Preface

This document is part of a series of instruction manuals, which can be used as guidelines for applying the Train Operations Model (TOM) to rail systems throughout the world. In this connotation, rail system definition includes main line railroads, heavy and light rail, trolleybuses, high-speed rail and MAGLEV and people movers.

There are several manuals in the series:

Volume 1 – An Introduction to the Instruction Manual for Applying the TOM
Volume 2 – Instruction Manual for Applying the TOM to Transit Systems DC Electric – English Units
Volume 3 – Instruction Manual for Applying the TOM to Transit Systems DC Electric – Metric Units
Volume 4 – Instruction Manual for Applying the TOM to Transit Systems AC Electric – English Units
Volume 5 – Instruction Manual for Applying the TOM to Transit Systems AC Electric – Metric Units
Volume 6 – Instruction Manual for Applying the TOM to Railroads Fueled – English Units
Volume 7 – Instruction Manual for Applying the TOM to Railroads Fueled – Metric Units
Volume 8 – Instruction Manual for Applying the TOM to Rail Systems; Technology Aspects

**Volume 9 – Instruction Manual for Procedures and Shortcuts in the TOM**
Volume 10 – Instruction Manual for Including the Return Circuit in Electric Rail Systems
Volume 11 - Instruction Manual Exercising the AC Drive Model
Volume 12 – Instruction Manual DC Electric Power System Methodology
Volume 13 – Instruction Manual AC Electric Power System Methodology
Volume 14 – Instruction Manual Exercising the Rail Voltage Model for DC Traction Systems

Volumes 2-7 cover nearly all transit systems and railroads in the world.

This instruction manual is Volume 9.

These volumes are unprotected. Thus the user is free to make notes or rewrite sections according to his preferences.

The primary purpose for using the **TOM** is evaluation. The evaluation generally takes the form of a study, with certain objectives, which may or may not be well defined. As the study is conducted, new objectives may result, because of unanticipated results. Within the framework of evaluation, designs may be modified and further evaluated, so that in this sense, the **TOM** may be considered a design tool.

The **TOM** is used together with other standard software, such as Microsoft Office (in particular, WORD, EXCEL and POWERPOINT). This combined package is most effective in assembling client data as well as presenting results. In some instances, the **TOM** interacts directly with these office programs, while in other cases; the user handles the office packages directly.
# TABLE OF CONTENTS

1. **INTRODUCTION** ................................................................................. 5

2. **HELP FEATURES** ............................................................................. 5
   2.1. HELP COMMAND BUTTON ................................................................. 5
   2.2. QUESTION MARK (?) HELP ................................................................. 7
   2.3. SCREEN INSTRUCTIONS ................................................................. 12
   2.4. PROGRAM MANUAL ........................................................................... 14
   2.5. INSTRUCTION MANUALS ................................................................. 18
   2.6. TRAINING COURSE VIDEOS AND NOTES ........................................ 18

3. **TEXT TRANSFER SHORTCUTS** ......................................................... 18
   3.1. TRAIN FILE INPUT ............................................................................. 19
   3.2. NETWORK FILE INPUT ................................................................. 55
   3.3. NEGATIVE NETWORK FILE INPUT .................................................. 72
   3.4. TRACK LAYOUT FILE INPUT ............................................................. 83

4. **PROCEDURES** .................................................................................... 97
   4.1. NEW FILES FROM OLD FILES ......................................................... 97
       4.1.1. Windows Explorer Method ......................................................... 106
       4.1.2. TOM Method ............................................................................. 119
   4.2. SHORTCUTS .................................................................................... 126
       4.2.1. Select Command Button ............................................................ 126
       4.2.2. File Identification ...................................................................... 131
       4.2.3. File of Filenames File Shortcuts .................................................. 137
       4.2.4. Train Location File ...................................................................... 145
           4.2.4.1. Normal Procedure ............................................................... 146
           4.2.4.2. Shortcut Procedure ............................................................. 152
       4.2.5. Saved For Future Additions ......................................................... 167
   4.3. COASTING ....................................................................................... 167
       4.3.1. Setting Up Coasting with the TOM ............................................. 169
       4.3.2. Base Case – No Coasting ........................................................... 176
       4.3.3. Anticipatory Coasting ................................................................. 178
       4.3.4. Sawtooth Coasting .................................................................... 188
       4.3.5. Running Time and Energy .......................................................... 208
   4.4. ELEVATION FILES .......................................................................... 210
   4.5. TRAIN FILES .................................................................................. 232
       4.5.1. Train Resistance ......................................................................... 232
       4.5.2. Train Makeup ............................................................................ 253
           4.5.2.1. Car Library .......................................................................... 255
4.5.2.2. Locomotive Dispatch ................................................................. 261
4.5.2.3. Train Building ....................................................................... 285

4.6. SPEED COMMAND FILES ............................................................. 300

4.7. NETWORK FILES .......................................................................... 311
4.7.1. Moving Substations and Tiestations ........................................ 311
4.7.2. Substation Out of Service .......................................................... 311

4.8. FMM POWER PROFILE OPERATIONS ....................................... 311
4.8.1. Average Power Profiles ............................................................. 313
4.8.2. Append Power Profiles .............................................................. 341
4.8.3. Clip Power Profiles .................................................................. 345
4.8.4. Meet and Loop Power Profiles .................................................. 351
4.8.4.1. Meet .................................................................................... 352
4.8.4.2. Loop ................................................................................... 376
4.8.5. Route Checker .......................................................................... 400

4.9. Archiving ...................................................................................... 410

4.10. Saved For Future Additions .......................................................... 412

5. WORKING WITH THE DATABASE .................................................. 413
5.1. INITIALIZING THE DATABASE ....................................................... 413
5.2. SEARCH FOR FILE ...................................................................... 415
5.3. MODIFYING FILES ....................................................................... 417
5.4. VIEWING AND MODIFYING FILES ............................................ 422
5.5. DELETING A FILE ......................................................................... 426
5.6. EXECUTING FILE OF FILENAMES ............................................. 429
5.7. TRACING AN OUTPUT FILE .......................................................... 441
1. INTRODUCTION

This document can be used to discover most of the user-friendliness and shortcuts within the TOM.

This volume has four parts. Each of the parts corresponds to user-friendliness or shortcut features of the TOM.

The first part (Chapter 2) describes the help availability to users of the model. These user-friendly features are of several varieties, including the program manual, several instruction manuals, screen instructions for each screen related to an input file and a question mark (?) help access for every object on every screen.

The second part (Chapter 3) describes the text transfer features, which several screens have, allowing a smooth connection for data flows between Excel and the TOM. Supplemental calculations may be performed in Excel and then transferred to the TOM.

The third part (Chapter 4) contains the Procedures. Some of these procedures are short, while others are lengthier; this section highlights many of these procedures.

The fourth part (Chapter 5) is Working With The Database. The Database Utility (DB) is a series of computer programs, which interact with the user to access all of the files, which are readable by the modules and the simulators of the TOM. This chapter provides examples of using the DB to operate the TOM.

2. HELP FEATURES

Although the TOM is a sophisticated engineering tool, designed for use by knowledgeable engineers with computer savvy, it has an extensive built in help system.

2.1. HELP COMMAND BUTTON

Most screens in the TOM have a HELP command button.
Click the HELP command button to obtain the next screen.
This screen reminds the user of the various ways to obtain help.

The next sections provide more detail on the various help methods within the TOM.

2.2. **QUESTION MARK (?) HELP**

On the TOM main screen, click the FCM command button to obtain the next screen.
Double-click on the **TEST** rail system in the **Select a Rail System** list box.
Click the **TPS Input** check box to obtain the following screen.

![File Construction Module - Main Screen](image)

Double-click on the **Control** item in the **TPS Input** list box. This produces the **Control File Input – Main Screen**.
Click the (?) at the top right hand corner of the screen. This changes the cursor into a cursor (?). Click this cursor (?) on the **Maximum Acceleration** text box in the **Acceleration, Deceleration and Jerk** frame.
Every object on every screen has the **question mark (°) help.** As another example, use the same procedure on the **Maximum Speed** text box in the **Speeds** frame.
It is highly recommended that a rookie user use this help system.

2.3. **SCREEN INSTRUCTIONS**

Screen instructions (SI) are provided for most screens for input files to the TOM. As an example, click the picture at the top of the Control File Input – Main Screen. This action produces the following screen.
The file **SPTPSCL-.txt** is a text file, which provides instructions for making entries into this screen. The file is displayed in the **TOM – File Viewer**. The user has the option of modifying this file to his tastes. This is easily accomplished by clicking the **Copy to Notepad** command button to obtain the next screen.
All modifications to the file may be made here and these modifications may be saved.

2.4. PROGRAM MANUAL

The Program Manual can be accessed through any Help command button on any screen. Clicking a Help command button produces the following screen.
Click the Help Program Manual command button to obtain the next screen.

Double-click on the TOM-MAN.doc icon to obtain the next screen.
This exposes the **Table of Contents** for the **Program Manual**. Click on the page number of a content to go to that point in the program manual. For example, click on p. 26 to go to the topic **OPERATING THE SIMULATORS**.
The program manual is password protected and cannot be changed by the user. Click the **Read Only** command button to access the manual.
The user is not able to change the manual.

2.5. INSTRUCTION MANUALS

The Instruction Manuals for the TOM were previously described in the Preface. All of these manuals can be downloaded from the Rail Systems Center website. Follow the TOM link on the website to find the manuals. All of them are in PDF format.

Licensees of the TOM can download the EXCEL spreadsheets and all of the files, which are mentioned in these manuals by contacting the Rail Systems Center. To do so, follow the Contact Us link at the website. Licensees will be given the download information.

2.6. TRAINING COURSE VIDEOS AND NOTES

Clients who take the Training Course for the TOM have Training Course Videos. This course is given at the client’s location or via the Internet.

3. TEXT TRANSFER SHORTCUTS

The purpose of the File Construction Module (FCM) is to aid the user in converting rail system raw data into a form, which can be input into the simulators, utilities and modules of the TOM.
There are four input files, which are complicated enough, so that additional steps may be required in calculation, before they can be turned into input files. Generally, these calculations can be effected in spreadsheets or other models, which have a text output.

The input files in question are Train File for the TPS, the Network File for the ENS or TMS, the Negative Network File for the RVM and the Track Layout File for the TMS.

In the next four sections, each of these procedures is discussed using EXCEL spreadsheets.

### 3.1. TRAIN FILE INPUT

The Train File is the most complicated file of all TPS inputs. There are seven potential areas in the input to the TPS, which may require the use of a spreadsheet, if he does not use the internal propulsion models.

1. Tractive Effort vs. Speed curves.
2. Electrical Braking Effort vs. Speed curves.
3. Friction Braking Effort vs. Speed curves.
4. Efficiency curves in power.
5. Efficiency curves in electric brake.
6. Power factor in power.
7. Electric brake power factor in electric brake.

Items 1 and 4 are always required for DC electric rail systems. Items 1, 2, 4 and 5 are required for DC electric rail systems, which regenerate in train braking. Items 1, 4 and 6 are always required for AC electric rail systems. Items 1, 2, 4, 5, 6 and 7 are required for AC electric rail systems, which regenerate in train braking.

Item 2 is only required when the normal brake rate is not specified in the Control File.

The first step is to set up a template in an EXCEL spread sheet to provide for the input. This will be done using the worst condition, which uses all seven inputs listed above.

Select the TEST rail system on the FCM main screen.
Click the **TPS Input** check box.
Select the **Train** item in the **TPS Input** list box.

Select the file **T-Aq.TES** in the **Train input file** file list box.
Click the **Propulsion Input** check box.
Click the **Text Transfer** command button.
Open an **EXCEL** book.

Label **Sheet 1 Train File**.
Go back to the Text to TOM Transfer screen.
Click the **Import** command button.

The Tractive Effort vs. Speed curve has been imported into the **Tractive Effort vs. Speed Curve** text box.

This curve will now be copied onto the clipboard by placing the mouse at the top-left of the text box and with mouse down by sliding all of the way on the left side of the text box to just below the last entry.

An alternative method to select the text is to place the mouse over the text box, click the right mouse button to expose the menu and select the **Select All** menu item.
To complete the copy, execute a <CTL>C or alternatively click the right mouse button over the textbox and select the Copy item in the menu.

