invalid data or rather the result of unusual traffic patterns. A series of examples is provided to illustrate how the quality control checks work and provides information on interpreting the output from the LTPP software.

Note that all graphs produced by the LTPP software are lane- and direction-specific for a relevant period. The software can create graphs for all lanes and directions for which data are submitted and loaded.

The revision of the software has eliminated a number of functions present in the original version of the QC software. Most of that functionality can be reproduced by using SQL on the ORACLE tables and spreadsheets if required. Section 5.4 discusses how this can be done. In order to fully understand this section the user should be familiar with section G on the ORACLE tables associated with this application.

QC edit checks are the first set of quality control checks. The first check counts the number of records (usually 4-card records) present for each day and examines the hourly traffic volume patterns that occurred on those days. The checks performed on volume patterns are discussed in sections 5.1 and 5.2. Gross vehicle weight analysis is a quality control check of 7-card data intended to detect both unreasonable scale calibration and scale calibration shifts over time. It is discussed in section 5.3.

5.1 4-Card Data

The first set of graph types produced by the LTPP software points out potential equipment failure by showing hourly volume patterns for 4-card records. Each of the QC checks described below results in a graph whose heading indicates the type of potential error detected. Each QC check produces one graph for each lane and direction per day in which an error is detected. ~~If the QC check detects more than one occurrence of a specific error per quarter (for one lane and direction), the hourly volumes for those days are printed on the same graph. (This means that a graph can become quite cluttered if the QC program detects data "errors" in a large number of days.)~~ This means that a substantial number of graphs can be generated.

5.1.1 Time Check Edit

The TIME CHECK edit graphs the hourly volumes for any day in which total volume at 1:00 a.m. exceeds total volume at 1:00 p.m. for the same lane and direction. If 1:00 a.m. volumes are larger than 1:00 p.m. volumes, the clock may be incorrect, or equipment failures may have arisen midday. Instructions to generate a listing of days which fail this criteria in a text file rather than a graph are found in section 5.4.1.

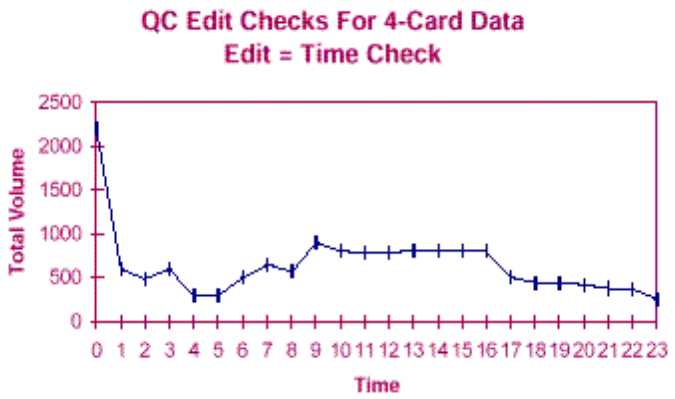


Figure 5-1 Time check edit - Example 1

Examples of output from the Time Check edit routine are shown in Figure 5-1 though 8.

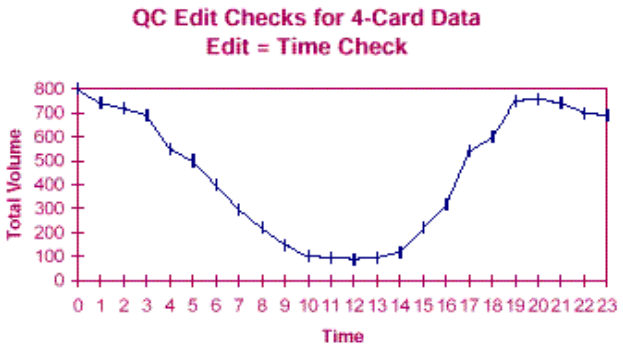


Figure 5-2 Time check edit – Example 2

In Figure 5-1, there is no direct evidence showing that these are caused by a special event that dramatically increased the volume data from a malfunctioning machine. In fact, the high volume around midnight could have been. However, Figure 5-2 shows that all volumes at night are greater than the noon hour volume. These data are questionable.

Figure 5-3, **Error! Reference source not found.**, and Figure 5-5also show questionable data.

