

Pro Physics Tutorial

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MSTS Pro Physics Tutorial

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Overview

The **TB_Pro_Physics** series of files is a concept in attaining Real World based physics for MSTs. While many physics offerings rely solely on formula based parameters, my **Pro_Packs** are based on using the formula based physics values as a baseline to start modifications. The values are then adjusted based on how the rolling stock performs in the SIM in regards to *Braking*, *Couplers*, *Throttle Percentages*, and the *Engine_Brake* parameters. Mike Simpson has been gracious enough to include my **Pro_Packs** in his latest release of the *Donationware* version of **Route Riter**.

This tutorial was created to help you upgrade your engines and rolling stock to **Pro** series standards. The method described below is the only way to do these upgrades but it is the method I used to upgrade thousands of pieces of the rolling stock without issue using Mike's great utility. My **Pro** series was built using locomotives that were upgraded to Bob Boudoin's fine physics files. You should first upgrade you locomotive eng files with Bob's physics in the following regions.

A couple things to be careful of are the lines containing the entries for:

```
"EngineBrakesControllerDirectControlExponent( 1 )"  
"Cabview/Headout"
```

Make sure you do not eliminate these or your engine brakes will not apply in the SIM. You may have to do your upgrades around these two lines since they can be found in different places depending on who built the eng file.

Now that your eng file is upgraded to Bob's physics in the regions noted above we can start upgrading the rest of your eng/wag files!!!

GETTING STARTED

1. If you use the utility **Trainstore**, then “*unstore*” everything.
2. Navigate to your **TRAINS** folder located in the MSTS root folder.
3. Right-click your mouse with the arrow over the **TRAINSET** folder containing the item you want to upgrade and choose *rename*.
4. Rename your **TRAINSET** folder to "**XTRAINSET**".
5. Now right click to choose a new "New Folder" and name it "**TRAINSET**".
6. Right-click again to choose another new folder and name it "**Done**".

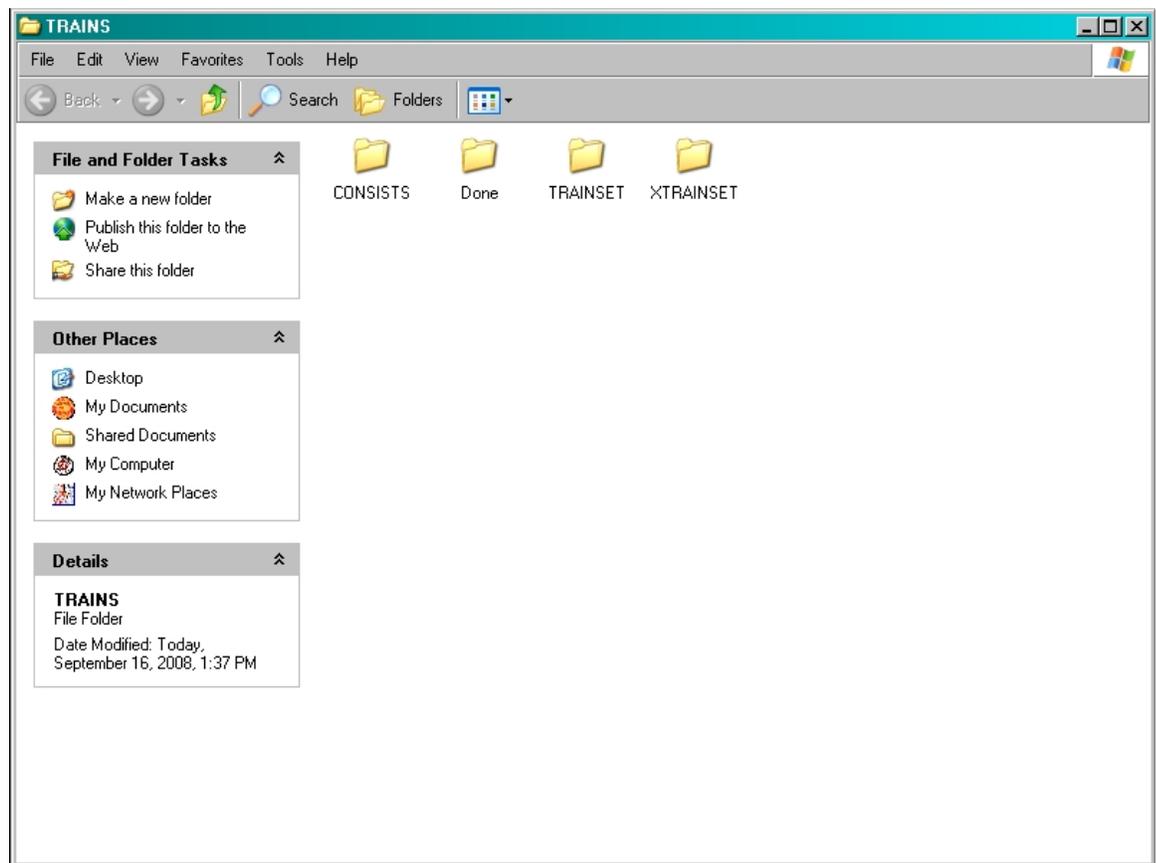


Figure 1

You should now have a **TRAINS** folder that looks like Figure 1.

7. Copy and Paste your **DEFAULT wag** file from your "**XTRAINSET**" folder to your new "**TRAINSET**" folder. This is the folder you will be doing all your upgrading in.

You are now set to start upgrading your rolling stock using **Route_Riter**.

DIESEL LOCOMOTIVES

For this tutorial we will be upgrading the MSTs SD402 locomotive from the official MSTs 1.2 upgrade.

UPGRADING THE COUPLER REGION:

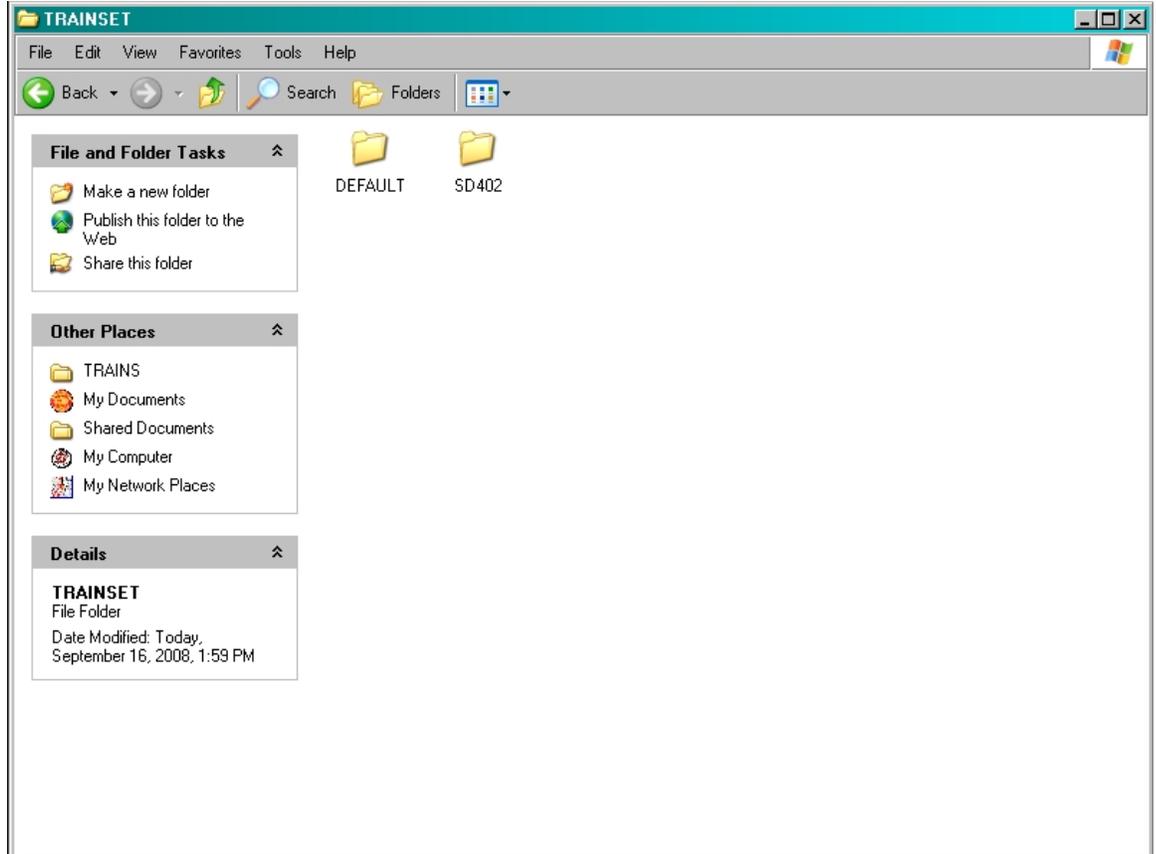


Figure 2

1. Copy and paste your **SD402** folder from your **"XTRAINSET"** folder to your new **"TRAINSET"** folder. It should now look like Figure 2.