*Paste the clipboard into the EXCEL spread sheet at position A5, by executing a <CTL>V.*
|   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 5 | 6 | 10000 | 10050 | 10600 | 10800 | 11000 | 11500 | 12000 | 12500 | 13000 | 13500 | 14000 | 14500 | 15000 | 15500 | 16000 | 16500 | 17000 |

Label the items similar to the next view.
This procedure can be carried out with the Electrical Braking Effort vs. Speed Curve and the Friction Braking Effort vs. Speed Curve. The result is shown in the next screen.
<table>
<thead>
<tr>
<th>Tractive Effort (lbs)</th>
<th>Speed (mph)</th>
<th>Electrical Braking Effort (lbs)</th>
<th>Speed (mph)</th>
<th>Friction Braking Effort (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>16000</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>16000</td>
<td>5</td>
<td>0</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>16000</td>
<td>10</td>
<td>2000</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>10400</td>
<td>15</td>
<td>11500</td>
<td>15</td>
<td>0</td>
</tr>
<tr>
<td>10400</td>
<td>20</td>
<td>14300</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>10400</td>
<td>25</td>
<td>14300</td>
<td>25</td>
<td>0</td>
</tr>
<tr>
<td>8500</td>
<td>30</td>
<td>14300</td>
<td>30</td>
<td>0</td>
</tr>
<tr>
<td>7600</td>
<td>35</td>
<td>14300</td>
<td>35</td>
<td>0</td>
</tr>
<tr>
<td>5745</td>
<td>40</td>
<td>14300</td>
<td>40</td>
<td>0</td>
</tr>
<tr>
<td>4190</td>
<td>45</td>
<td>14300</td>
<td>45</td>
<td>0</td>
</tr>
<tr>
<td>3230</td>
<td>50</td>
<td>14300</td>
<td>50</td>
<td>0</td>
</tr>
<tr>
<td>2592</td>
<td>55</td>
<td>11000</td>
<td>55</td>
<td>0</td>
</tr>
<tr>
<td>2122</td>
<td>60</td>
<td>12000</td>
<td>60</td>
<td>0</td>
</tr>
<tr>
<td>1775</td>
<td>65</td>
<td>11000</td>
<td>65</td>
<td>0</td>
</tr>
<tr>
<td>1505</td>
<td>70</td>
<td>9000</td>
<td>70</td>
<td>0</td>
</tr>
<tr>
<td>1272</td>
<td>75</td>
<td>8700</td>
<td>75</td>
<td>0</td>
</tr>
<tr>
<td>1081</td>
<td>80</td>
<td>7600</td>
<td>80</td>
<td>0</td>
</tr>
<tr>
<td>929</td>
<td>85</td>
<td>6400</td>
<td>85</td>
<td>0</td>
</tr>
<tr>
<td>786</td>
<td>90</td>
<td>5300</td>
<td>90</td>
<td>0</td>
</tr>
<tr>
<td>644</td>
<td>95</td>
<td>4200</td>
<td>95</td>
<td>0</td>
</tr>
<tr>
<td>520</td>
<td>100</td>
<td>3000</td>
<td>100</td>
<td>0</td>
</tr>
</tbody>
</table>

Return to the **Text Transfer to TOM** screen.
Click the **Reset** command button.
Click the **Real Power Efficiency** check box.

Click the **Import** command button.
The template for the real power efficiency will now be set up in the Excel spreadsheet. Copy the speed points from the Speed Points text box.
Paste them in the spreadsheet at position I4.
Return to the **Text Transfer to TOM** screen.

Copy the tractive effort points by sliding the mouse down the very left of the **Traction Effort Points** text box.
Paste them in the EXCEL spreadsheet at position H5.
Return to the **Text to TOM Transfer** screen.

Copy the real power efficiencies by sliding the mouse down along the left side of the **Real Power Efficiency Matrix** text box.

Paste them in the spreadsheet at position I5.
Label the axes and title of the spreadsheet entry.
Procedures for the remaining items to be transferred to the spreadsheet are the same. These include the **Power Factor**, **Electric Brake Efficiency** and **Electric Brake Power Factor**.

The results are shown in the next screens.
<table>
<thead>
<tr>
<th>TE Points</th>
<th>Speed Points</th>
<th>Power Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>0.97</td>
<td>0.71</td>
</tr>
<tr>
<td>20</td>
<td>0.73</td>
<td>0.62</td>
</tr>
<tr>
<td>30</td>
<td>0.56</td>
<td>0.47</td>
</tr>
<tr>
<td>40</td>
<td>0.43</td>
<td>0.38</td>
</tr>
<tr>
<td>50</td>
<td>0.37</td>
<td>0.34</td>
</tr>
<tr>
<td>60</td>
<td>0.32</td>
<td>0.30</td>
</tr>
<tr>
<td>70</td>
<td>0.29</td>
<td>0.28</td>
</tr>
<tr>
<td>80</td>
<td>0.26</td>
<td>0.26</td>
</tr>
<tr>
<td>90</td>
<td>0.24</td>
<td>0.24</td>
</tr>
<tr>
<td>100</td>
<td>0.22</td>
<td>0.22</td>
</tr>
</tbody>
</table>

And.
This spreadsheet can now be used as a template for calculating.

Using a spreadsheet, the **Text to TOM Transfer** can be used in the reverse direction, in order to transfer from EXCEL to the TOM.

The example used is taken from the EXCEL workbook **DCEEWorkbookForInstructionManual.xls**, which accompanies the instruction manual **Volume 2 – Instruction Manual for Applying the TOM to Transit Systems DC Electric – English Units.** Sheet DATA of that workbook is shown next.
The Tractive Effort vs. Speed Curve and the Efficiency Curve for Power will be transferred as the example.

Begin with the File Construction Module – Train File Input – Main Screen shown next.
Click the **Propulsion Input** check box.
Click the **Text Transfer** command button.
Copy the **Tractive Effort vs. Speed Curve** from the EXCEL spreadsheet.
Paste the curve into the **Text to TOM Transfer** screen.

Click the **Transfer** command button.
Click the **Reset** command button.
Click the **Real Power Efficiency** check box.

Copy the speed portion of the efficiency curves in the **EXCEL** spreadsheet.
Paste the speed values into the **Speed Points** text box.
Copy the tractive effort portion of the efficiency curves in the **EXCEL** spreadsheet.

Paste the tractive effort values into the **Traction Effort Points** text box.
Note that in this case the tractive effort points range between 0 and 1, indicating that the efficiency curves are expressed as a function of speed and percent maximum tractive effort at the given speed, rather than as a function of speed and tractive effort. The latter expression was done previously.

Finally, copy the efficiency values from the EXCEL spreadsheet.
Paste the efficiency values in the Real Power Efficiency Matrix text box.
Click the **Transfer** command button.

![Transfer screen](image)

Click the **Close** command button to close the screen.
Note that the efficiency curves have been transferred to the **Propulsion Efficiency Real Power** grid and the number of speed points, the number of tractive effort points and the maximum speed are accounted.

Click the **TE vs Spd Curve** check box.
This screen verifies the transfer of the tractive effort vs. speed curve.

### 3.2. NETWORK FILE INPUT

The **Network File**, input to the **ENS** and **TMS**, also can use the **Text Transfer** function in its construction. Show the **File Construction Module – Main Screen**, with the **WMATA** rail system selected.
Click the **ENS Input** check box.
Select the **Network** item in the **ENS Input** list box.

Select the **N-BOYE.WMA** file in the **Network input file** file list box.
Click the **AC Part of Nodal Diagram** check box.
Click the **Text Transfer** command button.
Click the **Import** command button.
Open the **EXCEL** workbook **TOMInstructionManualForShortcutsInTheTOM.xls**.
Rename Sheet2 to Network File.
Return to the **Text to TOM Transfer** screen.
Copy the AC Line text box to the clipboard.
Paste the clipboard into the **EXCEL Network File** sheet at A4.
Label, title and format the spreadsheet as shown in the next screen.

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
<th>K</th>
<th>L</th>
<th>M</th>
<th>N</th>
<th>O</th>
</tr>
</thead>
<tbody>
<tr>
<td>LV1</td>
<td>MVP</td>
<td>LC07</td>
<td>1</td>
<td>0</td>
<td>0.002</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LV2</td>
<td>MVP</td>
<td>LC06</td>
<td>1</td>
<td>0</td>
<td>0.002</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LV3</td>
<td>MVP</td>
<td>LC03</td>
<td>1</td>
<td>0</td>
<td>0.002</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LV4</td>
<td>MVP</td>
<td>LC02</td>
<td>1</td>
<td>0</td>
<td>0.002</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LV5</td>
<td>MVP</td>
<td>LC01</td>
<td>1</td>
<td>0</td>
<td>0.002</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LC11</td>
<td>MC11</td>
<td>NC11</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LC10</td>
<td>MC10</td>
<td>NC10</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LC09</td>
<td>MC09</td>
<td>NC09</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LC08</td>
<td>MC08</td>
<td>NC08</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LC07</td>
<td>MC07</td>
<td>NC07</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LC06</td>
<td>MC06</td>
<td>NC06</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LC05</td>
<td>MC05</td>
<td>NC05</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LC04</td>
<td>MC04</td>
<td>NC04</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LC03</td>
<td>MC03</td>
<td>NC03</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LC02</td>
<td>MC02</td>
<td>NC02</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LC01</td>
<td>MC01</td>
<td>NC01</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LD01</td>
<td>MD01</td>
<td>ND01</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LD02</td>
<td>MD02</td>
<td>ND02</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LD03</td>
<td>MD03</td>
<td>ND03</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LD04</td>
<td>MD04</td>
<td>ND04</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LD05</td>
<td>MD05</td>
<td>ND05</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LD06</td>
<td>MD06</td>
<td>ND06</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LD07</td>
<td>MD07</td>
<td>ND07</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LD08</td>
<td>MD08</td>
<td>ND08</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LD09</td>
<td>MD09</td>
<td>ND09</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LD10</td>
<td>MD10</td>
<td>ND10</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LD11</td>
<td>MD11</td>
<td>ND11</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LD12</td>
<td>MD12</td>
<td>ND12</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LD13</td>
<td>MD13</td>
<td>ND13</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LD14</td>
<td>MD14</td>
<td>ND14</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LD15</td>
<td>MD15</td>
<td>ND15</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LD16</td>
<td>MD16</td>
<td>ND16</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LD17</td>
<td>MD17</td>
<td>ND17</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LD18</td>
<td>MD18</td>
<td>ND18</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LD19</td>
<td>MD19</td>
<td>ND19</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LD20</td>
<td>MD20</td>
<td>ND20</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LG01</td>
<td>MG01</td>
<td>NG01</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LG02</td>
<td>MG02</td>
<td>NG02</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LG03</td>
<td>MG03</td>
<td>NG03</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LG04</td>
<td>MG04</td>
<td>NG04</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LG05</td>
<td>MG05</td>
<td>NG05</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LG06</td>
<td>MG06</td>
<td>NG06</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LG07</td>
<td>MG07</td>
<td>NG07</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LG08</td>
<td>MG08</td>
<td>NG08</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LG09</td>
<td>MG09</td>
<td>NG09</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LG10</td>
<td>MG10</td>
<td>NG10</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LG11</td>
<td>MG11</td>
<td>NG11</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LG12</td>
<td>MG12</td>
<td>NG12</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LG13</td>
<td>MG13</td>
<td>NG13</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LG14</td>
<td>MG14</td>
<td>NG14</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LG15</td>
<td>MG15</td>
<td>NG15</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LG16</td>
<td>MG16</td>
<td>NG16</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LG17</td>
<td>MG17</td>
<td>NG17</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LG18</td>
<td>MG18</td>
<td>NG18</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LG19</td>
<td>MG19</td>
<td>NG19</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LG20</td>
<td>MG20</td>
<td>NG20</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LG21</td>
<td>MG21</td>
<td>NG21</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LG22</td>
<td>MG22</td>
<td>NG22</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LG23</td>
<td>MG23</td>
<td>NG23</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LG24</td>
<td>MG24</td>
<td>NG24</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LG25</td>
<td>MG25</td>
<td>NG25</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LG26</td>
<td>MG26</td>
<td>NG26</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LG27</td>
<td>MG27</td>
<td>NG27</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LG28</td>
<td>MG28</td>
<td>NG28</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LG29</td>
<td>MG29</td>
<td>NG29</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LG30</td>
<td>MG30</td>
<td>NG30</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LG31</td>
<td>MG31</td>
<td>NG31</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LG32</td>
<td>MG32</td>
<td>NG32</td>
<td>1</td>
<td>0</td>
<td>0.001</td>
<td>22.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sum=1634.401
Return to the **Text to TOM Transfer** screen.
Click the **Reset** command button.
Click the **AC Nodes** check box, followed by a click on the **Import** command button.
Continue this procedure for AC Nodes in a similar manner for the procedure for AC Lines. Continue similar procedures for DC Lines, DC Nodes and Converters. When completed, the EXCEL Network File sheets are shown next.
3.3. NEGATIVE NETWORK FILE INPUT

The Negative Network File, input to RVM, also can use the Text Transfer function in its construction. Show the File Construction Module – Main Screen, with the WMATA rail system selected.
Click the **RVM Input** check box.
Select the **Neg Network** item in the **RVM Input** list box.

Click the **Show Nodal Diagram** command button.
Click the Text Transfer command button.
Click the **Import** command button.
Return to the EXCEL workbook
TOMInstructionManualForShortcutsInTheTOM.xls.
Rename Sheet3 to Neg Network File.
Return to the **Text to TOM Transfer** screen.
Copy the DC Lines text box.

Paste in the spreadsheet.
Title, label and format the entries in the spreadsheet.
Repeat the same procedure for the nodes.