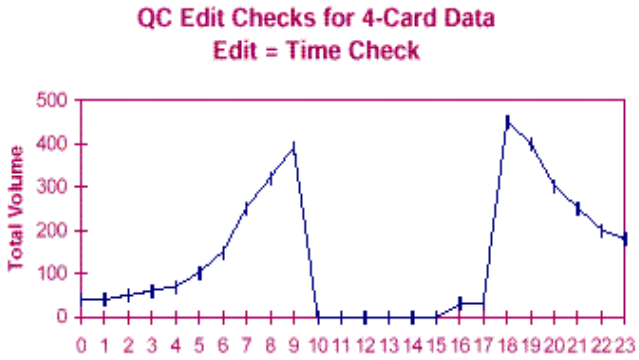


Figure 5-3 Time Check Edit – Example 3

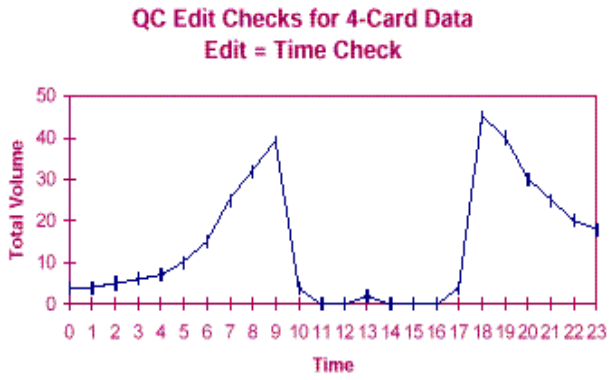


Figure 5-4 Time Check Edit - Example 4

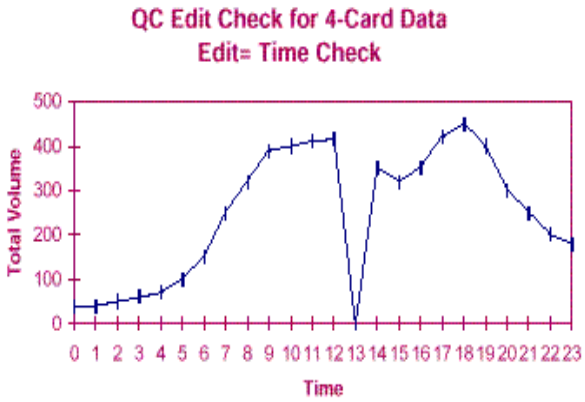


Figure 5-5 Time Check Edit – Example 5

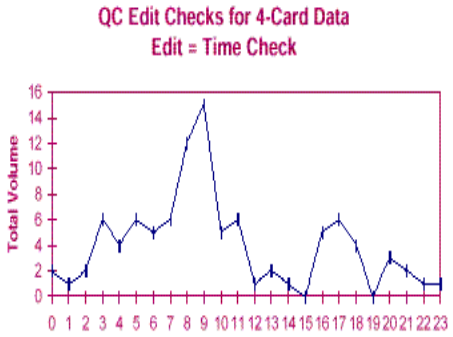


Figure 5-6 Time check edit - Example 6

It is difficult to decide whether Figure 5-6 shows valid data. This volume pattern can occur frequently when the hourly volumes are very low at a given site.

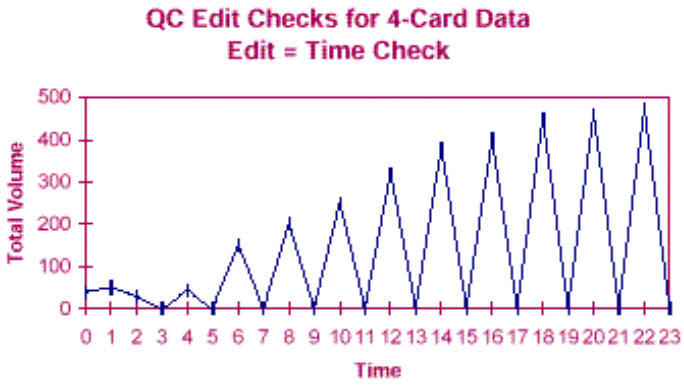


Figure 5-7 Time check edit - Example 7

Figure 5-7 shows irregular on/off patterns. Two hourly volumes seem to be combined into one hour volume. These data would be purged, as it is extremely unlikely that traffic would behave in this manner.

5.1.2 4+ Consecutive Static Volumes Edit

$ The program 4+ consecutive static volumes graphs the hourly volumes for every day during which four or more consecutive hours have the same non-zero volume. If this happens, the data may or may not be invalid. State personnel should review these data, and if the data are determined to be invalid, they should be removed from the database. If a site normally exhibits low traffic volumes, these data may usually be left in the

database. This is because low-volume sites often exhibit identical volumes (often 1 vehicle per hour) for several consecutive hours early in the morning. However, if a site normally has higher volumes, these data are usually flagged for removal because it is statistically unlikely that volumes will be exactly the same four hours in a row. Nevertheless, the choice of when to remove these data is left to the state reviewer. Instructions to generate a list rather than a graph are found in section 5.4.2.

No example of four or more consecutive non-zero hourly volumes is shown. ~~The production of graphs for 4+ Consecutive Non-zeros occurs frequently in the QC analyses, especially with 7-card data from locations where hourly truck volumes are low. However, most of these occurrences represent valid conditions. Therefore, this edit check is ignored most of the time. If the hourly volumes are high and the repeated non-zero hourly volume is also high, then this day of data might be purged.~~

5.1.3 8+ Consecutive Zero Volumes

The 8+ consecutive zero volume edit graphs the hourly volumes for every day during which the hourly volumes recorded at the site are zero for eight or more consecutive hours. This event usually indicates that some portion of the equipment (typically axle sensors) may have failed, but the data collection equipment is still producing hourly records. Instructions to generate a list (a text file listing dates which are identified by this check) rather than a graph are found in section 5.4.3.

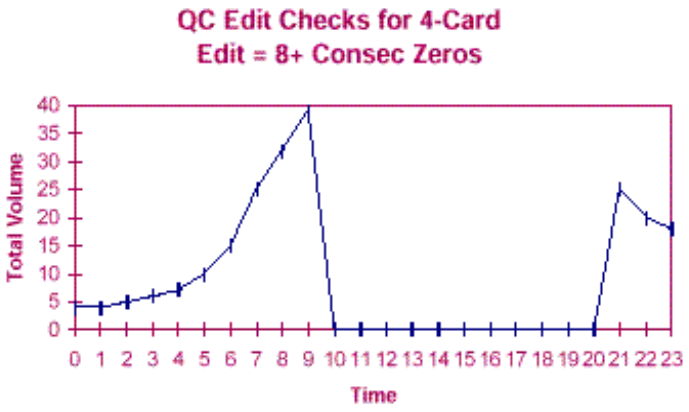


Figure 5-8 8+ consec zeros edit

Figure 5-8 shows a pattern where the hourly traffic volumes from 10 a.m. to 8 p.m. are zero. These data should be purged. This edit check may detect errors when devices are malfunctioning (outputting zero hourly volumes).