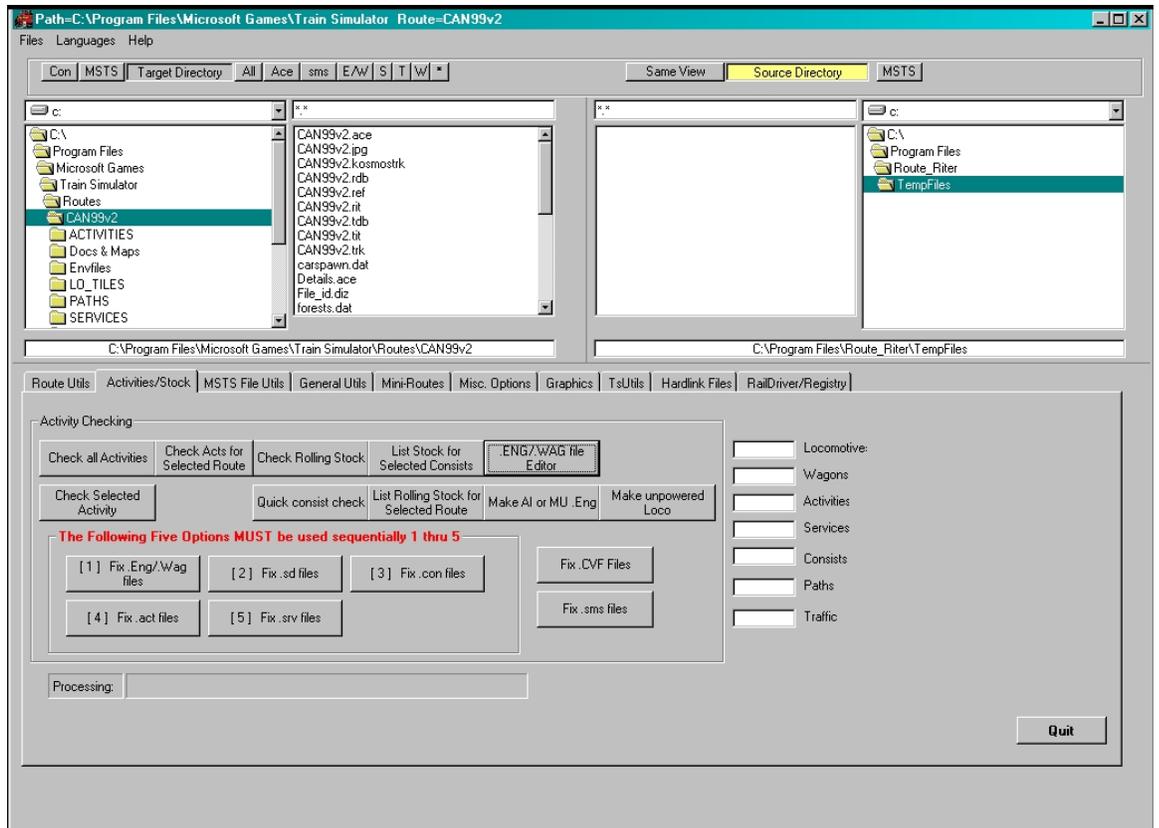


Figure 3

2. Open **Route_Riter** and left-click the "Activities/Stock" tab. The window in Figure 3 should be what you see.

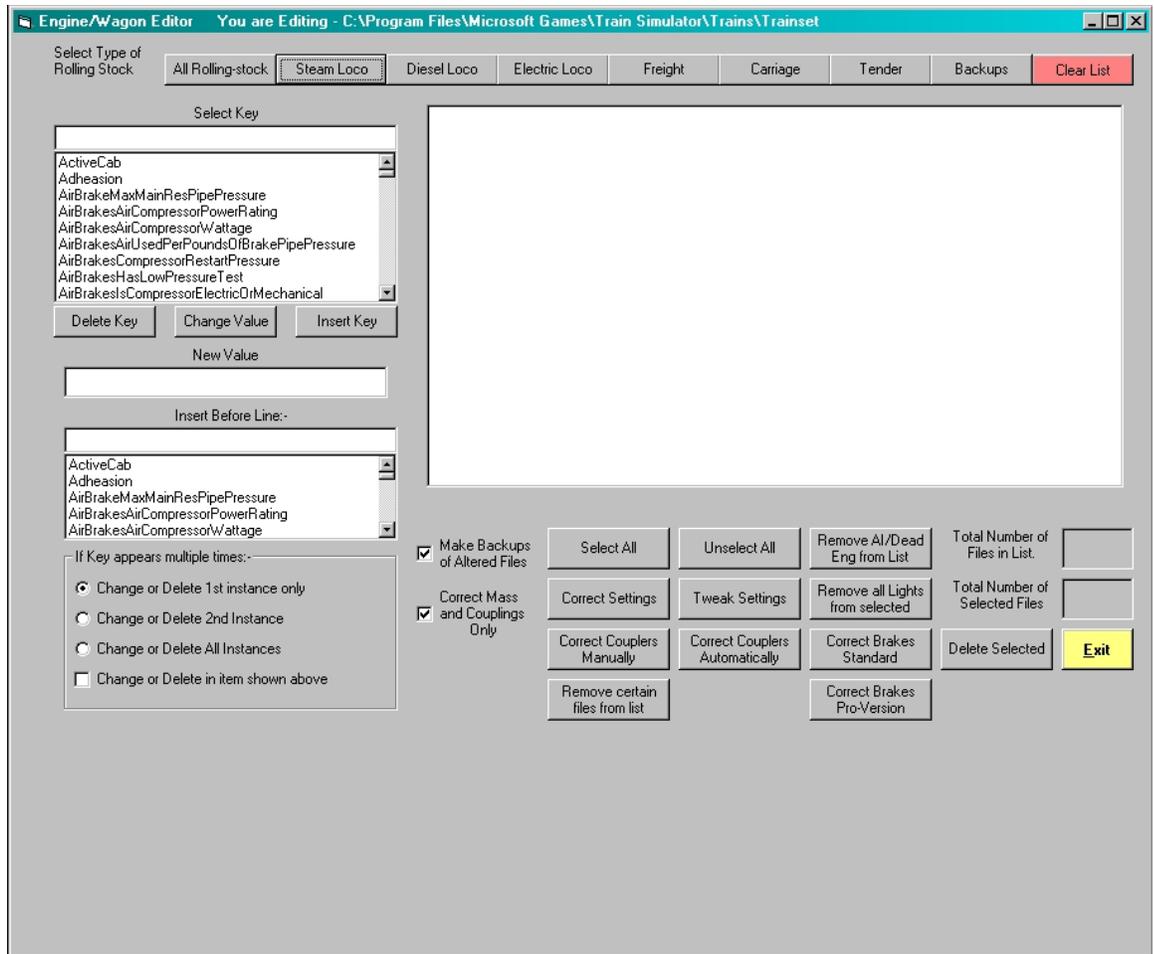


Figure 4

3. Left-click the "ENG/WAG file Editor" button. You should now see the editor as in Fig. 4.
4. Uncheck the "Correct Mass and Couplings Only" box by holding the mouse arrow over the box and left-click. If you don't want **Route_Riter** to create backups you can uncheck the "Make Backups of Altered Files" box.