The results are next.
3.4. **TRACK LAYOUT FILE INPUT**

The **Track Layout File**, input to the TMS, also can use the **Text Transfer** function in its construction. Show the **File Construction Module – Main Screen**, with the **WMATA** rail system selected.
Click the **TMS Input** check box.
Select the **TrkLayout** item in the **TMS Input** list box.
Select the **TW-boy.wma** item in the **Track Input File** file list box.
Click the **Text Transfer** command button in the **Aids For Track Layout Construction** frame.
Click the **Import** command button.
Open the EXCEL workbook **TOMInstructionManualForShortcutsInTheTOM.xls**.
Create a new sheet. Call it **Track Layout File**.
Return to the **Text to TOM Transfer** screen.
Copy the **Track Segments** text box.
Paste it into the EXCEL spreadsheet at A5.
Title, label and format the **Track Segment** area.
The same procedure can now be applied to the nodes. The spreadsheet shows the results.
<table>
<thead>
<tr>
<th>Segment Name</th>
<th>Origin Node</th>
<th>End Node</th>
<th>Track #</th>
<th>Grade [Grad]</th>
<th>Curves [Long]</th>
<th>Speed Codes</th>
<th>Modes</th>
<th>Nodes</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>E1</td>
<td>D1</td>
<td>E1</td>
<td>0</td>
<td>0</td>
<td>64 (-1)</td>
<td>1</td>
<td></td>
<td></td>
<td>E1</td>
</tr>
<tr>
<td>E2</td>
<td>D2</td>
<td>E2</td>
<td>0</td>
<td>0</td>
<td>64 (-1)</td>
<td>1</td>
<td></td>
<td></td>
<td>E2</td>
</tr>
<tr>
<td>E3</td>
<td>D3</td>
<td>E3</td>
<td>0</td>
<td>0</td>
<td>64 (-1)</td>
<td>1</td>
<td></td>
<td></td>
<td>E3</td>
</tr>
<tr>
<td>E4</td>
<td>D4</td>
<td>E4</td>
<td>0</td>
<td>0</td>
<td>64 (-1)</td>
<td>1</td>
<td></td>
<td></td>
<td>E4</td>
</tr>
<tr>
<td>E5</td>
<td>D5</td>
<td>E5</td>
<td>0</td>
<td>0</td>
<td>64 (-1)</td>
<td>1</td>
<td></td>
<td></td>
<td>E5</td>
</tr>
<tr>
<td>E6</td>
<td>D6</td>
<td>E6</td>
<td>0</td>
<td>0</td>
<td>64 (-1)</td>
<td>1</td>
<td></td>
<td></td>
<td>E6</td>
</tr>
<tr>
<td>E7</td>
<td>D7</td>
<td>E7</td>
<td>0</td>
<td>0</td>
<td>64 (-1)</td>
<td>1</td>
<td></td>
<td></td>
<td>E7</td>
</tr>
<tr>
<td>E8</td>
<td>D8</td>
<td>E8</td>
<td>0</td>
<td>0</td>
<td>64 (-1)</td>
<td>1</td>
<td></td>
<td></td>
<td>E8</td>
</tr>
<tr>
<td>E9</td>
<td>D9</td>
<td>E9</td>
<td>0</td>
<td>0</td>
<td>64 (-1)</td>
<td>1</td>
<td></td>
<td></td>
<td>E9</td>
</tr>
<tr>
<td>E10</td>
<td>D10</td>
<td>E10</td>
<td>0</td>
<td>0</td>
<td>64 (-1)</td>
<td>1</td>
<td></td>
<td></td>
<td>E10</td>
</tr>
<tr>
<td>E11</td>
<td>D11</td>
<td>E11</td>
<td>0</td>
<td>0</td>
<td>64 (-1)</td>
<td>1</td>
<td></td>
<td></td>
<td>E11</td>
</tr>
<tr>
<td>E12</td>
<td>D12</td>
<td>E12</td>
<td>0</td>
<td>0</td>
<td>64 (-1)</td>
<td>1</td>
<td></td>
<td></td>
<td>E12</td>
</tr>
<tr>
<td>E13</td>
<td>D13</td>
<td>E13</td>
<td>0</td>
<td>0</td>
<td>64 (-1)</td>
<td>1</td>
<td></td>
<td></td>
<td>E13</td>
</tr>
<tr>
<td>E14</td>
<td>D14</td>
<td>E14</td>
<td>0</td>
<td>0</td>
<td>64 (-1)</td>
<td>1</td>
<td></td>
<td></td>
<td>E14</td>
</tr>
<tr>
<td>E15</td>
<td>D15</td>
<td>E15</td>
<td>0</td>
<td>0</td>
<td>64 (-1)</td>
<td>1</td>
<td></td>
<td></td>
<td>E15</td>
</tr>
<tr>
<td>E16</td>
<td>D16</td>
<td>E16</td>
<td>0</td>
<td>0</td>
<td>64 (-1)</td>
<td>1</td>
<td></td>
<td></td>
<td>E16</td>
</tr>
<tr>
<td>E17</td>
<td>D17</td>
<td>E17</td>
<td>0</td>
<td>0</td>
<td>64 (-1)</td>
<td>1</td>
<td></td>
<td></td>
<td>E17</td>
</tr>
<tr>
<td>E18</td>
<td>D18</td>
<td>E18</td>
<td>0</td>
<td>0</td>
<td>64 (-1)</td>
<td>1</td>
<td></td>
<td></td>
<td>E18</td>
</tr>
</tbody>
</table>

Ready
4. PROCEDURES

There are many procedures in the TOM that are not obvious from the Program Manual, since this is a document of reference rather than of instructions. Some of these procedures are short, while others are lengthier; this section highlights many of these procedures.

4.1. NEW FILES FROM OLD FILES

It is sometimes convenient to use a file from one rail system in another rail system. This is especially true when building a new rail system. This procedure can be accomplished in two ways:

1. Via Windows Explorer
2. Via the TOM

Assume that a new rail system is in the process of being built. Call this rail system NEW (mnemonic) with the file extension new.

Begin by setting up this rail system in the database. Open the TOM.
Click the \textbf{DB} command button.
Click the **Add** command button.
Enter the **Mnemonic** and **File Extension** in the appropriate text boxes.
Click the **Add Selection** command button.
It is desired to create a train file, which is close to a train file **T-chb.tes**, in the **NEW** rail systems directory. This will now be done in the two ways described.

Answer the query.
To get the screen in which the new directory is present.
4.1.1. Windows Explorer Method

Open the Windows Explorer and click on the (Applications Directory)/tomdat (default: c:\tom\tomdat) folder.
Double click on the folder, from which the file is to be taken, namely `tes`.
Find the file **T-chb.tes**.
Copy the file using either the right mouse button or a `<CTL>`C.

Open the **new** folder.
Paste the file into this folder.
Rename the file with a new file extension.
Return to the main screen of the TOM.
Select the **NEW** rail system in the **Rail System Selection** combo box.
Click the FCM command button.
Click the **TPS Input** check box.
Select the **Train** item in the **TPS Input** list box.
Select the **T-CHb.new** item in the **Train input file** list box.
Click the **Create File** command button. This action registers the file in the **NEW** rail system database.
This file may now be modified and saved as either a new file or the same file.

4.1.2. TOM Method

The TOM method for creating a new file by modifying an old file does not use the windows explorer, but uses just the TOM.

Begin with the TOM main screen.
Click the **FCM** command button.
Select the TEST rail system.
Click the **TPS Input** check box.

Select the **Train** item in the **TPS Input** list box.
Select the file T-CHb.TES in the **Train input file** list box.
Change the file extension in the **name** text box from **TES** to **new**. Change the path `\tes` to `\new` in the **path** text box.
Click the **Create File** command button.
4.2. SHORTCUTS

4.2.1. Select Command Button

The Select or Select One command button appears on many screens of the TOM. In most cases, it refers to selection of an item in either a file list box or list box. In these cases, double clicking on the item in the box is equivalent to clicking on an item in a box followed by clicking the command button. Two examples are shown. The next screen shows the main screen of the File Construction Module.
Selection of the TEST rail system is accomplished by either clicking on the TEST item in the Select a Rail System list box, followed by a click on the Select command button or by double clicking on the TEST item in the list box. Both procedures produce the same results.
A second example is shown after clicking the **ENS Input** check box.
To select the **Network** item in the **ENS Input** list box, either click the **Network** item in the list box followed by a click on the **Select** command button or double click on the **Network** item in the list box. Both procedures produce the same result.
The final example is illustrated using this screen. To select the file N-A.tes in the Network input file list box, either double click on the file in the file list box or click on the file followed by a click on the Select One command button. Both procedures produce the same results.
The double click shortcut will work for most selections to be made in the screens of the TOM.

4.2.2. File Identification

For large projects, keeping track of files can be a difficult problem, if a file identification system, is not set up logically.

All TOM files are named in the format 12345678.ext, where ext is the file extension relative to the rail system. Only 8 alphanumeric characters are permitted before the file extension. However, every input file and many other files provide the capability for a seventy character Caption.

The Caption of any file can be displayed in a file list box by clicking on the file and then moving the mouse over the file list box. To demonstrate the procedure, the Power Profile Appender screen of the File Manipulation Module will be used.

Begin with the main screen of the TOM.
Click the **FMM** command button.
Select the TEST rail system.
Click the **Append Power Profiles** command button.
Click on the file **P-123.TES** in the **Power Profiles Available** file list box. Move the mouse over this file list box.
All files in any file list box can be identified in this manner.

### 4.2.3. File of Filenames File Shortcuts

The **File of Filenames** file can be thought of as executable files for the simulators: **TPS**, **ENS** and **TMS** and the **Rail Voltage Model (RVM)**. Importing the **File of Filenames** into the screen which created it provides a shortcut to editing the input files, which comprise it. An example is shown here.

On the main screen of the **TOM**, click the **FCM** command button.
Select the TEST Rail System, by double clicking on the TEST mnemonic in the Select a Rail System file list box.
Select the **TPS Input** option by clicking on it.
Select the **Fnames** item in the **TPS Input** list box by double clicking on it. This action will produce the **File of Filenames Input** screen.
Select the **TPS123.TES** filename in the **Select from: List of Files** list box by double-clicking on it.
Any of the input files in the Input File Name list box can be imported into the screen that created it using the following procedure.

Click on the file.
A mouse movement in the list box will identify this file. Click the right mouse button.
The file is displayed in the **TOM File Viewer**. Click the **Edit** command button.
The file is imported directly into the screen in which it was created. It can now be modified and recreated as the same file or a different file.

This procedure can be used for any input file into any of the simulators or other models.

4.2.4. Train Location File

The **Train Location File** is input to both the **TMS** and **ENS**. Many times, complicated timetables can be built from simpler ones by cutting and pasting. This will certainly be the case when the trains that are running have fixed headways.
Consider building a **Train Location File** for the **AM Peak** operation of the **DCEE Rail System**, illustrated in the **TOM Instruction Manual**:

**Volume 2 – Instruction Manual for Applying the TOM to Transit Systems DC Electric – English Units**

The information needed to construct the operating timetable is shown below:

<table>
<thead>
<tr>
<th>Operating Timetable Data</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Period</strong></td>
</tr>
<tr>
<td>AM Peak</td>
</tr>
<tr>
<td>AM Peak</td>
</tr>
<tr>
<td>Mid Day</td>
</tr>
<tr>
<td>Mid Day</td>
</tr>
<tr>
<td>PM Peak</td>
</tr>
<tr>
<td>PM Peak</td>
</tr>
<tr>
<td>Evening</td>
</tr>
<tr>
<td>Evening</td>
</tr>
</tbody>
</table>

Saturday, Sunday, or Holiday operation is from 8 AM – 12 PM and follows the **Weekday Mid Day Operating Timetable**.

The usual way to build the **Train Location File** is discussed first.

**4.2.4.1. Normal Procedure**

The **File Construction Module – Main Screen** is shown below with **Trn Loc** highlighted.
A click on the Select command button produces the Train Location File Input screen.
Entries for the **Name of File** – name and **File Captions** are provided. The next step in the completion of a train location file is to select the p-files from the **P-File** list box, appropriate for the **AM Peak** operation. These files are P-*a.dce* and are chosen by clicking on them. The next screen shows the results.
These timetable entries for the basis for constructing the timetable. For an ENS or TMS run during any period, all trains should already be on the line for that period, rather than a transition from a previous period. Since the Operating Time File for the AM Peak will run the simulation fro 8:00 – 8:06, the timetable should start early enough, so that by 8:00, the first trains of each Train ID should already have reached their arrival terminals.

Now the trains between Rock Garden and Fenton Harbor take 9 minutes for their runs. Trains running between Rock Garden and Noel End take 11 minutes for their runs. Thus the entries for each Train ID Departure Time should at least be 11 minutes before 8:00. The completed Timetable text box is shown next.
Click on the Create File command button to produce the following screen.
Click the Yes command button to review the file.
Close the File Viewer.

4.2.4.2. Shortcut Procedure

Begin with the File Construction Module – Train Location Input screen.
Click the **Headway** check box.
Begin with the **Noel End Line**.

Fill in the screen.
This file will be created as a temporary file.
Click the Yes command button to review the file.
Notice that the file is saved in timetable format.

Return to the **Train Location Input** screen and enter the information for the **Fenton Harbor Line**.
Click the **Create File** command button.
Click the Yes command button to review the file.
Return to the **Train Location Input** screen. Import the first file **TL-temp.dce**.
Copy the contents of center text box.
Import the second file **TL-a.dce**.
Click the **Create File** command button.
Click the Yes command button to review the file.
This completes the shortcut procedure.

4.2.5. Saved For Future Additions

4.3. COASTING

Coasting is a power off, brake off condition of a train.

Two coasting modes are available to the TPS. These modes are referred to as **Anticipatory** coasting and **Sawtooth** coasting.

**Anticipatory** coasting occurs when the train proceeds into a no power/no brake condition in anticipation of a lower speed restriction or a stop.

The second form of coasting is sawtooth coasting. In this case, the train will accelerate to the current speed command or restriction and then revert to a no power/no brake condition until its speed drops by a certain amount.