5.1.4 Missing Hourly Volume

The program missing hourly volumes edit graphs hourly volumes for each day during which 4-card records are present for some, but not all, 24 hours of a day. This QC check points out when counters have failed and are no longer producing 4-card records. The graphs show the hours for which data are present for these days, and they are often helpful in explaining days with extremely low volumes that appear elsewhere in the QC graphic output.

~~The LTPP traffic data QC software discards data for these days if the data are from permanent devices. If the data are from portable devices, they are kept if they are part of a continuous, 24-hour data collection period that stretches over two or more calendar days. The LTPP program makes this distinction between Apermanent@ and Aportable@ devices to assure as much consistency as possible in the database (all of the daily volumes from permanent devices are based on midnight-to-midnight counts) while keeping and using as many data as possible from sites where few data are available. (Sites with portable devices may produce only one midnight-to-midnight day of data per year, but more than 48 hours of consecutive traffic counts may be present. Using all of the available hours doubles the number of days of data available for LTPP research in these cases.)14~~ Instructions to generate a list rather than a graph are found in section 5.4.4.

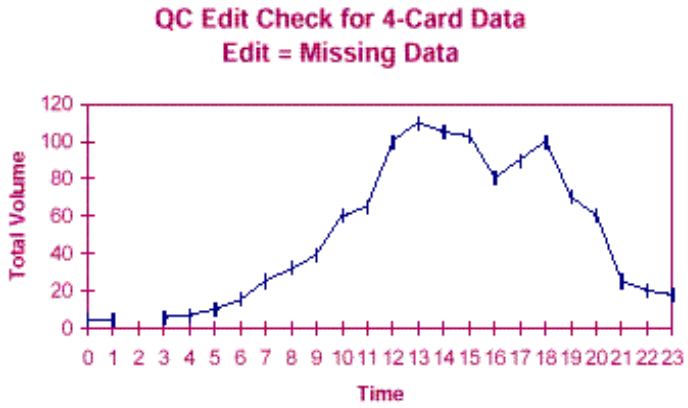


Figure 5-9 Missing data check edit

Figure 5-9 demonstrates the missing data edit check for 4-card data~~. If the day of data is incomplete (contains less than 24 hourly volumes) and from a permanent device, then the day of data will be purged in level 3 processing in the LTPP database. Level 3 processing does not~~

14 The revised LTPP analysis software ignores the “permanent” and “portable” equipment distinctions. Data is treated as continuous, 7 or more midnight to midnight days for a month, or sampled, less than 7 midnight to midnight days in a month. This distinction applies only to classification data. All weight data is treated as if midnight to midnight days exist.

delete incomplete days of data from a portable device if the incomplete day is the beginning day or ending day of a short-term count. This edit therefore produces graphs of the data that may be purged in Level 3 processing. States using the QC software for their own purposes should treat these partial days in the way that best fits their normal data processing routine.

5.2 7-Card Data

Two more types of graphs result from a review of the hourly volume patterns for 7-card records. [Not implemented in new software since they are seldom, if ever critical to making decisions on retaining WIM data.]

EDIT= 4+ CONSEC NONZEROS prints the hourly volumes for any day during which four or more consecutive hours have the same non-zero volume. This check is similar to that applied to 4-card records, described above. The only difference is that the 4-card records include car and light truck volumes, whereas the 7-card records usually do not include this information. This means that more 7-card record sites will have Alow@ volumes, and more of these graphs are likely to be produced even when state reviewers would consider the data valid.

EDIT=ZERO DATA or EDIT=MISSING DATA prints the hourly volumes for days during which 7-card records are present for some, but not all, 24 hours of a day. Unlike this check for 4-card data, when no 7-card data are present for a given hour, the hourly volume is considered zero. This difference is due to the data collection and reporting process. (4-card records are meant to be generated for all hours of the day, regardless of how many vehicles are observed; 7-card records are only generated when a vehicle is observed.)

If the data with zero hourly volumes are from sites that have typically high truck volumes, the data for the remainder of that day are usually considered to be invalid and should be flagged for removal to prevent false hourly volumes (i.e., the information that no traffic occurred during those hours) from being used in the data aggregation process. (The LTPP data aggregation process assumes that lack of a 7-card record simply means that no trucks were present.) If the data are from sites with typically low truck volumes, the data present for the remainder of the day are usually assumed to be valid and should be retained.

5.2.1 Distribution of Gross Vehicle Weight

The Gross Vehicle Weight graph illustrates the distribution of gross vehicle weights (GVW) for a user selected vehicle class (generally FHWA Class 9, 5-axle tractor-trailers). This graph

presents a single month, or an entire quarter, at a time depending on the period marked. Only one month or one quarter will appear on each graph. All valid vehicle weights measured during the time period selected are incorporated into the GVW distribution graph. The logic underlying the quality control process is based on the expectation of two peaks in the GVW distribution for Class 9 vehicles. The first peak represents unloaded tractor-trailers and should occur between 28 and 36 kips (1 kip = 1,000 pounds). This weight range has been determined from static scale data collected from around the country and appears to be reasonable for most locations. (Most unloaded peaks fall between 28 and 32 kips.) The second peak in the Class 9 GVW distribution represents the most common loaded vehicle condition at that site and varies somewhat with the type of commodity being carried. Generally, the loaded peak falls somewhere between 70 and 80 kips.

The QC software plots the GVW distribution.