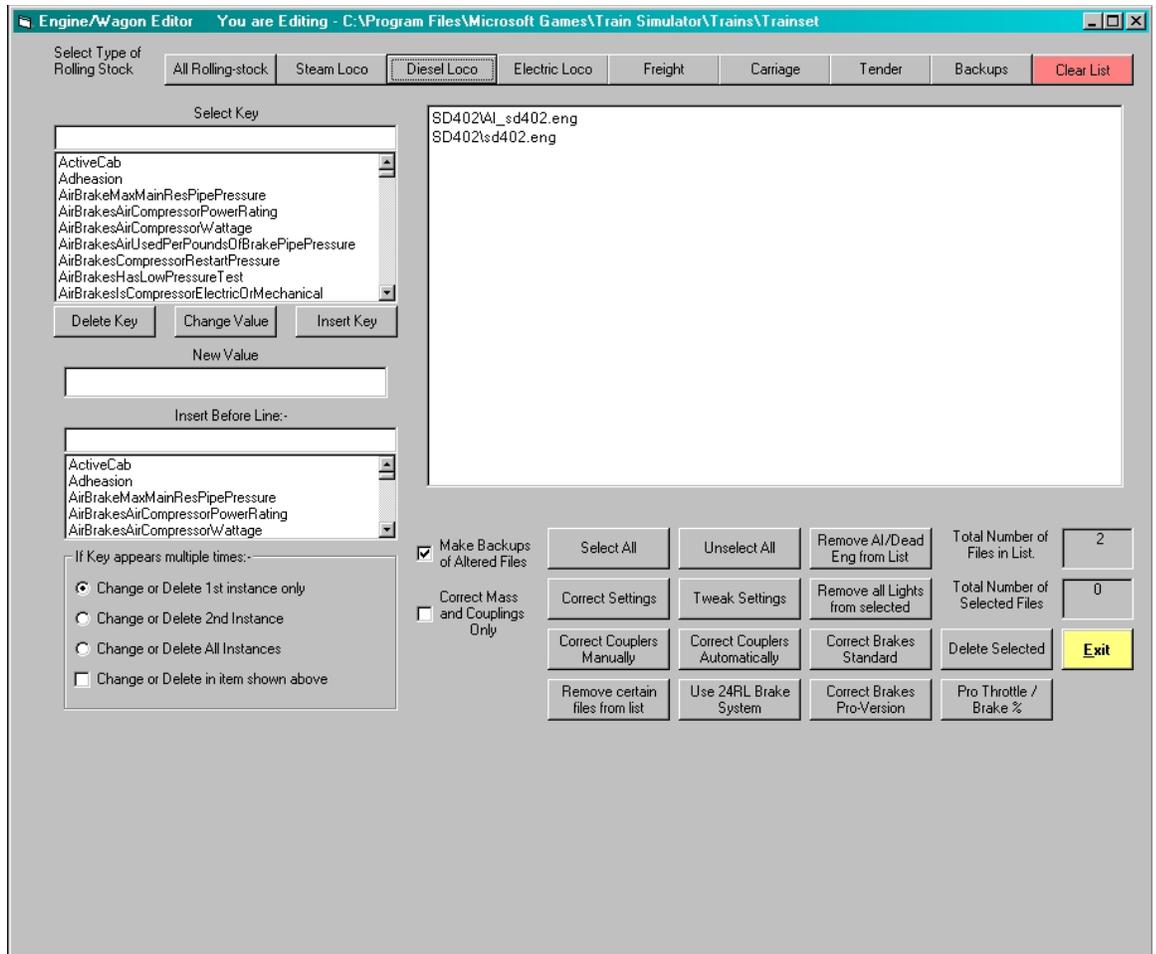


Figure 5

5. Left-click on the "Diesel Loco" Button. Your window should now look like Figure 5

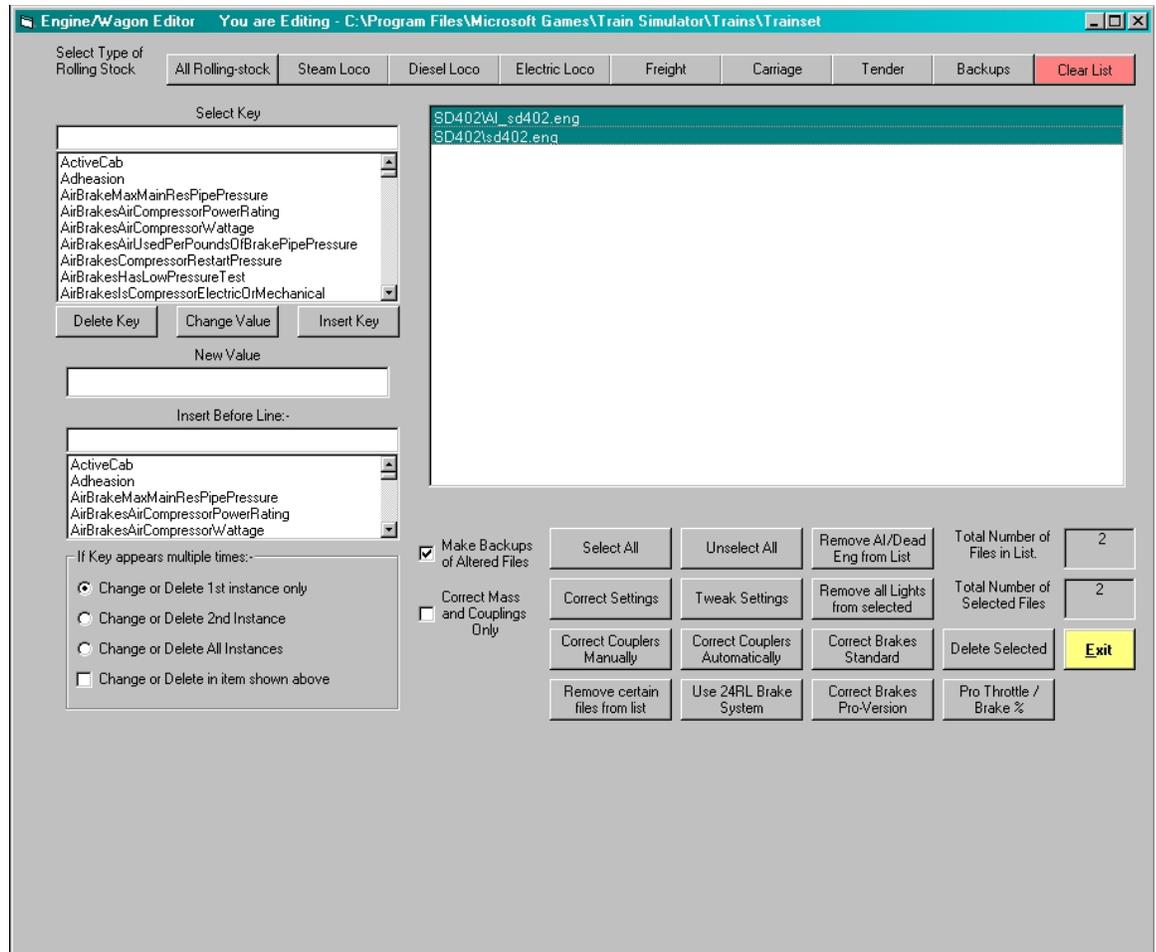


Figure 6

6. Now put your mouse arrow over the first item in the big box and left-click to highlight the file to modify. You can also left-click and hold the button down and drag your mouse down the screen to highlight all items you want to upgrade. You can also hi-light several files that are not successive on the list by holding the "Ctrl" button on your keyboard down and left-click all items you want to highlight or upgrade. Your window should look like Figure 6 after highlighting all eng. items in the main window.

7. Left-click the "Correct Couplers Manually" button. You will see a DerailBufferForce window open. Left-Click the "OK" button if the default 1000KN force is fine with you (you can also hit the "ENTER" button on your keyboard to move to the next step) or enter your own KN value and click "Enter".

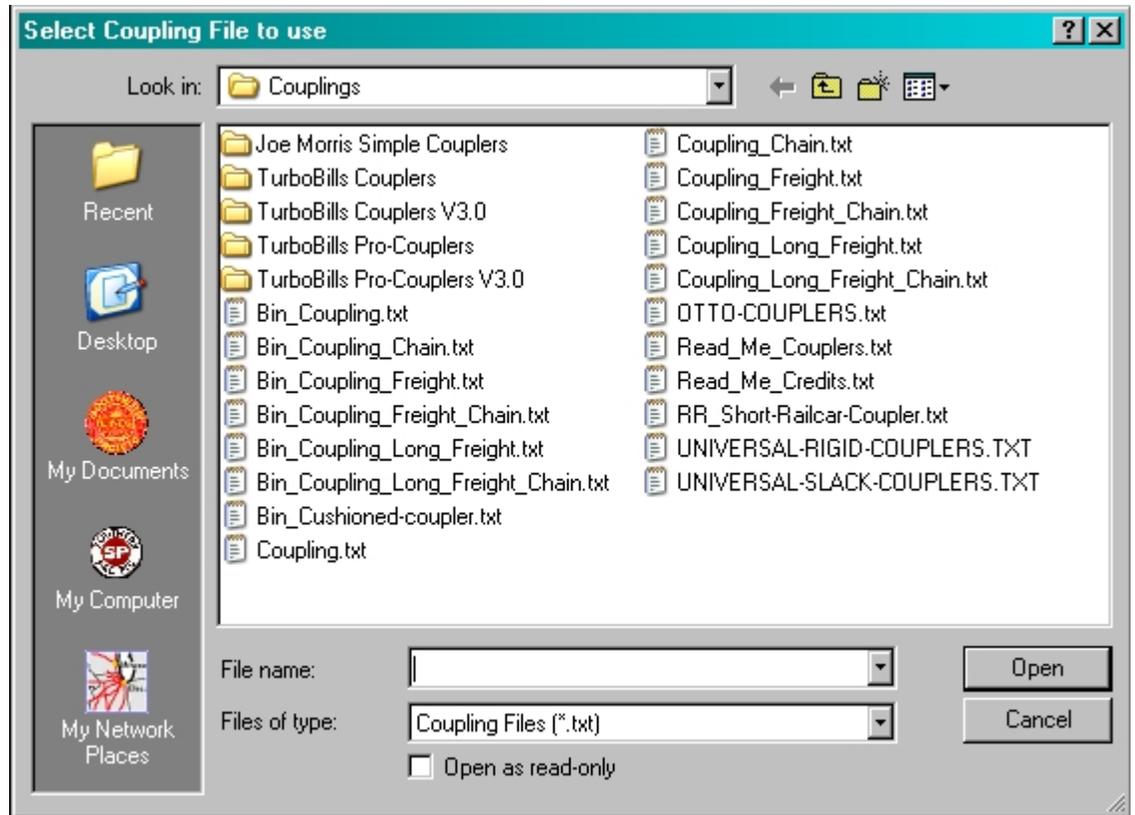


Figure 7

8. From the window shown in Figure 7, choose the coupler folder you want to apply to this item. In this case we will choose the "TurboBills_Pro-Couplers_V3.0" by double left-clicking on this folder.