Two options are available for **Sawtooth** coasting.
In the first option, a **Coast Speed** is set and the train accelerates to this speed and then begins coasting until it drops the certain amount (termed the **Speed Band**), then it accelerates again to the **Coast Speed** and so on, thus the term saw tooth coasting.

The second option of **Sawtooth** coasting uses the **Speed Restrictions** or **Speed Commands** as the **Coast Speed**. The **Speed Band** has the same meaning as in the first option.

If **Anticipatory** coasting is selected only the **Coast Speed** and **Coast Drag** are specified. In this case, the **Coast Speed** is the speed, below the **Speed Restriction**, to which the train coasts. When it reaches this speed, the train goes into normal braking. A **Coast Speed** must always be entered for **Anticipatory** coasting.

If **Sawtooth** coasting is selected the **Coast Speed**, the **Coast Drag** and the **Coast Speed Band** must be entered.

In this case, the **Coast Speed** is the speed to which the train accelerates before it begins coasting.

For **Sawtooth** coasting, if the **Coast Speed** is the **Speed Restriction** or **Speed Command**, then the default 0 is selected. In **Sawtooth** coasting the **Speed Band** is the range over which the speed drops before power is reapplied. A **Speed Band** is required for **Sawtooth** coasting.

Although coasting is a no power condition, for electric trains with electric (dynamic braking), the electric brake is sometimes kept active so that it would build up braking force upon application. The drag caused by this brake during coasting is called the **Coast Drag** and it is expressed as a fraction of full braking effort.

Examples are now shown of the various forms of coasting.

A very simple test track has been chosen to illustrate the concepts of what the **TPS** will do for various coasting situations. The position of the test track lies between 0 and 20. It has no grades or curves, which means level, tangent track. It has a top speed limit of 75 with one speed restriction between positions 10 – 11, of 40.

The train used is a typical rapid transit train of six self-propelled cars with regenerative braking.

In all of the cases shown in the examples, plots of **Speed vs Position** and **Acceleration vs Position** are presented.
4.3.1. Setting Up Coasting with the TOM

Coasting is specified in the **Control** file, which is input to the **TPS**. On the main screen of the **TOM**, choose the **TEST** Rail System in the **Rail System** combo box.

Click the **FCM** command button to expose the **File Construction Module – Main Screen**.
Click the **TPS Input** check box to expose the next screen.

![File Construction Module - Main Screen](image)

Select a Rail System

DCEE
MARTA
MIAMI
MTA MD
TEST
WMATA

**Build files for:**

- IPS Input
- ENS Input
- TMS Input
- ECM Input
- RVM Input

**TPS Input**

- Fnames
- Control
- Train
- Station
- Grade
- Curve
- Spd Res
- Spd Cmd
- Route

Click the **Select** button to proceed.

---

Page 170 of 445 Pages
Select the Control item in the **TPS Input** list box.

Click the **Select** command button to expose the next screen.
Click the **Coasting** check box to expose the following screen.
In the **Coasting Enabled** combo box, select the **Anticipatory** item.
The **Coast Speed** and the **Coast Drag** govern **Anticipatory** coasting.

Select the **Sawtooth** item in the **Coasting Enabled** combo box.
The **Coast Speed**, **Coast Speed Band** and **Coast Drag** govern **Sawtooth** coasting.
4.3.2. Base Case – No Coasting

Case: Coast Test - No Coasting

This is the base case. The train obeys all of the speed restrictions and runs from the Begin to End Stations. This kind of run is sometimes referred to as the minimum time run, because given the speed restrictions and the capability of the train; the train will use its full capability to exactly obey the speed restrictions.

Speed vs Position
Case: Coast Test - No Coasting
Acceleration vs Position

Note that the full accelerating and braking capabilities are used to change speeds.
4.3.3. Anticipatory Coasting

Case: Coast Test – Anticipatory – Coast Speed 80 – Drag 0

In this case, the **Coast Speed** is set higher than the speed restriction. As a consequence, coasting will not occur. The results are the same as the base case of no coasting.

**Speed vs Position**

![Graph showing Speed vs Position](image-url)
Case: Coast Test - Anticipatory - Coast Speed 80 - Drag 0
Acceleration vs Position
Case: Coast Test - Anticipatory - Coast Speed 60 - Drag 0

The **Coast Speed** is set at 60. In **Anticipatory** coasting, the **Coast Speed** is the speed below the **Speed Restriction**, to which coasting will occur. After the **Coast Speed** is achieved through coasting, normal braking will occur.

**Speed vs Position**
Case: Coast Test - Anticipatory - Coast Speed 60 - Drag 0
Acceleration vs Position

In the region of coasting, the deceleration (red) is due to train resistance and the Coast Drag.
Case: Coast Test - Anticipatory - Coast Speed 40 - Drag 0

The **Coast Speed** is set at 40. In Anticipatory coasting, the **Coast Speed** is the speed below the **Speed Restriction**, to which coasting will occur. After the **Coast Speed** is achieved through coasting, normal braking will occur.

**Speed vs Position**
Case: Coast Test - Anticipatory - Coast Speed 40 - Drag 0
Acceleration vs Position

In the region of coasting, the deceleration (red) is due to train resistance and the Coast Drag. Note that the coasting occurs right to the Speed Restriction (40), then the speed is maintained until the Speed Restriction changes to 75.
Case: Coast Test - Anticipatory - Coast Speed 20 - Drag 0

The Coast Speed is set at 20. In Anticipatory coasting, the Coast Speed is the speed below the Speed Restriction, to which coasting will occur. After the Coast Speed is achieved through coasting, normal braking will occur.

Speed vs Position

In this case, the train coasts to the Speed Restriction (40) and then maintains speed because there is no lower Speed Restriction to anticipate. For the stop at End, the coast is to the Coast Speed (20) because of the anticipated Speed Restriction (0) at the End Station.
Case: Coast Test - Anticipatory - Coast Speed 20 - Drag 0
Acceleration vs Position

In the region of coasting, the deceleration (red) is due to train resistance and the Coast Drag. Note that the coasting occurs right to the Speed Restriction (40), then the speed is maintained until the Speed Restriction changes to 75.
Case: Coast Test - Anticipatory - Coast Speed 60 - Drag 0.1

Speed vs Position

The additional drag added to the train resistance causes the slope of the Speed vs Position curve to be steeper in the coasting region.
Case: Coast Test - Anticipatory - Coast Speed 60 - Drag 0.1
Acceleration vs Position

The additional drag added to the train resistance causes the coasting region to be shorter than the case without drag.
4.3.4. Sawtooth Coasting

Case: Coast Test – Sawtooth – From Spd Res – Spd Bnd 3 - Drag 0
Speed vs Position

![Sawtooth Coasting Graph]

The name Sawtooth coasting adequately describes the Speed vs Position curve, which results. In this case, the coasting is tied to the Speed Restrictions.
Case: Coast Test – Sawtooth – From Spd Res – Spd Bnd 3 - Drag 0
Acceleration vs Position
Case: Coast Test – Sawtooth – From Spd Res – Spd Bnd 20 - Drag 0
Speed vs Position

With a larger **Speed Band**, the number of teeth in the saw is smaller.
Case: Coast Test – Sawtooth – From Spd Res – Spd Bnd 20 - Drag 0
Acceleration vs Position

<table>
<thead>
<tr>
<th>Position</th>
<th>Acceleration</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>3.00</td>
</tr>
<tr>
<td>2.0</td>
<td>2.91</td>
</tr>
<tr>
<td>4.0</td>
<td>1.89</td>
</tr>
<tr>
<td>6.0</td>
<td>0.89</td>
</tr>
<tr>
<td>8.0</td>
<td>-0.44</td>
</tr>
<tr>
<td>10.0</td>
<td>-1.12</td>
</tr>
<tr>
<td>12.0</td>
<td>-2.91</td>
</tr>
<tr>
<td>14.0</td>
<td>-4.81</td>
</tr>
<tr>
<td>16.0</td>
<td>-6.71</td>
</tr>
<tr>
<td>18.0</td>
<td>-8.61</td>
</tr>
<tr>
<td>20.0</td>
<td>-10.51</td>
</tr>
</tbody>
</table>

End
Case: Coast Test – Sawtooth – From Spd Res – Spd Bnd 60 - Drag 0
Speed vs Position
Case: Coast Test – Sawtooth – From Spd Res – Spd Bnd 60 - Drag 0
Acceleration vs Position
Case: Coast Test – Sawtooth – From Spd Res – Spd Bnd 80 - Drag 0

Speed vs Position

The largest Speed Band in this case would be the Speed Restriction. Choice of a Speed Band larger than the Speed Restriction reverts back to the Speed Restriction.
Case: Coast Test – Sawtooth – From Spd Res – Spd Bnd 80 - Drag 0
Acceleration vs Position
Case: Coast Test – Sawtooth – From 80 – Spd Bnd 3 - Drag 0
Speed vs Position

In this case, the **Coast Speed** is set higher than the **Speed Restriction**. No coasting will occur.
Case: Coast Test – Sawtooth – From 80 – Spd Bnd 3 - Drag 0
Acceleration vs Position
Case: Coast Test – Sawtooth – From 60 – Spd Bnd 3 - Drag 0
Speed vs Position

The Coast Speed is lower than the 75 Speed Restriction but higher than the 40 Speed Restriction. As a result, coasting occurs in the 75 regions but does not occur in the 40 region.
Case: Coast Test – Sawtooth – From 60 – Spd Bnd 3 - Drag 0
Acceleration vs Position
Case: Coast Test – Sawtooth – From 40 – Spd Bnd 3 - Drag 0
Speed vs Position

In this case, coasting occurs throughout the run.
Case: Coast Test – Sawtooth – From 40 – Spd Bnd 3 - Drag 0
Acceleration vs Position
Case: Coast Test – Sawtooth – From 20 – Spd Bnd 3 - Drag 0

Speed vs Position

In this case as well, coasting occurs throughout the run.
Case: Coast Test – Sawtooth – From 20 – Spd Bnd 3 - Drag 0
Acceleration vs Position
In the 75 Speed Restriction regions, the Coast Drag is much smaller than the train resistance, thus the number of teeth in the saw is slightly smaller than the case of no drag. However, in the 40 Speed Restriction region, the Coast Drag is higher than the train resistance, thus a higher number of teeth in the saw.
Case: Coast Test – Sawtooth – From Spd Res – Spd Bnd 3 - Drag 0.1
Acceleration vs Position
Case: Coast Test – Sawtooth – From 60 – Spd Bnd 3 - Drag 0.1
Speed vs Position

The number of teeth in the saw increases because of the **Coast Drag**.
Case: Coast Test – Sawtooth – From 60 – Spd Bnd 3 - Drag 0.1
Acceleration vs Position
4.3.5. Running Time and Energy

Since the base case or the no coast case represents the minimum terminal-to-terminal run time, the terminal-to-terminal run time will increase for all TPS runs in which coasting occurs. Let the symbol $T$ be used to represent the run time and the symbol $E$ be used to represent the Energy of the run. The fractional time difference between a coasting run and the base run is just the expression:

$$\Delta T / T = (T_{Coast} - T_{Base}) / T_{Base}$$

And the fractional energy difference between a coasting run and the base run is just the expression:

$$\Delta E / E = (E_{Coast} - E_{Base}) / E_{Base}$$

A measure of coasting effectiveness is the negative ratio of the fractional energy difference to the fractional time difference. This is the definition of the Coasting Effectiveness Index:

$$\text{CEI} = \frac{-\Delta E / E}{\Delta T / T}$$

The larger this number, the better is the effect of energy savings by coasting.