A standard template to obtain a Class 9 GVW distribution is discussed in section 5.5.2. This must be examined to decide whether the vehicle weights illustrated represent valid data or the scale either is not correctly calibrated or is malfunctioning. The following discussion uses the Class 9 vehicles as the standard for site evaluation. ~~To help the you, reference lines appear on the GVW graph at 28, 36, and 80 kips.~~ [not implemented] ~~The graphs also lists percentages of vehicles that are less than 28 kips and vehicles greater than 80 kips in the lower left hand corner of the graph.~~ [Not implemented]. To get the data to calculate these values see section 5.4.5.

Both Peaks Shifted - If a plot shows both peaks shifted from their expected locations in the same direction (that is, both peaks are lighter than expected or heavier than expected), the scales are assumed to be out of calibration, and the data are not used within the LTPP database. (An agency would then want to visit the WIM site and adjust the scale calibration.)

One Peak Shifted - If a plot shows one peak correctly located but another peak shifted from its expected location, the site should be reviewed for other potential scale problems (such as a high number of classified but not weighed vehicles or scale failure during the data collection session). Additional information about that site may also be needed to determine whether the scale is operating correctly. Information that can be very useful for this determination includes the types of commodities Class 9 trucks are carrying on that road and the load distribution obtained from the scale when it was last calibrated. (For example, investigators might discover that a cement plant is just down the road from the WIM scale and that loaded, 5-axle, cement trucks are routinely exceeding the 80,000-

pound legal weight limit. This finding might result in the acceptance of a loaded peak at the site that exceeds the normal 80,000-pound upper limit.) If additional information indicates the presence of scale problems and the data will be submitted to the LTPP for inclusion in the LTPP database, the LTPP recommends that the agency include a description of the problems. (Data from a malfunctioning scale should be not be submitted to the LTPP. Data from a scale that is simply out of calibration should be submitted to the LTPP along with an explanation of the calibration problem.) If no evidence of scale problems is present and agency personnel believe that the data accurately reflect truck weights at that site, the LTPP will accept the submitted data for use within the LTPP database. The agency should explain why the data are valid, despite their appearance, so that LTPP researchers can be aware of the unusual truck characteristics at that site.

Number of Vehicles Heavier than 80 Kips - [Not implemented]
~~A second check performed with the Class 9 GVW data is an examination of the number (or percentage) of vehicles that are heavier than 80 kips.~~ This check should be performed partly because when many piezo-electric scales begin to fail, they generate a nearly flat GVW distribution. This distribution results in an inaccurate ESAL computation for a given number of trucks. It is particularly important to look at the number and percentage of Class 9 vehicles that weigh more than 100 kips. High percentages of extremely heavy Class 9 trucks (particularly vehicles over 100 kips) are assumed to be a sign of scale calibration or operational problems. It is highly unusual for 5-axle trucks (FHWA Class 9) to carry such heavy weights. In almost all cases, trucks legally carrying these heavy weights are required to use additional axles and are therefore classified as FHWA Class 10 (or higher) and do not appear in the GVW graph. While illegally loaded 5-axle trucks may be operating at the site in question, most illegally loaded trucks do not exceed the legal weight limit by more than several thousand pounds, and the number (or percentage) of these extremely high weights is usually fairly low.

In the case of either scale problems or extreme numbers of overloaded trucks, agency personnel should investigate the situation. If the data are valid, they should be submitted to the LTPP database along with an explanation of the investigation findings. Otherwise, the data should be withheld from further use by the LTPP.

Figure 5-10 is an example of a Class 9 gross vehicle weight (GVW) distribution. The unloaded peak falls within the expected unloaded range (28-36 Kips) and the loaded peak is less than the loaded maximum (80 Kips). There are no extreme outliers (large percentage of vehicles greater than 80 kips or less than 12 kips).

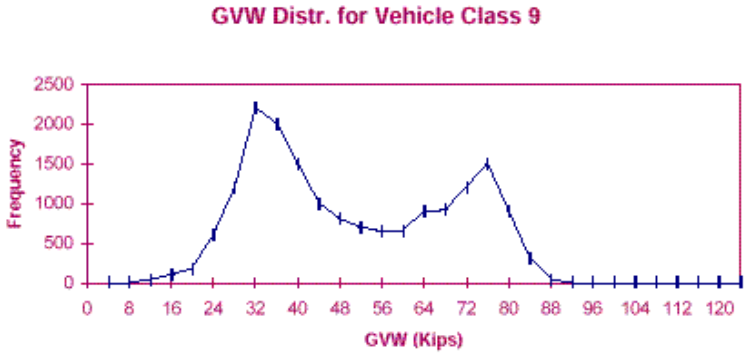


Figure 5-10 Gross vehicle weight distribution for vehicle class 9

Figure 5-11 is an example of a GVW distribution plot that shows a large percentage of vehicle Class 9s that weigh more than 80 kips.