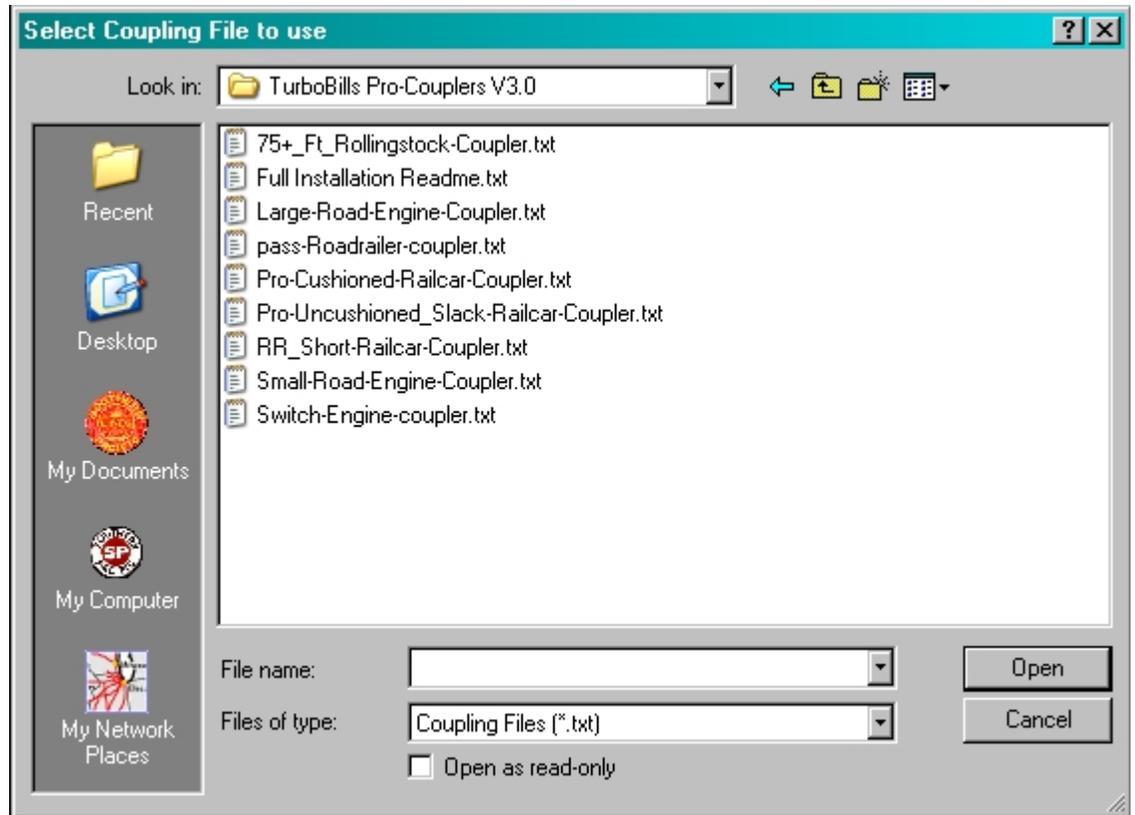


Figure 8

9. We will now double left-click on the "*Large-Road-Engine-Coupler.txt*" file as shown in Fig. 8. **Route_Riter** will now upgrade the items you have highlighted in the big window of the eng/wag file editor. **Route_Riter** will also automatically recalibrate your **.sd** file to dimensions that work best with the coupler chosen. It will also create a **.BAK** file so you can restore the original **.sd** file if you do not like the one **Route_Riter** created. The values will be recalculated to the nearest 1/100 value as MSTs does not like long decimal parameter values. The eng/wag editor will briefly display each item using the **shapeviewer** for a few seconds as it upgrades that item. This way you can go back and choose a different coupler if you not satisfied with the one you have chosen for that item after the process is completed for all items hi-lighted. When the process is completed you should see the window in Figure 9, below.

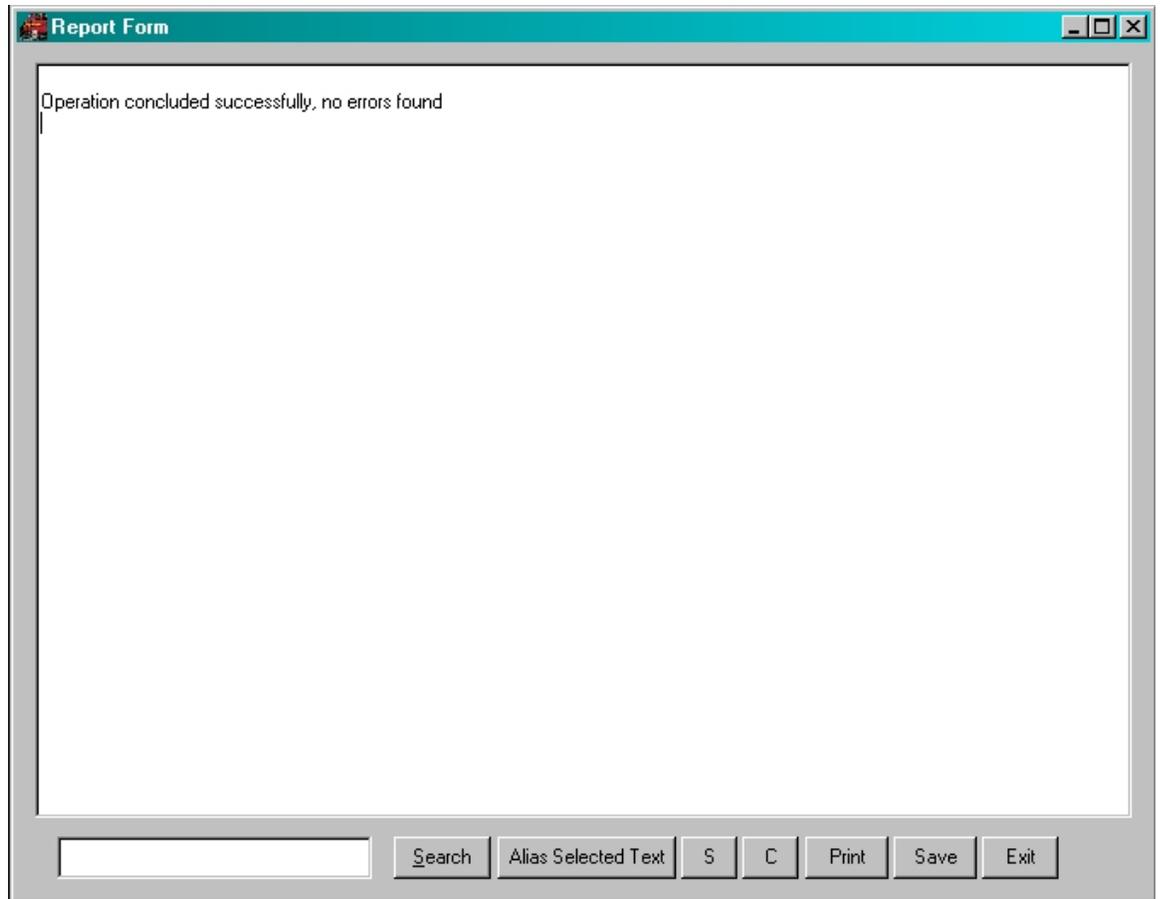


Figure 9

10 Your coupler region in the SD402 eng file should now look like Fig.10.

```

Wagon ( SD402
Type ( Engine )
WagonShape ( sd402.s )
Size ( 3.55m 4.79m 20.77m )
Mass ( 166.9t )

WheelRadius ( 20in )
InertiaTensor ( Box ( 3.55m 4.79m 20.17m ) )
Comment ( Use on all Diesel Engines from EMD SD-40 and GE Dash 6 six-axle and up in size )
Coupling (
Type ( Automatic )
Spring (
Stiffness ( 4e2N/m 6e6N/m )
Damping ( 5e6N/m/s 5e6N/m/s )
Break ( 5.1e7N 5.1e7N )
rO ( 12cm 15cm )
)
Velocity ( 0.2m/s )
)
Coupling (
Type ( Automatic )
Spring (
Stiffness ( 4e2N/m 6e6N/m )
Damping ( 5e6N/m/s 5e6N/m/s )
Break ( 5.1e7N 5.1e7N )
rO ( 12cm 15cm )
)
Velocity ( -0.2m/s )
)
Buffers (
Spring (
Stiffness ( 1e6N/m 5e6N/m )
Damping ( 1e6N/m/s 1e6N/m/s )
rO ( 0m 1e9 )
)
Centre ( 0.5 )
Radius ( 1 )
Angle ( 0.5deg )
)
Adhesion ( 0.2 0.4 2 0 )
DerailRailHeight ( 4cm )
DerailRailForce ( 45t )
DerailBufferForce ( 1000kN )
NumWheels ( 1 )
Friction (
100N/m/s 1 -1mph 0 1
5.1N/rad/s 1 -1rad/s 0 1
)
Comment ( Driving Engines Max Braking values by Bill Prieger. Additional
braking parameters contributed by Jean-Louis Chauvin. )