The following table shows a compilation of these values (indices) for the cases just run.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Run Time (min)</th>
<th>Energy (kWh)</th>
<th>Run Time Increase</th>
<th>Energy Decrease</th>
<th>Energy Decrease per Run Time Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coast Test - No Coasting (Base)</td>
<td>17.58</td>
<td>344.11</td>
<td>0.00%</td>
<td>0.00%</td>
<td>5.26</td>
</tr>
<tr>
<td>Coast Test - Anticipatory - Coast Speed 80 - Drag 0</td>
<td>17.58</td>
<td>344.11</td>
<td>1.76%</td>
<td>9.28%</td>
<td>1.70</td>
</tr>
<tr>
<td>Coast Test - Anticipatory - Coast Speed 60 - Drag 0</td>
<td>17.89</td>
<td>312.17</td>
<td>12.17%</td>
<td>20.64%</td>
<td>9.94</td>
</tr>
<tr>
<td>Coast Test - Anticipatory - Coast Speed 40 - Drag 0</td>
<td>19.72</td>
<td>273.10</td>
<td>26.28%</td>
<td>24.77%</td>
<td>6.72</td>
</tr>
<tr>
<td>Coast Test - Anticipatory - Coast Speed 20 - Drag 0</td>
<td>22.20</td>
<td>258.88</td>
<td>57.71%</td>
<td>38.21%</td>
<td>1.76</td>
</tr>
<tr>
<td>Coast Test - Anticipatory - Coast Speed 0 - Drag 0</td>
<td>22.20</td>
<td>258.88</td>
<td>115.45%</td>
<td>24.77%</td>
<td>0.52</td>
</tr>
<tr>
<td>Coast Test - Sawtooth - From Spd Res - Bnd 3 - Drag 0</td>
<td>17.90</td>
<td>295.73</td>
<td>1.82%</td>
<td>14.06%</td>
<td>7.72</td>
</tr>
<tr>
<td>Coast Test - Sawtooth - From Spd Res - Bnd 20 - Drag 0</td>
<td>19.63</td>
<td>295.73</td>
<td>10.95%</td>
<td>25.41%</td>
<td>2.18</td>
</tr>
<tr>
<td>Coast Test - Sawtooth - From Spd Res - Bnd 60 - Drag 0</td>
<td>29.28</td>
<td>232.03</td>
<td>368.95%</td>
<td>32.57%</td>
<td>4.99</td>
</tr>
<tr>
<td>Coast Test - Sawtooth - From Spd Res - Bnd 80 - Drag 0</td>
<td>29.28</td>
<td>232.03</td>
<td>665.56%</td>
<td>32.57%</td>
<td>0.49</td>
</tr>
<tr>
<td>Coast Test - Sawtooth - From 80 - Bnd 3 - Drag 0</td>
<td>17.58</td>
<td>344.11</td>
<td>1.76%</td>
<td>0.00%</td>
<td>0.52</td>
</tr>
<tr>
<td>Coast Test - Sawtooth - From 60 - Bnd 3 - Drag 0</td>
<td>21.45</td>
<td>227.25</td>
<td>32.01%</td>
<td>33.96%</td>
<td>1.54</td>
</tr>
<tr>
<td>Coast Test - Sawtooth - From 40 - Bnd 3 - Drag 0</td>
<td>31.39</td>
<td>189.99</td>
<td>78.56%</td>
<td>44.79%</td>
<td>0.57</td>
</tr>
<tr>
<td>Coast Test - Sawtooth - From 20 - Bnd 3 - Drag 0</td>
<td>65.02</td>
<td>265.65</td>
<td>269.85%</td>
<td>22.80%</td>
<td>0.08</td>
</tr>
<tr>
<td>Coast Test - Sawtooth - From Spd Res - Bnd 3 - Drag 0:1</td>
<td>17.89</td>
<td>340.98</td>
<td>1.76%</td>
<td>0.91%</td>
<td>0.52</td>
</tr>
<tr>
<td>Coast Test - Sawtooth - From 60 - Bnd 3 - Drag 0:1</td>
<td>21.45</td>
<td>290.22</td>
<td>22.01%</td>
<td>15.66%</td>
<td>0.71</td>
</tr>
</tbody>
</table>

Since most rail systems have constraints on running time because of schedule requirements, large departures from the minimum run time are not acceptable. In addition, if the run times become too long, there would be a requirement for additional trains. Thus, only small deviations from run times should be considered.
Several runs were made using the test track on which all of the rest of the coasting runs were made. In these runs, the Speed Band was varied from 1 to 19. The following graphs show the results.
4.4. ELEVATION FILES
It is sometimes worth developing elevation files from grade files in order to validate the grade files and to show elevation along with speed, power and acceleration vs position plots.

Elevation files will be developed using the files generated in Volume 2 Instruction Manual for Applying the TOM to Transit Systems DC Electric – English Units

The layout for the DC&E rail system is shown next.

Two elevation files should be created. The first file will be from Rock Garden to Noel End and the second file from Rock Garden to Fenton Harbor.

On the main screen of the TOM, select the DC&E rail system.
Click the **FMM** command button.
Click the **Create Elevation File** command button.
Double click the Rock Garden to Noel End grade file **GR-rn.dce**.
From the track layout file above, the Rock Garden station and the Noel End station are located at 0.3 and 7.0, respectively. Enter these numbers in the **Elevation Start Position** and **Elevation End Position** text boxes, respectively.
For the time being, enter an **Elevation Start Altitude** of 0.
Click the **Create File** command button.
Click the Yes command button to review the file.
Double click the Rock Garden to Fenton Harbor grade file **GR-rf.dce**.
Correct the **Elevation End Position** text box to reflect the location of the Fenton Harbor station at MP 6.4.
Click the **Create File** command button.
Click the Yes command button to review the file.
These elevation files may now be plotted. Click the **Graph** command button.
Click the **Elevation** check box.

Click the Rock Garden to Noel End elevation file (**el-rn.dce**) in the Choose Elevation File file list box. Click a Rock Garden to Noel End station file (**st-rna.dce**) in the Choose Station File file list box.
To provide a supplementary title for the graph, click the **View One** command button next to the **Choose Elevation File** file list box.
Copy the title of the file.

Paste the title in the **Supplementary Title:** text box.
This graph will be put together for display purposes, so a manual scale will be set.

Click the Set Scale check box.
Enter the scale as follows.

![Graph Type: Elevation vs. Position](image)

<table>
<thead>
<tr>
<th>Elevation</th>
<th>Minimum</th>
<th>Step Size</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>5</td>
<td>50</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Position</th>
<th>Minimum</th>
<th>Step Size</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>.5</td>
<td>8</td>
</tr>
</tbody>
</table>

Supplementary Title: Rock Garden to Needle End

Click the Select command button.
Click the **Complete Graph** command button. Paste the graph and format border.
Follow the same procedure for the Rock Garden to Fenton Harbor elevation plot.
If the altitude of an intermediate position point had been known, the elevation files could have been adjusted to this point.
4.5. TRAIN FILES

There are other features in the Train File input screens that are worth describing here. The first of these features is concerned with train resistance and the second has to do with train makeup.

4.5.1. Train Resistance

The TOM uses two different methods to calculate train resistance: a Davis Type Equation and the Coefficient Method.

A Davis Type Equation has the following form.

![Train Resistance Diagram]

The Coefficient Method has the following form.
The Coefficient Method is the more general way of expressing train resistance. Thus any expression of train resistance using a Davis Type Equation can be expressed using the Coefficient Method. The reverse is not necessarily true.

The DCEE rail system will be used to show a feature of the TOM in particular, the Train file input.
Click the **FCM** command button.
Click the **TPS Input** check box.
Double click the **Train** item in the **TPS Input** list box.

Select the train file **T-fr1.dce**.
Click under the **Help** command button.
This action exposes the **Train Resistance Calculator** command button. Click the command button to show the next screen.
The train file selected has the train resistance expressed in a **Davis Type Equation**. Click the **Import from Screens** command button to import the equation into this screen.
The train resistance for this train can now be calculated for any value of speed and train weight, up to the full train weight. For the empty weight (97 tons) and 0 mph speed, enter these values and click the **Calculate Using Davis Equation** command button to obtain the next screen.
To recalculate the train resistance for a speed of 30 mph and train weight of 130 tons, enter these values in the appropriate text boxes and click the **Calculate Using Davis Equation** command button.

---

**Coefficient Equation Variables**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$C_1$ [lbs]</td>
<td></td>
</tr>
<tr>
<td>$C_2$ [lbs/ton]</td>
<td></td>
</tr>
<tr>
<td>$C_3$ [lbs/mph]</td>
<td></td>
</tr>
<tr>
<td>$C_4$ [lbs/ton/mph]</td>
<td></td>
</tr>
<tr>
<td>$C_5$ [Lead] [lbs/ft$^2$/mph$^2$]</td>
<td></td>
</tr>
<tr>
<td>$C_5$ [Trail] [lbs/ft$^2$/mph$^2$]</td>
<td></td>
</tr>
</tbody>
</table>

**Davis Equation Variables**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Cars in Train</td>
<td>3</td>
</tr>
<tr>
<td>Number of Axles in Train</td>
<td>12</td>
</tr>
<tr>
<td>Flange Coefficient [lbs/ton/mph]</td>
<td>0.0710</td>
</tr>
<tr>
<td>Frontal Area [ft$^2$]</td>
<td>88.0</td>
</tr>
<tr>
<td>Lead Car Aerodynamic Coefficient [lbs/ft$^2$/mph$^2$]</td>
<td>0.00240</td>
</tr>
<tr>
<td>Trail Car Aerodynamic Coefficient [lbs/ft$^2$/mph$^2$]</td>
<td>0.00034</td>
</tr>
</tbody>
</table>

---

Calculation based on one lead car and remaining trailing cars.

**Train Resistance [lbs]**

| Train Resistance [lbs] | 474.1 |

**Train Resistance [lbs/ton]**

| Train Resistance [lbs/ton] | 4.888 |

---

**TPS**

---

**DCEE Rail System**

---

**Train input file**

---

**Choose English or Metric Units**

- [ ] English Units
- [ ] Metric Units

---

**Convert**

- Train Speed [mph]: 0
- Train Weight [tons] (Empty): 97
- Train Full Weight: 154.9

---

**Show Davis Formula**

---

**Transfer Davis to Screens**

---

**Close**

---

**Reset**

---

**Show Coefficient Formula**

---

**Transfer Coefficients to Screens**

---

**Import from Screens**
Since a Davis Type Equation expressed the train resistance, the train resistance may be converted to the coefficient method by clicking the **Convert** command button.
Click the **Calculate Using Coefficient Equation** command button.
Click the **Transfer Coefficients to Screens** command button.
To see the effect of this action, return to the **Train File Input – Main Screen**.
Note that the **Method to Specify Train Resistance** combo box has now been set at **Single Car Coefficients**.

Click the **Train Makeup Input** check box.
The single car coefficients have been transferred to the **Train File Input – Train Makeup Input** screen.

Return to the **Train File Input – Main Screen**.
Select the train file `T-fc1.dce`.

Click under the **Help** command button.
Click the **Train Resistance Calculator** command button.
Click the **Import from Screens** command button.
Click the **Select Type Car** combo box. Select **Car Type 1**.
Select Car Type 2.
4.5.2. Train Makeup

For transit applications, train makeup is relatively easy. In a particular train, there are generally two or three different type cars as defined by the File Construction Module – Train File Input – Train Makeup Input screen.
A **Type** car is different if any one of the entries in the column is different.

However in mainline railroad operation, there can be many different type cars as well as locomotives. Clicking under the **Help** command button exposes the next screen.
The **Locomotive Hauled** frame contains three command buttons, which are useful for aiding the user to deal with locomotive-hauled trains. The **Build Train** command button permits the user to build a locomotive-hauled train by selecting the locomotives and cars to be added to the train. The **Manage Car Library** command button allows the user to manage the car library by adding, deleting or modifying the data for locomotives and cars in the library. The **Locomotive Dispatch** command button provides the user with a method of testing the amount of motive power in the train consist for a dispatch policy that requires that a certain speed be maintained over a ruling grade.

All of these features will be discussed in the next three sections.

### 4.5.2.1. Car Library

The **Car Library** has two parts: The **Locomotive Library** and the **Freight and Passenger Car Library**.

Click the **Manage Car Library** command button.
4.5.2.1.1. **Locomotive Library**

Click the **Select Locomotive** combo box.
Note that in addition to common locomotives lead cars for various transit authorities are also included. Select the locomotive designated as GM - EMD - F40PH Fuel Curves Method.
The Locomotive Name is a unique identifier of the locomotive or car registered in the Car Library. Enter or modify with no (,) commas.

The Locomotive Train File is registered in the Car Library. It is a Train File, which is a one car train; namely, the locomotive. All of the propulsion and braking characteristics are imbedded in this train file. This file must also exist in the sub-directory in which the train file is opened.

The Number of Propulsion Units aboard the locomotive is registered in the Car Library. The value is normally 1.

The Locomotive Auxiliary Power is registered in the Car Library. Enter or modify as required. The units are kW.

The Locomotive Length over Couplers is registered in the Car Library. Enter or modify as required. The English units are feet and the Metric units are meters.

The Locomotive Empty Weight is registered in the Car Library. Enter or modify as required. The English units are tons and the Metric units are tonnes.

The Locomotive Full Weight is registered in the Car Library. Enter or modify as required. The English units are tons and the Metric units are tonnes.

The Locomotive Equivalent Rotational Weight is registered in the Car Library. Enter or modify as required. The English units are tons and the Metric units are tonnes.

The Locomotive Train Resistance Coefficients are registered in the Car Library. Enter or modify as required.

Train resistance is expressed by coefficients for each locomotive in the train. These coefficients are of the form:

\[ C_1 + C_2 \times W + (C_3 + C_4 \times W) \times V + C_5 \times V^2 \]

Where, \( W \) is the weight of the vehicle and \( V \) is its speed.

The Coefficient Equation Method is used in the Car Library.

The coefficient \( C_5 \) differs, depending on whether the locomotive is in lead or trailing. Thus there are two \( C_5 \) coefficients: \( C_5 \) (Lead) and \( C_5 \) (Trail). The trailing locomotives are always \( C_5 \) (Trail).
4.5.2.1.2.  Freight and Passenger Car Library

The **Freight and Passenger Car Library** contains both freight and passenger cars. Click the **Select Car** combo box.

Select the **Box; Hydra-Cushion 50 ton** entry.
The parameters, which describe the car, are displayed in the **Car Data** frame below the combo box. A new car may also be selected by clicking on **New** in the **Select Car** combo box.

The Car **Name** is a unique identifier of the car registered in the **Car Library**. Enter or modify with no (,) commas.

The Car **Length over Couplers** is registered in the **Car Library**. Enter or modify as required. The English units are feet and the Metric units are meters.

The Car **Empty Weight** is registered in the **Car Library**. Enter or modify as required. The English units are tons and the Metric units are tonnes.

The Car **Full Weight** is registered in the **Car Library**. Enter or modify as required. The English units are tons and the Metric units are tonnes.