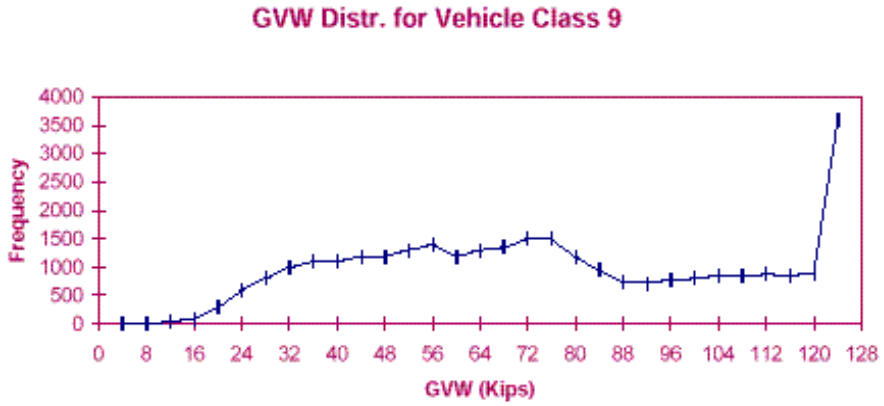


Figure 5-11 GWV Distribution - Example of high percentage of overweights

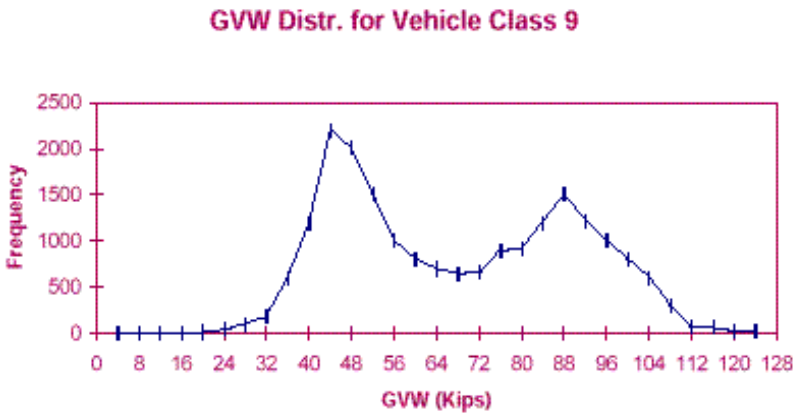


Figure 5-12 GVW Distribution – Example of right shifted peaks

The unloaded and loaded peaks in Figure 5-12 are shifted to the right of the expected ranges. There are also some vehicles that are greater than 100 kips. This plot demonstrates an over-calibration error.

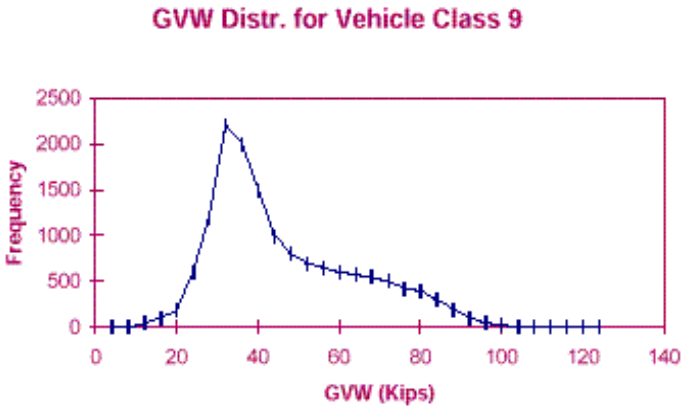


Figure 5-13 GVW distribution - Example without loaded peak

Figure 5-13 illustrates a GVW distribution without a loaded peak. These data would not be purged if this situation was typical for this site.

5.3 7-card, 4-card Comparisons

5.3.1 Volume Comparison

This analysis compares daily traffic volume information submitted in 4-card and 7-card formats. Each graph produced by the program (by lane and direction) contains volumes for one vehicle class, for one month or quarter, from both the 4-card and 7-card files. Significant differences between these two estimates of truck volume are often an indication of machine error. In addition, because most roads have fairly repeatable traffic volume patterns, visual inspection of daily traffic volume patterns often can be used to detect equipment malfunction.

The template described in section 5.3.1 will automatically produce graphs of daily truck volumes for FHWA Classes 6, 8, 9, and 13 on a monthly or quarterly basis. These classes constitute the majority of trucks for many sites, and they are also the classes into which most vehicles are incorrectly classified when vehicle classification equipment is malfunctioning. States may want to examine additional truck classification volumes (for example, for FHWA Class 11) at specific sites using the Graph Manager.

Errors that the graphs produced by this program can help identify include the following:

- shifts in vehicle classification
- loss of truck volume due to sensor failure
- significant increases in truck volumes caused by malfunctioning axle sensors.

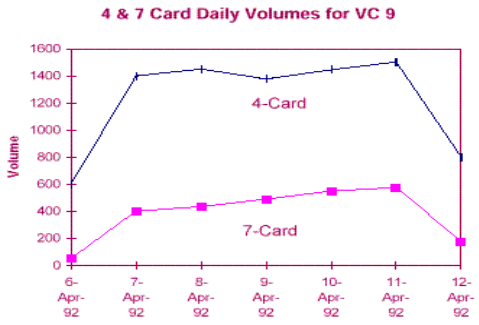


Figure 5-14 Example of non-matching 4- & 7-card volumes

Daily volumes may be examined to see whether they fall within an acceptable range given by the other data points. Seasonal and weekly patterns should be consistent. A dramatic decrease in daily and weekly volumes may indicate a sensor problem. When an axle sensor begins to fail, it often starts to miss one axle on closely spaced tandems. This problem results in a significant shift in observed volumes by classification, as the number of Class 9 trucks counted decreases significantly, and the number of Class 8 trucks increases significantly. Truck volumes also drop because of a variety of sensor errors and other equipment problems. Invalid truck volume increases are usually caused by chattering sensors

(which often result in simple misclassification problems and therefore a commensurate drop in some other volume classification) or by poorly tuned loop sensors. Other types of axle sensor failures can also result in sudden volume increases.

When volume estimates from 4-card and 7-card records differ significantly, it is a sign that additional attention must be paid to the submitted data. A variety of conditions can produce these differences.