```

UPGRADING THE BRAKE REGION:

1. Highlight the eng files you wish to upgrade by holding your mouse arrow over the eng file item you wish to upgrade and left-clicking. You can also hold the left button down and drag your mouse down the list of items. You can also hold the "Ctrl" Button down on your keyboard and left click non-successive items that you want to upgrade the brake regions on.
2. Once you've highlighted the items you want to upgrade, left-click the "Correct Brakes Pro Version" button.

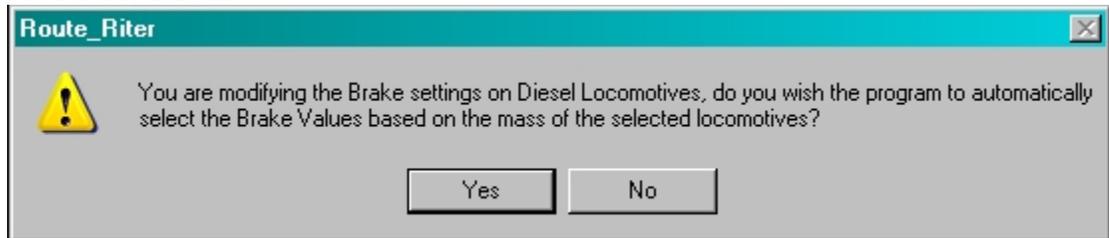


Figure A

3. A window will open as shown in Figure A. Left-click the "Yes" button.



Figure B

4. The editor will now display the window shown in the Figure B. You can choose either Cast Iron or Composition Brake shoes or also whether the equipment is outfitted with a Load Sensing Device. The bottom two options are for rolling stock upgrades, not engines. In this case we will stay with the editor's default settings in this window. Make sure you note or remember which brake shoe type you chose for the items you are upgrading. You can now click the "OK" button or hit "Enter" on your keyboard.



Figure C

5. The editor will now display the window shown in Figure C. This window is a safety feature making sure you are satisfied with the upgrade choice you have made for the items highlighted in the editor's item list window. If you are ready to make the upgrade to your items you can left-click the "Yes" Button or click "Enter" on your keyboard. The tool will now start upgrading your files. If you are not satisfied with any part of this upgrade process in case either the items highlighted are incorrect or if you chose the incorrect brake system or the wrong shoes for the items highlighted or whatever, you can left-click the "No" button and go through the selection process again.

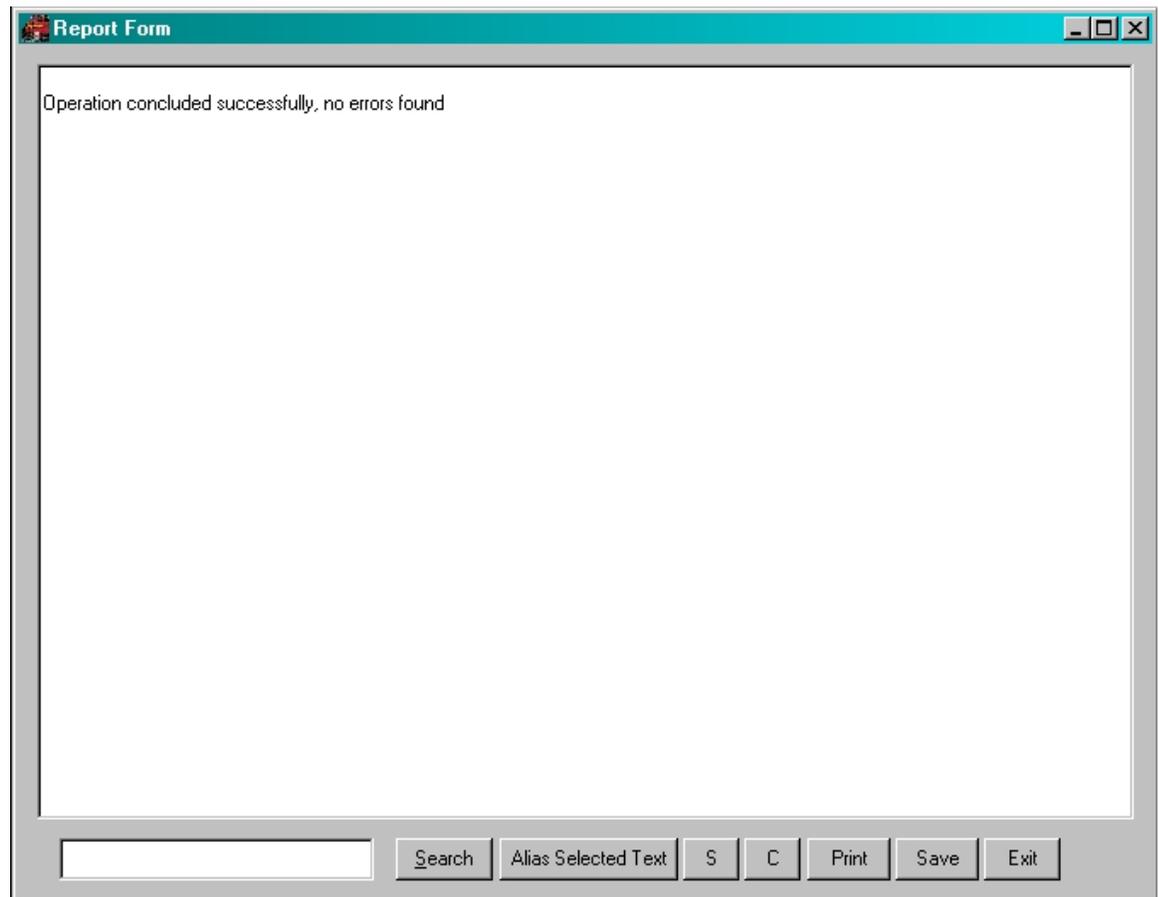


Figure D

6. Once the editor has completed upgrading the items hi-lighted in the editor's list window the window in Figure D will be shown. Left-click "Exit" to close this window. You have now completed upgrading your item/s brake region.

UPGRADING YOUR ENGINE_CONTROLLER/BRAKE-ENGINE REGIONS:

This upgrade is for locomotives only.

We will be adjusting your throttle notch percentages as well as adjusting the maximum engine brake cylinder pressure. Once this is completed you will notice in the SIM, that your throttle notches are not the same symmetrical values as before but are now rather non-symmetrical, which mirrors the throttle percentages of the Real World version of the item you are upgrading. If you use the **Raildriver**, then its throttle handle will no longer throttle up and down the nice neat way it has until now. You will now need to watch the F5 display as you throttle up and down to verify the run position you desire. It does not take long to get used to this method.

In addition to the above changes, the F5 value for your engine brake percentage will no longer go to 100% since the handle will now top out at the maximum adjusted brake cylinder pressure value. The little white box at the bottom of your screen will show a maximum of 100% though. If you do not want to adjust these values in your items in the eng file then you have completed upgrading your eng files at this point. You can go directly to step **X** and move on to the next items you want to upgrade. You could also quit if you're finished with your upgrading session. However, if you choose to go all the way for complete prototypical simulator performance then follow the steps listed below.

1. Highlight the items in the editor's list window that you want to upgrade.

NOTE: Only upgrade player drivable items. Do not upgrade AI or Trailing units. To highlight the player eng files only if you have more than one in the list window, hold down the "CTRL" button on your keyboard and left-click the mouse button only on the items you wish to upgrade. In this case, we mean only the player drivable eng files. Also you should only upgrade eng files of the same model or locomotives outfitted with the same installed Prime Mover diesel engine.