The Car **Equivalent Rotational Weight** is registered in the **Car Library**. Enter or modify as required. The English units are tons and the Metric units are tonnes.

The Car **Train Resistance Coefficients** are registered in the **Car Library**. Enter or modify as required.

Train resistance is expressed by coefficients for each locomotive in the train. These coefficients are of the form:

\[ C1+C2*W +(C3+C4*W)*V+C5*V**2 \]
Where, \( W \) is the weight of the car and \( V \) is its speed.

The **Coefficient Equation Method** is used in the **Car Library**.

Cars always trail so the coefficient \( C_5 \) is always \( C_5 \) (Trail).

### 4.5.2.2. Locomotive Dispatch

The locomotive dispatch capability of the **TOM** will be discussed using the **FERR Rail System** data in the **TOM Instruction Manual**:

Volume 6 – Instruction Manual for Applying the TOM to Railroads Fueled – English Units.

It is necessary to first recreate the **FERR Rail System** and import the data. It is worth going through this procedure, since it is typical of importing the data used in any of the instruction manuals.

Begin with the **TOM Main** screen.
Click the **DB** command button.
This is the **Data Base Utility – Main Screen**. Click the **Add** command button.
In the Add Mnemonic here: text box, type FERR and in the Add File Extension: text box, type fre.
Click the **Add Selection** command button.
The new rail system **FERR** has been added.

Using the Windows Explorer or equivalent program, open the subdirectory:

```
TOMInstructionManuals\tomdat archives\FERR
```
That directory has the zipped files as shown. Unzip the first file into the directory:

`tom\tomdat\fre`

On the main screen of the TOM, select the **FERR Rail System**.
Click the FCM command button.
Click the **TPS Input** check box.
Select the **Train** item in the **TPS Input** list box.
In the **Train input file** file list box, double-click on the file T-C100.fre.
This is the train file for a Coal Train with 6 Heavy Haul Locomotives and 100 Hopper Cars. Click the **Train Makeup Input** check box.
Click in the space under the **Help** command button.
Once again, this exposes the **Locomotive Hauled** frame.

Click the **Locomotive Dispatch** command button.
The **Locomotive Dispatch** frame contains all of the procedures necessary to determine if a train has enough motive power. This determination is based on the dispatch rule of maintaining a fixed speed over a ruling grade and overcoming stiction on a starting grade.

It is assumed that a **Train File** resides in the screens of the **File Construction Module – Train Input** screens. This **Train File** could have been imported into these screens, or could have been built by the **Build Train** screen processes. The latter process will be discussed next. In the present case, the **Train File** was imported into the screen. It is the file: **T-C100.fre**.

The purpose of this screen is to test this **Train File** for correct motive power according to the dispatch rules, and if the **Train File** passes the test, to determine if less motive power will do the same job. Likewise, if the **Train File** fails the test, to add motive power to just pass the test.

There are two **Locomotive Dispatch Rules**:
1. Speed to be maintained over Ruling Grade. Set the speed (mph or kph) to be maintained over the ruling grade (%). Both speed and ruling grade are specified. The default values are shown in the speed and ruling grade text boxes, and should be changed to conform to the railroad and equipment available to that railroad. Change the speed and ruling grade if desired.

2. Stiction on Starting Grade. Stiction is defined here as the ratio (expressed as a fraction less than one) of the tractive effort once moving (at zero speed) to the tractive effort necessary to start. The starting grade (%) assumes that the whole train is on the grade. The default values are shown in the stiction and starting grade text boxes respectively, and should be changed to conform to the railroad and equipment available to that railroad. Change the speed and ruling grade if desired.

The default values of all four parameters; namely, speed, ruling grade, stiction and starting grade can be changed by clicking the **Set Default Dispatch Rules** command button, which exposes another screen, in which the default values may be changed.

The **Check Rule for Original Train** command button determines whether the rule is met with the motive power under consideration.

The **Total Tractive Effort** of the train is computed along with its **Train Resistance** and **Grade Resistance** at the speed to be maintained over the ruling grade.

The **Total Tractive Effort** of the Train is again computed at 0 speed as well as the train resistance and starting grade resistance at zero speed. Multiplying it by the stiction modifies this **Total Tractive Effort**. The smaller of the two tractive efforts is now named the **Total Tractive Effort**.

The Excess Tractive Effort (Total Tractive Effort less Resistance) is then determined. If the Excess Tractive Effort is positive the rule is met. If the Excess Tractive Effort is negative, the train fails the rule.

The rule, which dominated the dispatch, appears to the right of the **Check Rule for Original (Modified) Train** command button.

There are two options to be taken at this point: Change the dispatch rules or change the motive power.

By entering new values in the dispatch rule text boxes and clicking the Check Rule for Original (Modified) Train command button determines the effects of rule changes.

If motive power is to be changed, enter the new number of locomotives and again click the Check Rule for Original (Modified) Train command button.
It is generally prudent to select the number of locomotives, which just meets the rules. However, some railroads will add an extra locomotive in case one locomotive is out of service during the train run or for other unforeseen circumstances.

Click the **Check Rule for Original Train** command button.

The original train does not meet the requirements. The rule it does not meet is the **Speed on Ruling Grade**.

Enter 7 (locomotives) in the **Change the Number of Locomotives to:** text box.
Click the **Check Rule for Modified Train** command button.
The train still does not meet **Speed on Ruling Grade Rule**. Change the number of locomotives to 8 and click the **Check Rule for Modified Train** command button again.
Now it is possible that the Speed on Ruling Grade Rule is too stringent. Change the number of locomotives back to 6, followed by a click on the Check Rule for Modified Train command button.
Click the **Reset** command button to return to the initial screen.
Change the ruling grade to 1%.
Click the **Check Rule for Original Train** command button.
The train now meets the dispatch rules, the dominant of which in this case is speed on ruling grade.

To set the default settings of the dispatch rules, click the **Set Default Dispatch Rules** command button, to obtain the next screen.
Change the rules in the text boxes provided and click the **Modify Default File** to save the results.

Dispatch rules vary among railroads and are set depending on the working road.

After this procedure is completed, go back to the original **File Construction Module – Train File Input – Main Screen** to save the results by clicking the **Create File** command button.

### 4.5.2.3. Train Building

Before clicking the **Build Train** command button, it is necessary to import a **Locomotive Train File** into the **File Construction Module - Train File Input - Main Screen**.

A **Locomotive Train File** by definition has only one vehicle with one or more propulsion systems. Return to the **Train File Input – Main Screen**.
Select the Train File T-H.fre, which is a single locomotive.
Click the Train Makeup Input check box.
Click the space under the Help command button to expose the Locomotive Hauled frame.
Click the **Build Train** command button.
The **Build Train** frame contains all of the capability for building a train, which consists of a Lead Locomotive, Trailing Locomotives (Same locomotive name as the lead) and Freight and/or Passenger Cars. The **Train File** of the Lead locomotive is the base for building the train. This file is the one imported into the **File Construction Module – Main Screen**.

The **Lead Locomotive Train File** must be in the same directory of the selection.

The **Lead Locomotive Name** is the name of the locomotive, which **Train File** belongs to the lead locomotive. This is obtained automatically from the **Car Library**.

Let us now build a train consisting of 3 trailing locomotives plus varieties of other cars. Start with the locomotives.
Click the **Add Trailing Locos** command button.
Choose the Type of car from the Car Library by clicking the Select Type Car combo box. Enter the number of cars of that type into the text box to the right of the combo box. Click the Add Type Car command button to add these cars to the train consist. Continue repeating this process until the train build is complete.

For example:

Select the freight or passenger cars by first clicking the Select Type Car combo box.
Select the Box; Hydra-cushion 50 ton.
Enter the number of cars (28).
Click the **Add Type Cars** command button to add the cars to the train.
Continue the process of building the train in this manner.
The list of the buildup of the train consist shows the train as it is being built. The type of locomotives (Lead or Trailing) and the Names of the cars and the numbers of each are displayed. Any row, except that of the Lead Locomotive can be deleted from the list box by clicking on the row, followed by a click on the **Delete** command button below. After confirmation, the row is deleted.

To delete an entry, simply click on the entry (tank cars) in the list box and click the **Delete Row** command button.
When completed, click the Select command button.
Note that a reminder is generated to change the file name when this file is saved, since it is a new **Train File**. Click the **OK** command button.
4.6. **SPEED COMMAND FILES**

Speed command files are different than speed restriction files.

The position at which a new speed is read in a speed command file is the position at which the front of the train begins changing its motion in order to achieve the speed.
The position at which a new speed is read in a speed restriction file is the position at which the front of the train must be at that speed.

From the point of view of a train operator, speed commands tell her when to change to achieve the new speed and speed restrictions tell him where he is to achieve the new speed.

Generally a speed command file can only be generated with a power profile of a train, which already obeys all of the speed restrictions.

Begin with the **File Construction Module – Main Screen** with the **TPS Input** check box checked.

![File Construction Module - Main Screen](image)

Click the **Spd Cmd** item in the **TPS Input** list box, followed by a click on the **Select** command button below it.
If this is the first time that a speed command file is developed for a train run, click the **Check Using Power Profile** check box.
Select the Power Profile for the train run, P-dc+.TES.
Enter the **File Name** and the **File Caption**.
Click the **Create File** command button.
Click the **OK** command button and edit the file as desired.
The speed commands can be rounded off slightly to conform to reality.
Recreate the file with the new values.
Click the Yes command button to review the file.
<table>
<thead>
<tr>
<th>File Name</th>
<th>C:\User\omdat\vos\test.txt</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td></td>
</tr>
<tr>
<td>-99.0000</td>
<td>0.0000</td>
</tr>
<tr>
<td>123.0000</td>
<td>57.0000</td>
</tr>
<tr>
<td>3.0000</td>
<td>0.0000</td>
</tr>
<tr>
<td>0.0000</td>
<td>55.0000</td>
</tr>
<tr>
<td>1.5000</td>
<td>65.0000</td>
</tr>
<tr>
<td>3.7000</td>
<td>0.0000</td>
</tr>
<tr>
<td>2.0000</td>
<td>63.0000</td>
</tr>
<tr>
<td>2.2000</td>
<td>0.0000</td>
</tr>
<tr>
<td>2.3970</td>
<td>56.0000</td>
</tr>
<tr>
<td>2.9250</td>
<td>40.0000</td>
</tr>
<tr>
<td>102.0000</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

FILEMODE: C:\\omdat\\test\\SC-test.txt
4.7. NETWORK FILES

4.7.1. Moving Substations and Tiestations

4.7.2. Substation Out of Service

4.8. FMM POWER PROFILE OPERATIONS

The File Manipulation Module (FMM) has four programs, which work with power profiles (p-files), which are output from the Train Performance Simulator (TPS). These programs are: Power Profile Averager, Power Profile Appender, Power Profile Clipper and Route Checker.

The first three programs are not used that often in everyday work with the model. The Route Checker is used mostly as a diagnostic tool.

Begin with the main screen of the TOM with selection of the TEST Rail System.
Click the **FMM** command button.
4.8.1. Average Power Profiles

The Power Profile Averager (PAV) Program develops an average power profile given two or more power profiles (TPS Output) from different trains. For example, a train made up of mixed AC drive and cam control cars with identical performance characteristics could be simulated by running two trains, one of them with all AC drive cars and the other with all cam control cars. Using PAV, the mixed train power profile is developed from the other two power profiles.

This is the principal use of the PAV.

In order for the PAV to work, the power profiles to be averaged must have the same number of records. This is assured by having trains with the same performance characteristics. All input files to the TPS, which generates the power profiles must be the same. The only exception is the Train File, which can differ only in propulsion efficiencies and power factor in both power and electrical braking. The Ttractive Effort Curve must be the same for both cars.

It will be necessary to create a train file with the same characteristics as a base train file.
The **DCEE Rail System** will be used for this purpose. Expose the **Main Screen** of the **File Construction Module** with the **DCEE Rail System** selected and the **TPS Input** check box checked.

Select the **Train** item in the **TPS Input** list box, followed by a click on the **Select** command button below.
Import the AC drive train file **T-fc2.dce** into the screen by double-clicking on it in the file list box on the left.
Click the **Propulsion Input** check box.
Click the TE vs Spd Curve check box.
Click the **Text Transfer** command button.
Click the **Import** command button.
Copy the **Tractive Effort vs Speed Curve** from the text box.
Open an **EXCEL Spreadsheet**.
Paste the **Tractive Effort vs Speed Curve** into the spreadsheet and label.
### AC Drive Train

<table>
<thead>
<tr>
<th>Speed</th>
<th>Tractive Effort</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>16223</td>
</tr>
<tr>
<td>5</td>
<td>16223</td>
</tr>
<tr>
<td>0</td>
<td>16223</td>
</tr>
<tr>
<td>15</td>
<td>16223</td>
</tr>
<tr>
<td>25</td>
<td>16223</td>
</tr>
<tr>
<td>30</td>
<td>16223</td>
</tr>
<tr>
<td>35</td>
<td>16223</td>
</tr>
<tr>
<td>40</td>
<td>16223</td>
</tr>
<tr>
<td>45</td>
<td>16223</td>
</tr>
<tr>
<td>50</td>
<td>16223</td>
</tr>
<tr>
<td>55</td>
<td>16223</td>
</tr>
<tr>
<td>60</td>
<td>16223</td>
</tr>
<tr>
<td>65</td>
<td>16223</td>
</tr>
<tr>
<td>70</td>
<td>16223</td>
</tr>
<tr>
<td>75</td>
<td>16223</td>
</tr>
</tbody>
</table>

Return to the **File Construction Module – Train File Input - Main Screen.**
Import the **Cam-Control Train** into the screen by double-clicking on the file **T-fr2.dce**.
Return to the Text to TOM Transfer screen.
Click the **Import** command button.
Copy the **Ttractive Effort vs Speed Curve** from the text box, place it into the **EXCEL Spreadsheet** and label.
This action verifies that the **Tractive Effort Curves** are identical.