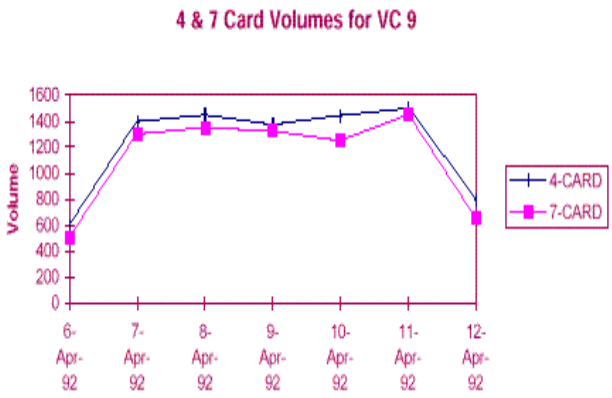


Figure 5-15 Example of matching 4- and 7-card volumes

Single Piece of Collection Equipment -

Where a single piece of equipment collects both of these data sets, differences in 4-card and 7-card volumes occur when a WIM device can detect, but is unable to weigh, a vehicle. This often happens when the vehicle being weighed is Aoff-scale.@ If this problem occurs infrequently (under 10 percent of the Class 9 trucks are counted but not weighed), the scale is probably working correctly; however, this percentage should not grow very large with a correctly operating scale. Large differences in 4-card and 7-card volumes usually mean that the scale is suffering from some type of operational problem.

Two Pieces of Collection Equipment -

This graph allows a "sanity check," or a check of the reasonability, of the data collected by both devices. Where two different devices are used (usually a portable classifier and a portable WIM scale, or a permanent classifier and a portable WIM scale), large differences in the two volume estimates can mean either that at least one of the data collection devices is not functioning correctly or that the classification algorithms being used by the devices are inconsistent. In all likelihood, one (or both) of the data collection devices is incorrectly classifying trucks. This may mean that one of the devices is malfunctioning, or it may mean that one of the devices has a poor translation table for converting axle spacing and axle count information into classification information. Usually the equipment has to be visually observed to determine which system is misclassifying vehicles.

Figure 5-14 gives an example of a big difference between 4-card and 7-card daily volumes for trucks. Figure 5-15 shows an example in which the 4-card and 7-card daily volumes for vehicle class 9 are similar.

5.3.2 Vehicle Class Distribution Comparison

This analysis compares vehicle class frequencies (percent of truck volume by class) submitted in 4-card and 7-card formats. Each graph produced by the program contains quarterly or monthly frequencies for vehicle classes 4 through 13 from both the 4-card and 7-card files. See section 5.5.4 for the templates on producing these graphs on either a monthly or quarterly basis. ~~Percentages of each vehicle class in comparison to total trucks are shown at the top of each graph for 4- and 7-card data. The total volume of trucks counted (by card type) is plotted in the graph itself.~~ [Not implemented; see section 5.4.6 for instructions on how to obtain the necessary data.] ~~Note that the plot shows total vehicle volumes not percentages.~~ These volumes are not adjusted to account for different count durations. Thus, the total volume presented in this graph for a 12-day classification count will be much higher than the volume for that vehicle class from a 2-day weighing session during the same period, even if the two devices counted the same number of trucks during the two days that the WIM scale operated. ~~Similarly, the percentages of vehicles counted by class and shown in tabular form at the top of the graph are for the duration of all days of data for the period being plotted. This tabular information and graph can be used to perform several quality control checks.~~ The primary checks that can be performed are discussed below. The percentages referenced must be generated separately.

Change in Percentages from 4-Card to 7-Card Data -

Significant differences between the percentage estimates from 4-card and 7-card data sets indicate machine error or misclassification problems in one or both of the data collection devices. For example, when two data collection devices are being used, the relative difference in percentage of trucks in each classification for 4-card and 7-card data may show that, for one device, vehicles that should be assigned to vehicle Class 9 are being shifted to another classification.

Atypical Percentages or Frequencies

If agency personnel know roughly the typical truck mix at the site, this graph can indicate when a scale is malfunctioning by showing atypical vehicle percentages or frequencies for truck classes. For example, in many states Class 9 trucks are observed much more frequently than Class 8 trucks. (This ratio is usually more than 3 to 1.) When this graph shows that the number of Class 8 trucks observed exceeds the number of Class 9 trucks,

the agency should examine the operation of the data collection equipment to determine whether the equipment is consistently missing axles.

Similarly, these graphs often show that WIM and automatic vehicle classification devices are treating some smaller vehicles differently. This becomes apparent when one of these devices observes a very high proportion of Class 5 trucks (2-axle, 6-tire trucks) while the other observes relatively few of these vehicles. This discrepancy normally indicates either that one of these devices is slightly off on its measurement of axle spacing distances or that the classification algorithms used by the two devices are dissimilar.

Vehicle Class Frequencies Outside Acceptable Range

In a similar analysis, a reviewer can use these graphs to determine whether the vehicle mix is changing over time. Quarterly or monthly vehicle class frequencies may be examined to see whether they fall within an acceptable range given by the other data points. A dramatic change in vehicle class frequencies over time may indicate a sensor or other equipment problem.

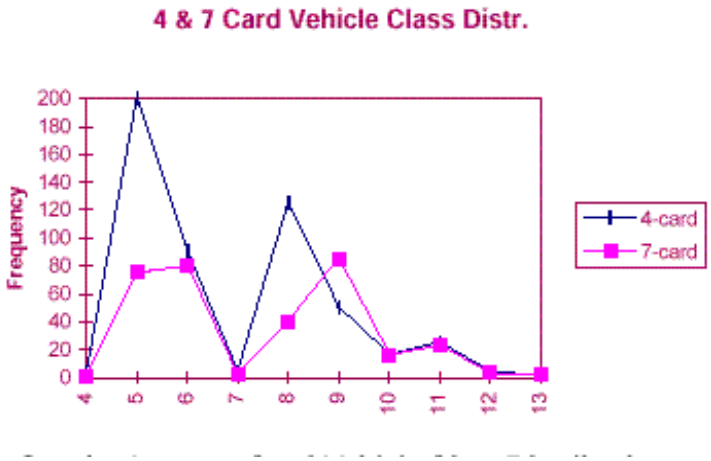


Figure 5-16 Example of vehicle class distribution discrepancies

If there is a big difference between 4-card and 7-card daily volumes for a given vehicle class, the 4- and 7-card vehicle class distribution plots can detect misclassification errors. Figure 5-16 demonstrates misclassification errors between vehicle Class 8 and vehicle Class 9.