To find out which prime mover your engine is equipped with, open your web browser to the website listed below:

http://en.wikipedia.org/wiki/Category:Locomotives_by_builder

- A. Now chose "*EMD Locomotives (1)*".
- B. Find "*EMD SD40-2*" model in the model listings and click on it.
- C. You will see a brief write-up of the locomotive's history, when it was built, who bought it and most importantly the prime-mover the engine was originally fitted with. Further down in the text we find that the SD40-2 was outfitted with both Turbocharged and non-turbocharged 16 cylinder 645 prime-movers.

You will be able to select which prime mover your locomotive contains later in this process. Hopefully, there will be a photo of the item you are upgrading. If there is a photo available then you can *left-click* on the picture to create a larger image. You will be looking to see if the locomotive has cast iron brake shoes or composition brake shoes. On three axle units up to SD45's, see if there is a brake cylinder for each wheel.

If this is the case, then the locomotive has the cast iron shoes originally equipped on that unit. If there are only one or two brake cylinders, then the unit is equipped with a composition shoe. In most of the photos available, you can quite clearly see this by looking at the wheels.

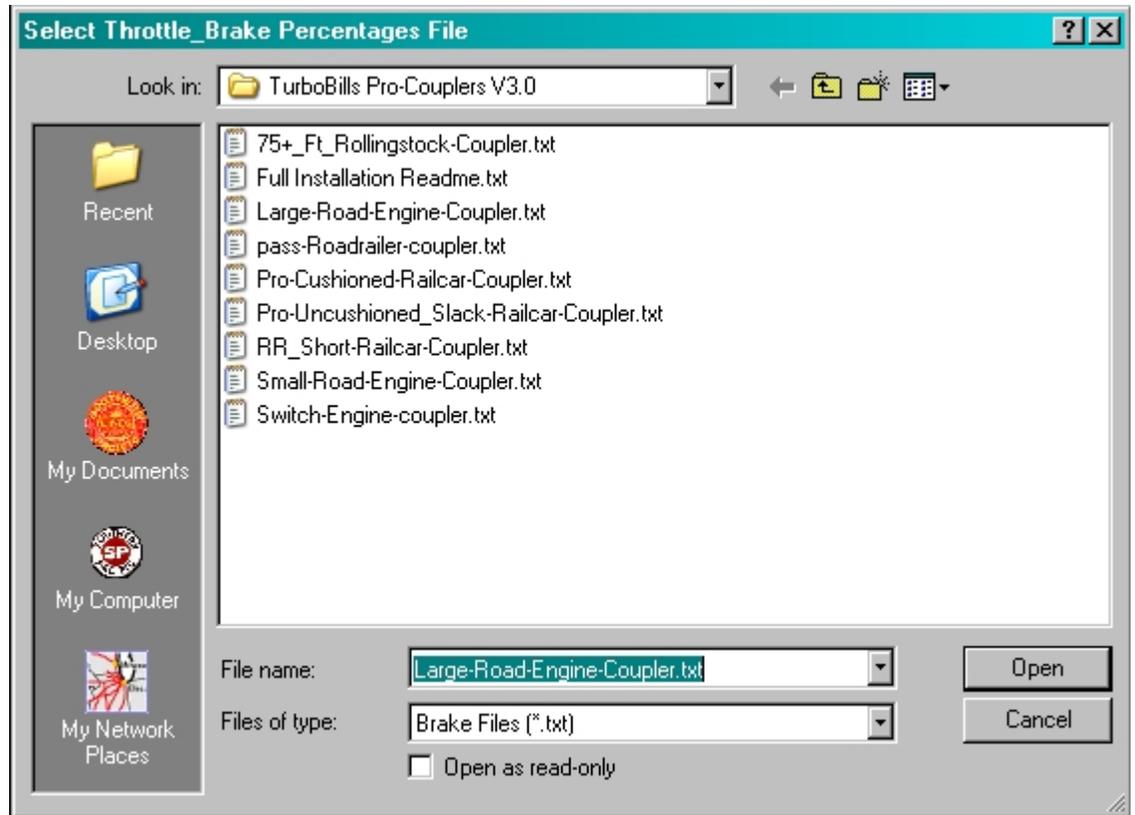


Figure 101

2. Now left-click on the "Pro throttle/Brake %" button. You will notice that the new window still shows the coupler files. See Figure 101.

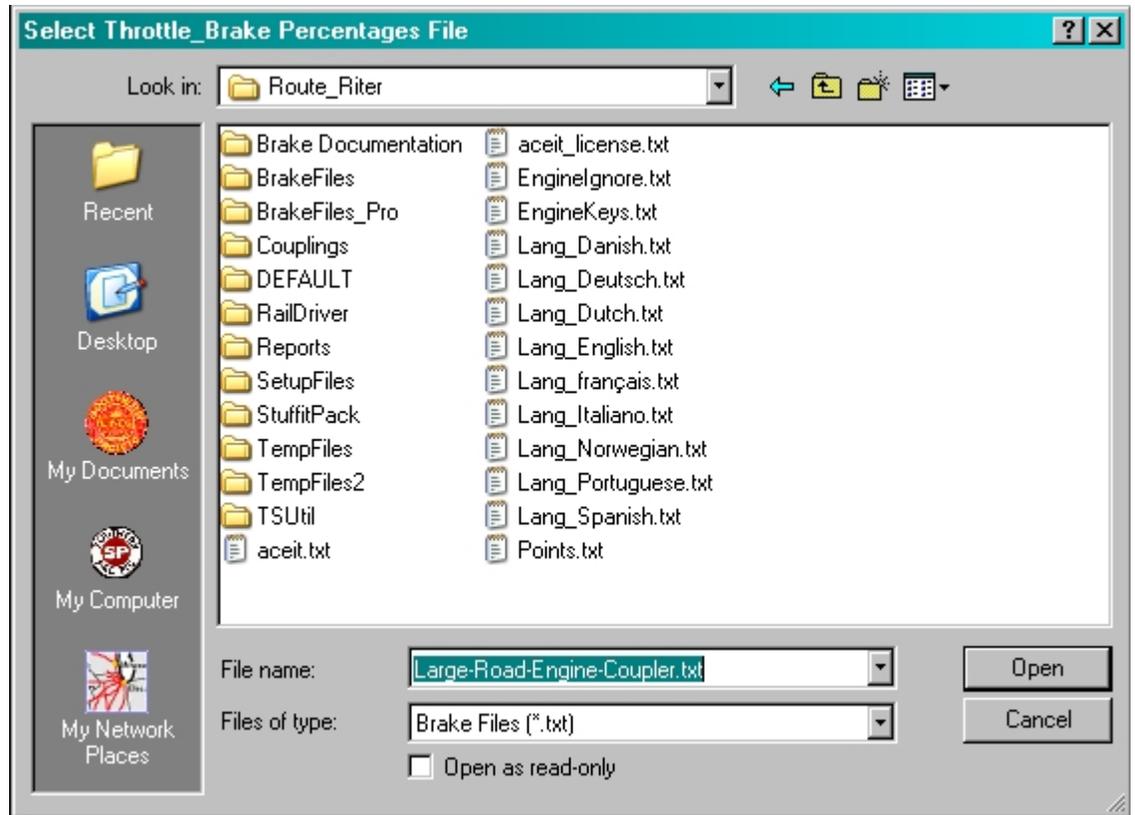


Figure 102

3. Left click on the little folder with the "up" arrow in it near the top of the Figure 101 window to navigate back to the window shown in Figure 102.
4. Now double left-click on the "**BrakeFiles_Pro**" folder. You will now see the window in Fig. 103. (Note: figure missing)