Return to the main screen of the **TOM**.
Click the **FMM** command button.
Click the Average Power Profiles command button.
The files **P-fra.dce** and **P-rfra.dce** are power profiles for the six car trains of AC Drive and CAM-Control, respectively. It is desired to produce a train of one AC Drive unit coupled to one CAM-Control unit. In the case of this exercise, the unit is two power cars with a trailer car.

In the **Power Profiles Available** file list box, double-click on the file **P-fra.dce**, to be used as the base.
The number of cars is 3.
Double-click on the file **P-rfra.dce** in the same file list box and again the number of cars is **3**.
The train id is entered in the **Train ID for Averaged Files** text box. The **File Name** is also provided.
Click the **Create File** command button to complete the process.
Click the Yes command button to review the file.
<table>
<thead>
<tr>
<th>File Name</th>
<th>File Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Train Operations Model - File Viewer</td>
<td>File Viewer Interface</td>
</tr>
</tbody>
</table>

Scroll to the bottom.
It is well to graph the power curves for all three trains.

Two ACD Car Units
Two CAM Car Units

POWER VS POSITION: Future Normal FH-RG AM Peak CAM Car Units

- Rock Garden
- Market Place
- Veteran Ave
- Dillard Dock
- Ferguson House

Position

Power (v/mw)
One **CAM Car unit** coupled to one **ACD Car unit**.

During regeneration in the mixed car units, there is less energy regenerated from the train because of half the number of regenerating cars and some of this energy feeds the auxiliaries aboard the non-regenerating cars.
4.8.2. Append Power Profiles

To Append Power Profiles means to stack one power profile behind another to obtain one power profile. This tool is used together with the Clip Power Profiles process when one or several of the items listed is required.

1. A train changes its performance characteristics during a run.
2. Meets (where tracks diverge and then later merge; distance are different.)
3. Loops (where tracks turn the train completely around)

An example of the Power Profile Appender process will be conducted in the TEST Rail System.

Begin with the File Manipulation Module – Main Screen.

Click the Append Power Profiles command button.
The file **P-dc-.tes** will be appended to **P-dc+.tes** to form the appended file **P-dc+-tes**.

The completed screen is shown next.
Click the Create File command button.
Click the Yes command button to review the file.
The part of the file that shows the connection of the two files is shown in the above screen.

4.8.3. Clip Power Profiles

The Clip Power Profiles process is also quickly demonstrated using the TEST Rail System. This process clips records from the front and/or back of a power profile to provide a shorter power profile.

Begin again with the File Manipulation Module – Main Screen.
Click the **Clip Power Profiles** command button.
The power profile \texttt{P-dc+.tes} will be clipped between before milepost 1.0 and after milepost 2.0 to produce the file \texttt{P-cdc+.tes}.
Click the **Create File** command button.
The **Time Offset of Power Profile** text box contains the time of the first saved record as it relates to the beginning of the file before clipping.

Click the **Yes** command button to review the file.
Note that the first record begins at time $t = 0$. 

<table>
<thead>
<tr>
<th>Time</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00</td>
<td>1.00</td>
</tr>
<tr>
<td>1.00</td>
<td>1.02</td>
</tr>
<tr>
<td>2.00</td>
<td>1.04</td>
</tr>
<tr>
<td>3.00</td>
<td>1.06</td>
</tr>
<tr>
<td>4.00</td>
<td>1.08</td>
</tr>
<tr>
<td>5.00</td>
<td>1.10</td>
</tr>
<tr>
<td>6.00</td>
<td>1.12</td>
</tr>
<tr>
<td>7.00</td>
<td>1.14</td>
</tr>
<tr>
<td>8.00</td>
<td>1.16</td>
</tr>
<tr>
<td>9.00</td>
<td>1.18</td>
</tr>
<tr>
<td>10.00</td>
<td>1.20</td>
</tr>
<tr>
<td>11.00</td>
<td>1.22</td>
</tr>
<tr>
<td>12.00</td>
<td>1.24</td>
</tr>
<tr>
<td>13.00</td>
<td>1.26</td>
</tr>
<tr>
<td>14.00</td>
<td>1.28</td>
</tr>
<tr>
<td>15.00</td>
<td>1.30</td>
</tr>
<tr>
<td>16.00</td>
<td>1.32</td>
</tr>
<tr>
<td>17.00</td>
<td>1.34</td>
</tr>
<tr>
<td>18.00</td>
<td>1.36</td>
</tr>
<tr>
<td>19.00</td>
<td>1.38</td>
</tr>
<tr>
<td>20.00</td>
<td>1.40</td>
</tr>
<tr>
<td>21.00</td>
<td>1.42</td>
</tr>
<tr>
<td>22.00</td>
<td>1.44</td>
</tr>
<tr>
<td>23.00</td>
<td>1.46</td>
</tr>
<tr>
<td>24.00</td>
<td>1.48</td>
</tr>
<tr>
<td>25.00</td>
<td>1.50</td>
</tr>
<tr>
<td>26.00</td>
<td>1.52</td>
</tr>
<tr>
<td>27.00</td>
<td>1.54</td>
</tr>
<tr>
<td>28.00</td>
<td>1.56</td>
</tr>
<tr>
<td>29.00</td>
<td>1.58</td>
</tr>
<tr>
<td>30.00</td>
<td>1.60</td>
</tr>
<tr>
<td>31.00</td>
<td>1.62</td>
</tr>
<tr>
<td>32.00</td>
<td>1.64</td>
</tr>
<tr>
<td>33.00</td>
<td>1.66</td>
</tr>
<tr>
<td>34.00</td>
<td>1.68</td>
</tr>
<tr>
<td>35.00</td>
<td>1.70</td>
</tr>
<tr>
<td>36.00</td>
<td>1.72</td>
</tr>
<tr>
<td>37.00</td>
<td>1.74</td>
</tr>
<tr>
<td>38.00</td>
<td>1.76</td>
</tr>
<tr>
<td>39.00</td>
<td>1.78</td>
</tr>
<tr>
<td>40.00</td>
<td>1.80</td>
</tr>
</tbody>
</table>
4.8.4. Meet and Loop Power Profiles

The Meet and Loop train running provides an exercise of unusual uses of the TOM.

The Meet case is a situation where tracks separate, such as a Y junction and then come together again, and where the distance along the first path is different from the distance of the second path.

The Loop case is a situation where the tracks separate, in a first Y junction and loop to form a second Y junction so that in terms of train direction, the second Y junction precedes the first Y junction. These are illustrated in the next picture.

![Meet and Loop Illustration](image)

The distances \( d_1 \) and \( d_2 \) are not equal.
4.8.4.1. Meet

An example of handling a Meet with the TOM will be described using a rail system called MEET. Using the file extension, mte, for this system, consider the situation depicted in the next picture.

![MEET Rail System Diagram]

The are no grades or curves. The MEET Rail System is all level, tangent track.

The speed limit is 70, everywhere.

There are two terminal stations Begin at position 0.0 and End at position 4.0 measured on track 1. End is at position 3.0 if measured along track 2. The Meet occurs at position 3.0 if measured along track 1 and at position 2.0 if measured along track 1 until position 1.0 and then along track 2.

To build the MEET Rail System, add the system using the Database Utility.

The problem of the Meet will be addressed by running two different trains, one train, a six-car cam-control, represented by file T-Cb.TES, the other train, a six car AC drive train, represented by file T-Dac.TES.

The cam-control train will run on track 1, while the AC drive train will run on tracks 1-2-1.
The procedure is to run both trains from **Begin** to **End**, using input files with the appropriate positions for each train. The power profile of the **AC Drive** train will be clipped to only include the records from positions **0.0-1.999** (less than 2.0). A third **TPS** will be executed, where the **AC Drive** train runs from position **3.0** to **4.0** on track **1**, with the **Initial Position** and **Initial Speed** at position **3.0** is specified in a new **Control File**. The power profile which results from this run is then appended to the clipped power profile of the original **AC Drive** train.

Begin by adding the **MEET Rail System** to the **Database**. The result is shown next.

Next, capture the train files from the **TEST Rail System**. The first is **T-Cb.TES**, which will become **T-Cb.mte**.
Click the **Create File** command button to effect the transfer.
Click the **Reset** command button to transfer the second train file.
Change the **Train Part of Name** text box to **A1** and click the **Create File** command button to effect the transfer.
The following screens will show the **File Viewer** for the created input files.
Control File.

```
1905181615 6 9295827 0 0
5 1 1 1.00 1.00
1 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
(+0ir)
FILENAME: C:\tom\tomdata\ate\GL-1.ate
```
Station File for train on track 1.
Station File for track 1-2-1 train.

Note that the End station is at position 3.0.
Grade File for all cases.
Curve File for all cases.
Speed Restriction File for all cases.
Route File for train on track 1.
Route File for train on tracks 1-2-1.
File of Filenames for train on track 1.
File of Filenames for train on tracks 1-2-1.
Run the TPS for train on track 1.
Run the TPS for train on tracks 1-2-1.
Clip the power profile of the train on tracks 1-2-1 to end at position 1.999 (less than 2.0).

This is power profile P-2c.mte. View it by clicking the Yes command button.
The next step is to run the **AC Drive** train from **3.0** to **4.0**, beginning at the appropriate position and speed. Open the **Route Checker** in the FMM. View the power profile **P-2.mte**.
The position of the swichover back to track 1 is 2.000 and the speed is 70.

Build a new **Control File** which starts the train at 3.000 with speed of 70.

Create a new station file with one station, **End** at position 4.0.
Create the new **File of Filenames** for the partial run on track 1.
Run the TPS.

The power profile from this run, P-2p.mte will now be appended to the clipped power profile, P-2c.mte, to complete the true power profile for the AC Drive train, P-2m.mte.
This completes the process for resolving a Meet condition.
4.8.4.2. Loop

An example of handling a Loop with the TOM will be described using a rail system called LOOP. Using the file extension, lpe, for this system, consider the situation depicted in the next picture.

The are no grades. The LOOP Rail System is all level track.

The speed limit is 70 on Track 1 and 10 on Track 2.

There are two terminal stations Begin at position 0.0 and End at position 2.0 measured on track 1. The Loop occurs at position 1.0 if measured along track 1 and rejoins track 1 at position 0.90. The distance along track 2 between junctions is 0.314. Thus, track 2 rejoins track 1 at position 1.314 as measured along track 1 and then track 2.

The geometry is shown in the next picture.
The problem of the Loop will be addressed by running a six car AC Drive train, represented by file T-Dac.TES.

The procedure is run two trains, using input files with the appropriate positions for each train. The first train will run from Begin to End, switching over to track 2 at position 1.0.

The power profile of the AC Drive train will be clipped to only include the records from positions 0.0-1.313 (less than 1.314). A third TPS will be executed, where the AC Drive train runs from position 0.9 to 0.0 on track 1, with the Initial Position and Initial Speed at position .90 is specified in a new Control File. The power profile which results from this run is then appended to the clipped power profile of the original AC Drive train.

Begin by adding the LOOP Rail System to the Database. The result is shown next.
Transfer the AC Drive train from the TEST Rail System to the LOOP Rail System.
Set up the input files for the TPS run around the loop. Only the File Viewer view of the files will be shown.
Control File.
Station File.

Note that the assumption is that the train runs on track 2 all the way to the station **End**.
Curve File.

```
4
-1.00000  .00000
 1.00000  .00000
 5.33000  190.00000
10.00000  .00000
FILESIZE: C:\tom\tomdat\lp\CF-1.lpe
Loop Curve
```
Speed Restriction File.

File Name: C:\tom\tomdata\ips\SP-10.lpe

Loop: Speed 10

<table>
<thead>
<tr>
<th>Loop</th>
<th>Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>86.0000</td>
</tr>
<tr>
<td>2</td>
<td>96.0000</td>
</tr>
<tr>
<td>3</td>
<td>106.0000</td>
</tr>
<tr>
<td>4</td>
<td>116.0000</td>
</tr>
<tr>
<td>5</td>
<td>79.0000</td>
</tr>
<tr>
<td>6</td>
<td>89.0000</td>
</tr>
</tbody>
</table>

FILEBASE: C:\tom\tomdata\ips\SP-10.lpe

Page 384 of 445 Pages
Route File.

```plaintext
3
-1.00000 1
1.00000 1
10.00000 2
FILENAME: C:\tom\tomdata\lpe\USP-1.lpe
```
File of Filenames File.

```
File Name: C:\tom\tomdata\lpe\YPS1.lpe

YPS1.lpe

BEGIN TO END 6 CAR AC DRIVE

BEGIN TO END 6 CAR AC DRIVE

```

File: C:\tom\tomdata\lpe\YPS1.lpe

BEGIN TO END 6 CAR AC DRIVE

BEGIN TO END 6 CAR AC DRIVE

BEGIN TO END 6 CAR AC DRIVE
Run the TPS.