5.4 Generating Statistics using the ORACLE tables

The user is assumed to be familiar with SQL and its syntax in the ORACLE environment when referencing this section. Any application used to create and run SQLs may used with any needed syntax changes. The SQLs presented were developed for SQL Worksheet**7** in ORACLE Enterprise Manager**7**.

The naming conventions used in this subsection are:

D	direction
dd	day
L	lane
mm	month
yyyy	4-digit year
xxxxxx	concatenation of STATE_CODE and SHRP_ID

The direction for a LTPP lane is numeric. The value of D can be from 1-8 where 1 is North, 2 is Northeast, 3 is East, 4 is Southeast, 5 is South, 6 is Southwest, 7 is West and 8 is Northwest. The IMS reports only N, S, E or W. How the intermediate directions are converted (or if they even exist in the original data) has not been determined at this point. The LTPP lane, L, is the number of the lane on the highway counting through lanes from the right shoulder in the LTPP direction. With one or two exceptions, the LTPP lane is equal to 1. A value of 0 for LTPP lane means that all of the lanes in one direction have been included in the data as a single value. This data will not be in the summary tables. Grouped lane data is considered a critical error. To determine if there is more than 1 lane in the LTPP direction, the LTPP Information Management System (IMS) must be checked.

The common syntax to get data from a table is:

```
SELECT * FROM tablename WHERE fieldname1 = AA [ AND fieldname2 = BB ...]
[ORDER BY fieldnameA [, fieldnameB, ....] ;
```

The asterisk indicates that all fields in a record will be extracted from a file. It can be replaced by explicit lists of variables in any of the statements in these subsections. Where variables are explicitly named, other orders are possible. The ones provided reflect the author=s preferences. In this section anything in brackets [] is optional.

To generate a listing of specific information to accompany the data set, a file may be spooled to capture the extraction results. The process produces an ASCII text file that may be manipulated

in a spreadsheet or database. Start the sequence with a spool command which includes a path and file name to store the text output in a logical place. There can be NO spaces in any of the subdirectory names in the path. Enter as many SQLs as desired and end the sequence of commands with the spool off command. Alternatively, each command may be sent to an individually named file.

5.4.1 List of Days – 1 am > 1 pm Volume

SELECT direction, lane , year, month, day, error FROM LTPPD4xxxxxx
WHERE error = 62 [AND direction = D] [AND lane = L] [AND year = yyyy] [AND month = mm]
[ORDER BY [direction,] [lane,] [year], [month,] [day]];

5.4.2 List of Days – 4 Consecutive Static Volumes

SELECT direction, lane , year, month, day, error FROM LTPPD4xxxxxx
WHERE error = 61 [AND direction = D] [AND lane = L] [AND year = yyyy] [AND month = mm]
[ORDER BY [direction,] [lane,] [year], [month,] [day]];

5.4.3 List of Days – 8+ Consecutive Zeros

SELECT direction, lane , year, month, day, error FROM LTPPD4xxxxxx
WHERE error = 60 [AND direction = D] [AND lane = L] [AND year = yyyy] [AND month = mm]
[ORDER BY [direction,] [lane,] [year], [month,] [day]];

5.4.4 List of Days – Missing Data

SELECT direction, lane , year, month, day, error FROM LTPPD4xxxxxx
WHERE error = 63 [AND direction = D] [AND lane = L] [AND year = yyyy] [AND month = mm]
[ORDER BY [direction,] [lane,] [year], [month,] [day]];

5.4.5 Statistics for Class 9 Weights

This application requires manipulating the exported data by hand or in a spreadsheet to obtain the actual statistics.

SELECT * FROM LTPPGVWyyyyxxxxxx
WHERE vehicle_class = 9 [AND lane = L] [AND direction = D]
ORDER BY [direction,] [lane,] month;

The total number of class 9 vehicles can be determined from the LTPPGVW table by summing all the bins (BIN1 - BIN50). The BINj represent the weight groups into which gross vehicle weights have been aggregated to obtain a frequency distribution. Each bin represents a four kip (four thousand pound) interval from the lowest value up to 1 less than the next multiple of 4000 (i.e. 0-3999, 4000-7999 ...). It is also possible to use the LTPPVOL7 tables and sum the values over all days in a month.

To find the percentage and number of unusually light or heavy vehicles use the following calculations.

- **$** The number of Class 9s weighing more than 80 kips is the sum of BIN21 to BIN50 for Class 9 vehicles.
- **$** The percentage of Class 9s weighing more than 80 kips is the sum of BIN21 to BIN50 divided by the total number of Class 9s.
- **$** The percentage of Class 9s weighing less than 28 kips is the sum of BIN1 to BIN7 divided by the total number of Class 9s.
- **$** The percentage of Class 9s weighing less than 12 kips is the sum of BIN1-BIN3 divided by the total number of Class 9s.

A extra step is required to get quarterly numbers. Aggregation with Excel**7** of all relevant monthly totals for a quarter is probably the simplest way.