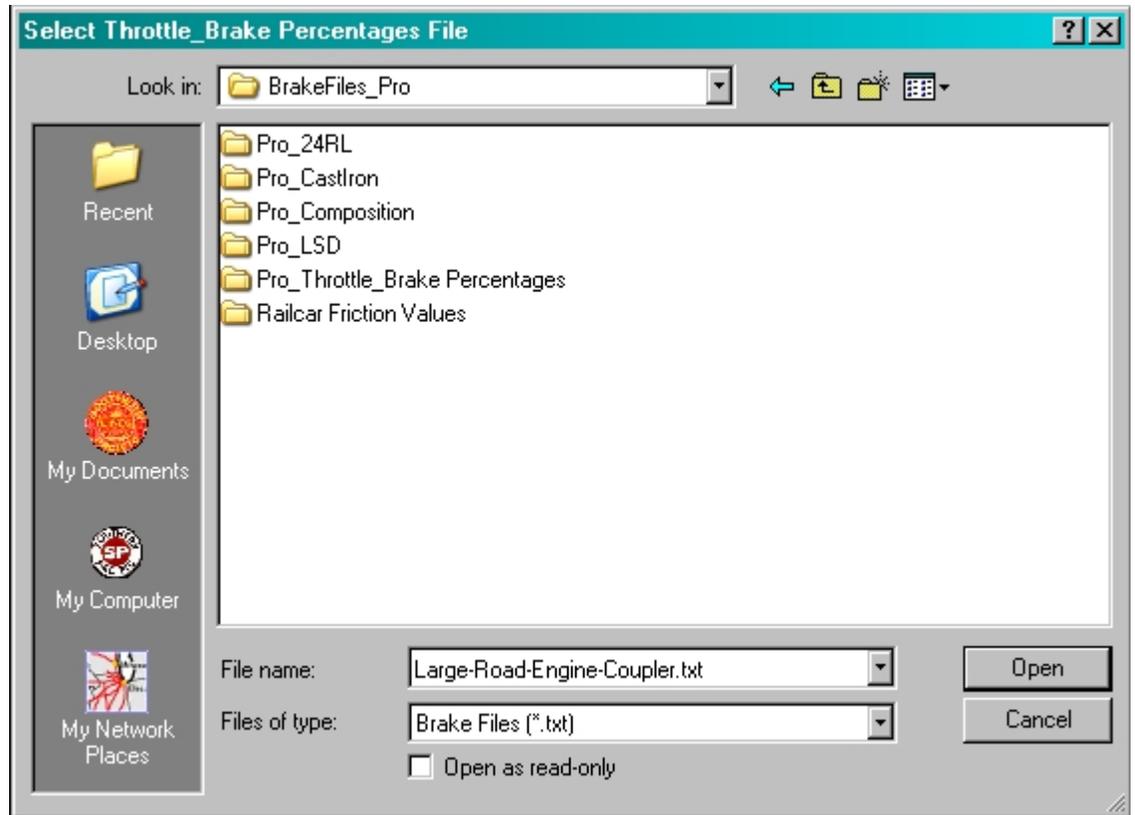


Figure 104

5. In the new window (Fig. 104), we will choose the ***"Pro_Throttle_Brake Percentages"*** by double left-clicking on that folder icon.

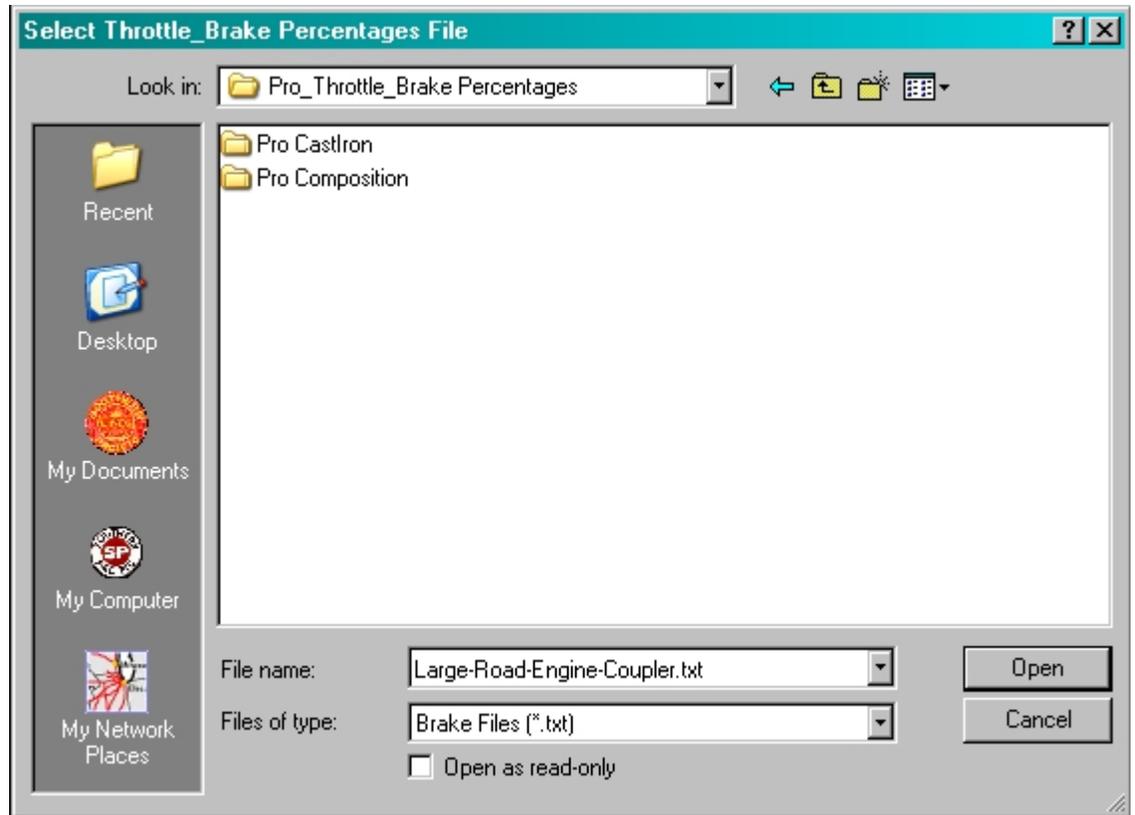


Figure 105

6. Since we determined that this engine came fitted with Composition Brake shoes from the photo's we studied on the website, we will now double left-click the **"Pro Composition"** folder in Figure 105.

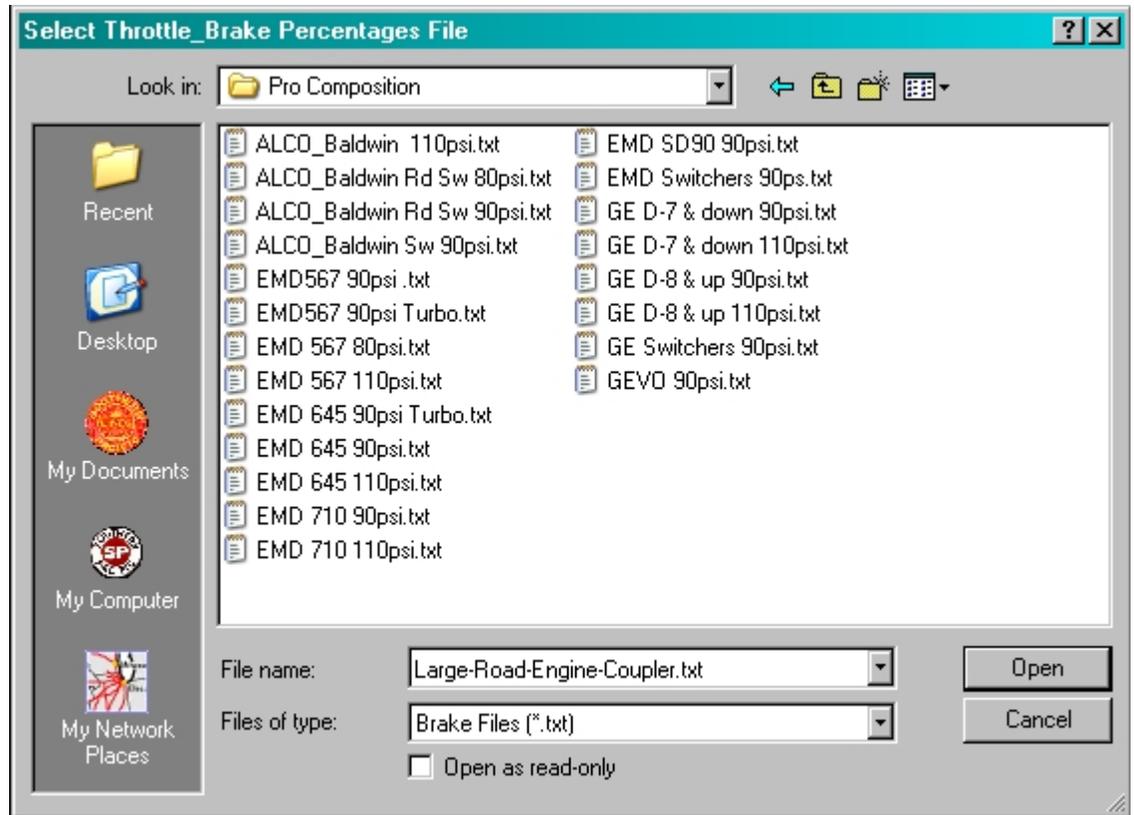


Figure 106

7. You should now see a new window as shown in Figure 106 with an array of locomotives to choose from. As per our trip to the Internet, we found out that the SD40-2 came with a 645 prime mover so we have the choice of Turbocharged and non-turbocharged. In this case we will equip our **eng** file with the "EMD645 90psi Turbo.txt" option. To determine the correct psi file to choose from, open your eng file for the item you are upgrading and seek out the line in Figure 106. By doing this we can see that our engine uses a 90psi train brake pressure. Now go back to our editor in **Route_Riter** and double left-click the "EMD 645 90psi Turbo.txt" file.

8. If you are sure you have chosen the correct file for the item you are updating click the "Yes" button or press the "Enter" Button on your keyboard and the editor will upgrade the files you have highlighted.