The next step is to clip the power profile just generated by the TPS. A view of the power profile in the vicinity of position 1.314 is shown next.
The power profile will be clipped at 1.313.
Click the **Create File** command button and review the file.
The next step is to develop the power profile of a train starting at position 0.90 and running back to station Begin. It will involve four new input files.
The first new file will be the **Speed Restriction File**. It must take into account the train leaving the loop. The speed limit remains at 10 until the tail of the train leaves the loop. Since the train length is 450 ft (6 cars x 75 ft/car) or 0.085 mi, the speed restriction between position 0.9 and position 0.985 must be 10.

**Speed Restriction File**
Since the train will start at 0.9, only the **Begin** station is entered in the **Station File**.
The Control File must include the Initial Position and Initial Speed as well as be set up for a Decreasing Position Run.

Control File.
### File of Filenames File.

<table>
<thead>
<tr>
<th>File Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>C:\tom\omdat\lpe\GL-0.lpe</td>
<td>Control file input</td>
</tr>
<tr>
<td>C:\tom\omdat\lpe\T-Dec.lpe</td>
<td>Train file input</td>
</tr>
<tr>
<td>C:\tom\omdat\lpe\ST-r.lpe</td>
<td>Station file input</td>
</tr>
<tr>
<td>C:\tom\omdat\lpe\GR-1.lpe</td>
<td>Grade file input</td>
</tr>
<tr>
<td>C:\tom\omdat\lpe\GT-1.lpe</td>
<td>Curve file input</td>
</tr>
<tr>
<td>C:\tom\omdat\lpe\SP-10r.lpe</td>
<td>Speed/s file input</td>
</tr>
<tr>
<td>y C:\tom\omdat\lpe\RT-1.lpe</td>
<td>Route file input</td>
</tr>
<tr>
<td>y C:\tom\omdat\lpe\P.r.lpe</td>
<td>Power profile output</td>
</tr>
<tr>
<td>y y C:\tom\omdat\lpe\PVr.lpe</td>
<td>Detailed output</td>
</tr>
<tr>
<td>y y C:\tom\omdat\lpe\VSS.r.lpe</td>
<td>Summary output</td>
</tr>
<tr>
<td>FILENAME: C:\tom\omdat\lpe\TP56r.lpe</td>
<td>Loop to Begin 6 car AC Drive Reverse Run</td>
</tr>
</tbody>
</table>
Run the TPS.
View the new power profile.
Scroll to the bottom.

This power profile is now appended to the clipped power profile.
Click the **Yes** command button to review the file.
This portion shows the return to track 1 from track 2. Scroll to the bottom.
4.8.5. Route Checker

The **Route Checker** is a process in the **File Manipulation Module**. It is generally used for diagnostic purposes.

Power profiles are used as inputs into both the **ENS** and **TMS**. When power profiles are created by the **TPS**, the records are spaced by time. The base time increment is the **Display Time Interval** in the **Control File**, whose main screen is shown next.

A diagram of the trajectory calculation for a train is shown next.
The calculation of the trajectory begins at zero speed and at the position designated in the input files. It proceeds in time steps whose duration is specified by the Control File entry Calculational Time Interval.

It proceeds forward until the first speed restriction is encountered at which time a backward calculation in time is started beginning at the speed restriction position and the speed restriction speed. When the trajectory represented by the forward calculation is intersected by the trajectory represented by the backward calculation, the remaining part of the forward trajectory from the intersection point to the speed restriction encountered is eliminated and the piece of the backward calculation from the speed restriction to the intersection point is added to the remaining part of the forward trajectory. Time is adjusted to compensate.

If the position is in the range of the speed restriction, the speed is set to the speed restriction and the remainder of the trajectory through the speed restriction is added to the existing trajectory.
If the next speed restriction is higher, the calculation proceeds in the forward direction until the next lower speed restriction is encountered, at which time, the same process is repeated.

If the next speed restriction is lower, the same process is repeated.

This procedure continues until a stop is encountered, at which time the trajectory is used to determine the records of the power profile.

Although the power profile is displayed mainly at Display Time Intervals, adjustments must be made for the time at the intersection, and as a result, there are records, which are less than the Display Time Interval apart.

An example is shown in the power profile \textit{P-dc+}.TES.

![Image of power profile](image)

The time 27.00 seconds is the last time point of the forward trajectory before the intersection for the backward and forward trajectories. The intersection occurs at the time point 27.82 seconds as measured on the forward trajectory.

All of the times must be adjusted after this to make the physics of the trajectory correct.

Now in the \textit{ENS} and \textit{TMS} snapshots are taken of the system as the trains move forward in time. The snapshot interval, specified as the Time interval between snapshots in the
Operating Time File, must be the same as the Display Time Interval in the Control File.

Because the power profile is not constructed to be in the same time interval consistently through the file, the ENS or TMS must adjust the power profile using an averaging process to provide a power profile which is exactly in the same time interval to conform to the Operating Time File. This averaging process is reproduced in the Route Checker program.

The only problem which arises during the averaging process occurs when a train changes from one track to another. A decision must be made on which track to place the train. Sometimes the decision is wrong. This is investigated using the Route Checker.
A second and perhaps more important use of the **Route Checker** is to determine the source of the power profile and whether or not it is what the user thinks it is.

Begin with the main screen of the **FMM**, with the **WMATA Rail System** selected.

![File Manipulation Module - Main Screen](image)

Click the **Route Checker** command button.
Select the file **P-c1b1.wma** by a double-click.
There is much information here concerning this power profile.

1. **Routing Information** - The routing information listed is the beginning position and track number, the positions of all track number changes made by the train and the end position and track number. The positions indicated refer to the front of the train. These positions are the exact positions used by the ENS or TMS in locating trains on the system. They will vary slightly from the positions in the power profile because of a time equalizing process that takes place in the ENS and TMS.

2. **Selected Train ID** - The text box contains the 4-alphanumeric ID of the train represented by the power profile.

3. **Selected Train Direction** - The text box contains + dir for trains moving in the direction of increasing position or – dir for trains moving in the direction of decreasing position. If the train moves in both directions for appended power profiles, both is indicated.

4. **Selected Train Run Duration** – The duration of the TPS run specified by the power profile is given in the text box. This item may be copied and pasted in another screen or application. If the power profile is one of the appended or clipped variety, the total time represented by the group of records from beginning to end of the power profile. The format is hh:mm:ss.

5. **Selected Train Energy** - The text box contains the total energy expended over the run as represented by the power profile. It is the integral of power over time. If the train is electric, the value is kWh. If the train is non-electric, using fuel, the value is gallons in English units or imperial gallons in Metric units.
6. **Selected Train Snapshot Time Interval** – The time interval separating the records.

7. **Input Files** - The frame shows a listing of all TPS input files, which were used to construct the power profile. These TPS input files can be viewed directly, by clicking on the label appropriate to the input file.

A click on the *Time Calculator* command button produces the *Time Calculator* screen, with the run duration already present in the screen.

Times may be added or subtracted in any or all of the five formats.

A click on the *View Averaged Power Profile* command button will display the averaged position and track # of the train as a function of time. This is used for analysis of track change points in the ENS and TMS.
These can be exported into **EXCEL** or other programs accepting text.

Finally, a detailed look at the input files which generated this power profile can be conducted. An example is shown with the **Train File**.

Click on the **Train** lable in the **Input File** frame.
The **File Viewer** appears with that train file imported.

Click the **Edit** command button.
The file is imported into the screen which created it for further analysis.

Again, it is emphasized that the **Route Checker** is a powerful analysis tool.

### 4.9. Archiving

Archiving **Rail System Directories** can save the user a lot of work in recreating new files, especially in studies where several contingencies are developed. This has already been done in producing these instruction manuals.
Archiving allows the user to use the same filenames for input and output, while changing the input files but leaving their names the same. By doing this, one needs only to keep track of the archive rather than individual input and output files within that archive.

Let's take an example of archiving, which was done in the Volume 2 Instruction Manual

The customer specification was written in the following manner:

"The Client, the DCEE Transit Authority, operates an electrified rail transit system between the areas of Rock Garden on its western extremity to the areas of Noel in the southeast and Fenton Harbor in the northeast. The system is double tracked and as it proceeds east from the Rock Garden area, it splits into a Y at Lazy Junction, one set of double tracks proceeding to the Fenton Harbor area while the other set to the Noel area. Trains are now operated manually using a fixed block signaling system.

The Client has asked that a study be done to accomplish several objectives.

The present fleet of 63 CAM (resistor control) Cars is old and after thorough inspection, it was found only 14 of these cars could be fit for service in 3 years, the time it would take to procure new cars. In order to reduce the cost of the procurement, a study done previously indicated that once the procured cars were on the property, there would be a new method of operation. The procurement would consist of 28 ACD (AC Drive) Cars and 21 Trailer (no propulsion power) Cars. Thus together with the 14 remaining CAM Cars, future operation would include a fleet of 63 cars. The basic unit for passenger service would be a triplet, which includes one trailer car coupled with two powered cars.

It has also been determined that the energy costs for operating the system will exceed the budget this year. This condition is expected to grow worse in the following years. It has been suggested that applying coasting to train operation could reduce the energy cost to bring it within budget. Coasting is a strategy where the trains operate in a no power, no brake condition during inter-station runs. The Client wants to estimate the energy savings using the coasting strategy in present operations.

In the study, which led to the specification of the car purchase, it was stated that energy savings would be realized as a consequence of the operation of the future fleet of cars. The Client wishes to quantify this energy savings through simulation. He also wishes guidance on whether or not to include coasting once the new operation has begun."

It is necessary to consider all year operation. It turns out that the auxiliary power on board the vehicle is different in summer, winter and (spring=fall). Thus Train files will be different in three inputs of auxiliary power.

Since in present operation, the requirement is to study four operation modes (normal and 3 types of coasting), present operation will have 12 Archives; namely one for each combination.
Likewise, future operation will have 12 Archives (seasonal) and normal + 3 coasting). This makes a total of 24 archives. Other archives can be added for further studies.

4.10. Saved For Future Additions
5. WORKING WITH THE DATABASE

The Database Utility (DB) is a series of computer programs, which interact with the user to access all of the files, which are readable by the modules and the simulators of the TOM.

This section provides examples of using the DB to operate the TOM.

5.1. INITIALIZING THE DATABASE

Begin with the main screen of the TOM.
Select the TEST rail system. Click the DB command button.

Click the View Database command button.
5.2. **SEARCH FOR FILE**

The **Search for File** text box provides the user with a quick way to scroll through the files to the file he desires. For example to scroll to the train files in the database enter **T**- into the text box.
To work with the file T-CHb.TES, click on the gray area next to the file.
5.3. MODIFYING FILES

Input files can be modified using the **Database Utility – Table View** screen. Suppose the desire is to create a train file for the **NEW Rail System** by modifying a train file (**T-CHb.TES**) in the **TEST Rail System**. This is easily accomplished as follows.
Click the Modify File command button.
The file T-CHb.TES is automatically imported into the proper screen. The next step is to make the modifications. After these modifications are complete, name the file in the **NEW Rail System** and change the path.
Click the **Create File** command button.
Click the **Yes** command button to review the file.
5.4. VIEWING AND MODIFYING FILES

This section shows that from the Database Utility – Table View screen, an input file may be viewed and then modified.

Return to the TEST Rail System, Database Utility – Table View.
Click on the file AM-tes.tes.
Click on the View File command button.
This is the view of the file. Click the **Edit** command button.

```plaintext
<table>
<thead>
<tr>
<th>DC</th>
<th>1.7500</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>1.7500</td>
<td>2</td>
</tr>
<tr>
<td>P2</td>
<td>2.0000</td>
<td>2</td>
</tr>
<tr>
<td>P3</td>
<td>2.5000</td>
<td>1</td>
</tr>
</tbody>
</table>
```

FILE: C:\tom\dressed\var-test.txt

DC Test Line
The file can now be modified.

5.5. **DELETING A FILE**

Return to the TEST Rail System, Database Utility – Table View.
Click the **Delete File** command button.
To delete the file, click the **Yes** command button.
The file AM-tes.tes has been deleted.

5.6. EXECUTING FILE OF FILENAMES

File of Filenames files are considered executable files in the sense that these files are the first files to be called by the simulators in the model.

Return to the Database Utility – Table View screen for the TEST Rail System.
Type TPS in the Search for File text box.
Type an additional dc in the same text box.

Note that a Run Simulator command button appears on the screen. To run the TPS, click on the Run Simulator command button.
The indicator says that the simulator is now running. When it is finished, the following screen appears.
Click the **Yes** command button to review the summary output.
Return to the **Data Base Utility – Table View** screen.
Type **ENS** in the **Search for File** text box after clearing the text box.
Click on the **ENSdc.TES** database entry.
Click on the **Run Simulator** command button.
The simulator is now running. When finished the following screen results.
Click the **YES** command button to review the output.
Normally, the summary outputs of the ENS or TMS are not permanently saved. If saving this file is desired, click the Save File As command button at the top left of this screen to save this file to the path and filename in the text box to the right of the command button.
5.7. TRACING AN OUTPUT FILE

Output files can be traced using a trace function. Return to the Data Base Utility – Table View.
Click the output file AO-ace.tes in the database.
Click the Trace File command button.
Click the **Yes** command button.
This completes the trace of the output file. Any of the input files may now be traced by using the procedure in Section 4.2.3