The same data set can be used to plot comparative monthly or quarterly gross vehicle weight distributions after loading into a spreadsheet. A similar process may be used to get the data for any other vehicle classification.

5.4.6 Volume Comparisons 4- & 7- cards

Note that to compare data for a given period the values of year (yyyy) within the SQL statement must match in these two statements.

4-card Volume information -

```
SELECT * FROM LTPPD4xxxxxx
WHERE error = 0 AND purge = 0 AND hour = 0 [AND direction = d] [AND lane = L]
AND year = yyyy
ORDER BY [year,] [direction,] [lane,] month;
```

- **$** The total number of trucks is the sum of VOLUME4 through VOLUME20 over the month or quarter of interest.

- The total number of trucks in a class X is the sum of VOLUMEX over the month or quarter of interest.
- The percentage of trucks in a class X with respect to all trucks is the total in the class divided by the total number of trucks.
- The number of days of data by month or quarter can be determined by counting the number of days in the interval in question.

The values for error = 0, purge = 0 and hour = 0 eliminate all days with invalid data or less than 24 hours in the day.

7-card Volume information -

```
SELECT * FROM LTPPVOL7yyyyxxxxxx
[WHERE  [direction = d] [AND lane = L] ]
ORDER BY [direction,] [lane,] month ;
```

A separate select statement is needed for each year to be matched in the 4-card data set.

- The total number of trucks is the sum of CNT4 through CNT20 by month or over the quarter of interest.
- The total number of trucks in a class X is the CNTX for the month or the sum of the same over the quarter of interest.
- The percentage of trucks in a class X with respect to all trucks is the total in the class divided by the total number of trucks.
- The number of days of data by month or quarter can be determined by counting the number of days in the interval in question.

5.4.7 Graphs Excluding Purged Records

Purging data eliminates it from inclusion in creating daily summaries and annual estimates of vehicle statistics. However, the QC software provides no method for reviewing the impact on the data set after the purges are applied. The process described here is one method for investigating the effects of the purges. It uses the ORACLE tables since the software processes the output files first and then annotates the ORACLE tables with the same information.

To determine which data files have had purges applied a query may be made of the LTPPFILETRACKER table with as much detail as required.

SELECT filename FROM LTPPFILETRACKER WHERE purge = 1 [AND state_code = XX] [AND shrp_id = AAAA ..] [AND startdate BETWEEN ('dd-MON-yyy' AND 'dd-MON-yyyy)]. *The required date format is '01-JAN-1998'.*

This does not provide any information as to the reason for the purges.

To verify that all classification data which failed a daily record check and was supposed to be purged has been use the following two step process.

Run a SQL of the form :

SPOOL path\dailypurge.sql;
SELECT 'SELECT year, month, day, error, purge FROM ', table_name, ' WHERE error >= 60 AND purge = 0 AND year = yyyy order by year, month, day ; ' FROM USER_TABLES WHERE table_name LIKE 'LTPPD4xxxxxx' ORDER BY table_name;

The value of xxxxxx may be as general or specific as desired.

Edit the spooled results to remove any non-SQL statements and set up the spool file to save the results. The output of the SQL (the nested select) will be a list of all days with 8+ consecutive zero volumes, 4+ consecutive static volumes, a 1 a.m. > 1 p.m. volume or missing hourly volumes which have NOT been purged. This does not automatically imply an error as there are instances (i.e. portable data collection equipment) where these records should not be purged.

To verify days have been purged for other types of errors, omit the error >= 60 condition from the SQL. Wildcard characters can be used to generate multiple file lists.

To verify that the relevant days of weight data have been purged, the same process can be executed using the LTPPVOL7yyyyxxxxxx table name and omitting the condition on error. The daily level errors are not applicable to weight files.

The output of any of these SQLs may then be graphed.

There is no way using this software to investigate the impact of purges on the GVW file without using the output files as raw data and reloading the data to compute new GVW distributions.

5.5 Standard Graphing Templates

The following set of graphing templates are suggested as standard for any installation of the traffic software. They provide the functionality to evaluate the data using the guidelines in this section.

A discussion of the Graph Template Manager is found in section 3.5.4.

5.5.1 4-card checks

This template will produce all of the graphs discussed in section 5.1.

- **$** Set file information to insure that valid data is available to plot. All options in the File Information may be changed each time this template is run.
- **$** Select all four Daily Volume Graphs
- **$** Under Templates box click “New”. Select the new template name and then click on the “Rename” option.
- **$** Place the cursor in the box and type “4-card checks” and click on “OK” to save the name.
- **$** Select “4-card checks” in the template box and then click on “Capture” under the graphs box. Graph 0 which appears will contain ALL 4 plots. [If each graph should be an individual selection, select each daily volume graph separately and click on “Capture” after each selection.]
- **$** To see the graphs in the template, click on “Run”.

5.5.2 GVW graph – Class 9

This template will produce the monthly graph discussed in section 5.2.1.

- **$** Set file information to insure that valid data is available to plot. In order for all of the necessary options to be available, the Data Type - Weight by Vehicle - must be selected. The remaining options in File Information may be changed each time this template is run.
- **$** Check ‘GVW Distribution’ under Weight Graphs.
- **$** In Data Selection pick ‘Monthly’, a valid year, lane, direction and Class = 9.
- **$** In Graphing Templates click on “New”. Select the new template name and then click on the “Rename” option.
- **$** Place the cursor in the box and type “MON_GVW_9” . Click on “OK” to save the name.
- **$** Select ‘MON_GVW_9’ in the template box. Then click on “Capture” under the graphs box.
- **$** To see the graph in the template, click on “Run”.