9. When you see the "Report Form" window, you have successfully completed the upgrade of your locomotive to the "Pro" series standards. To verify that the upgrades have been made open the **eng** file, use a Unicode editor program such as **Context** and look for the three regions you have just upgraded. There should be a new "Comment" at the beginning of each of the sections you upgraded describing the new upgrade you have done. Once you are sure the upgrades have been successfully completed, move the items folder from the present "**TRAINSET**" folder to the "Done" folder and move onto the next folder you want to upgrade. Continue doing this until you have upgraded all the locomotives you want to upgrade that are still in the "**XTRAINSET**" folder. When you have completed all the locomotive folders that you want to upgrade, copy all the locomotive folders from the "Done" folder to your "**XTRAINSET**" folder and chose the overwrite option when displayed. If you are done editing, then rename your present

"TRAINSET" Folder to **"ATRAINSET"** and remove the **"X"** from the front of your original **TRAINSET** folder so your SIM will function correctly. I hope enjoy the new experience your locomotive/ have to offer you.

UPGRADING ROLLINGSTOCK

There are three functions or regions that we will be upgrading in our rolling stock **wag** files. Follow the procedure laid out in our **"GETTING STARTED"** portion of this Tutorial or if you are still set up correctly to perform upgrades we can move on.

1. For this set of upgrades we will use the **"US2FREIGHTREFRIGE"** folder as our project. So copy and paste that folder in the **"TRAINSET"** folder we use to upgrade our eng/wag files. Make sure the **"DEFAULT"** folder is still in the editing **"TRAINSET"** folder as it was for the engines we upgraded.

2. If you are not still in the **eng/wag** file editor portion of **Route_Riter** then open the utility and navigate to the **eng/wag** file editor as we did in the **"DIESEL LOCOMOTIVES"** section of this Tutorial. If you have not done this process yet then scroll up to the **"DIESEL LOCOMOTIVES"** section and read the instructions for navigating to the **eng/wag** file editor. Once there, uncheck the **"Correct Mass and Couplings Only"** and the option above it as well if you do not want backups created of the files you are upgrading.

3. Now left-click on the **"Freight"** button above the large list window and the editor will list all the wag files in the **"TRAINSET"** folder.

4. Now left-click on the **"Select All"** button and left-click on the **"Correct Couplers Manually"** button.

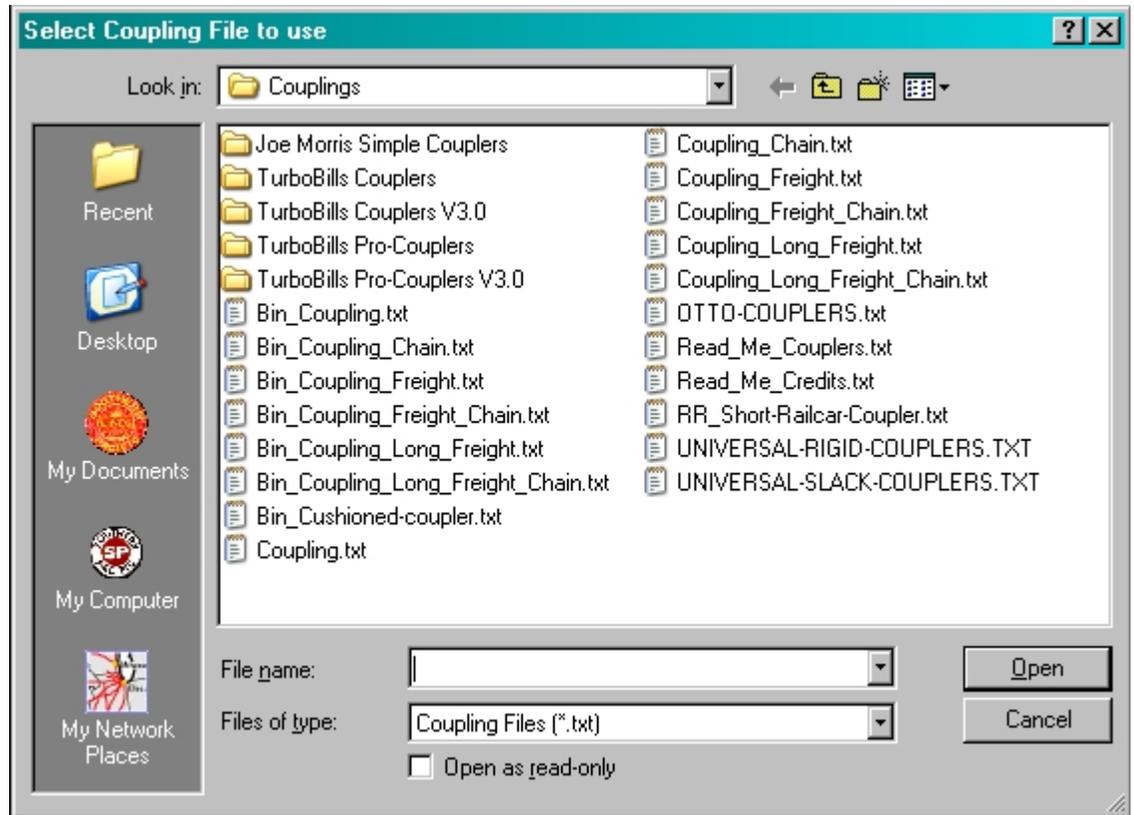


Figure 201

5. You should see the window as shown in Figure 201 (if you are continuing on from our Locomotive upgrade session then you may need to navigate back to the window shown in Fig. 201 using the folder with the "up" arrow button at the top of this window). Now double left-click the **"TurboBills Pro-Couplers V3.0"** folder option.

Here's the quick breakdown on which couplers belong to which rolling stock.

75+ _Ft_Rollingstock-Coupler.txt

-This coupler is used on all excessive length rolling stock over 75 feet in length, Examples: Autoracks, TOFC railcar flats, 85 ft Boxcars, etc.

Pass-Roadrailer-coupler.txt

-Passenger cars and road-railer equipment

Pro-Cushioned-Railcar-Coupler.txt

-used on all modern 50ft Boxcars, Bulkhead Flatcars, and Center-beam Flatcars.

Pro-Uncushioned_Slack-Railcar-Coupler.txt

-used on all rolling stock not listed in the Pro-Cushioned Coupler listings.

RR_Short-Railcar-Coupler

-The editor will automatically use this coupler on all cars under 39ft in length if the option is chosen to do so.

6. Double-left-click the **"Pro-Uncushioned_Slack-Railcar-coupler.txt"** file since this is the correct coupler for the rolling stock we are upgrading in this Tutorial.

7. The next window asks if you want the editor to automatically insert the short car coupler on wagons less 39ft in length. Always chose the "Yes" button. Upon doing so the editor will begin upgrading the coupler section of the highlighted **wag** files and you will know when it is finished because the Report Window appears. Click the "Exit" button to move on to the next step.

8. Now click the "Select All" button to hi-light all the wag files in the listings window then left-click the "Correct Brakes Pro Version" button.

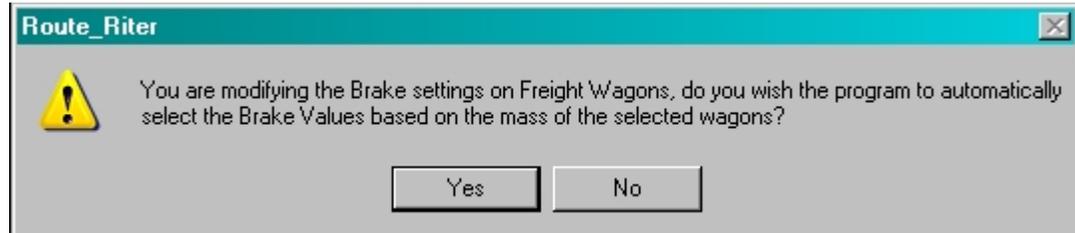


Figure 202

9. You will now see the window as shown in Figure 202. Select the "Yes" button and the editor will automatically insert the correct *maxbrakeforce* file for the weight of the wagons you are upgrading. The only time to chose the "No" button is when you do Intermodal rolling stock when you can manually choose the appropriate **IM txt** file in the **Pro-Brake Files** folder.

10. You now select the brake composition. In this case we will choose the default "Composition" with the "LSD Not Fitted" option already checked. You can either click the "OK" button or press the "Enter" button on your keyboard.

11. Again click the "Yes" button, or press the "Enter" Button on your keyboard, if you are satisfied with your choices so far. The editor will begin upgrading the items you have highlighted in the lists window of the editor.

12. (optional) Entering the correct friction values as calculated using Joe Realmuto's **F_Calc** calculator. To proceed, hold the "Ctrl" Button down on your keyboard and left click all the loaded files in the editor's list window. You can only do all loaded or all unloaded **wag** files or you will end up with incorrect friction values in the resulting **wag** files. Also if doing multiple wagon folders and **wag** files, only upgrade wagons of the same type since you need to be specific about the friction values you want on your selected wagons.

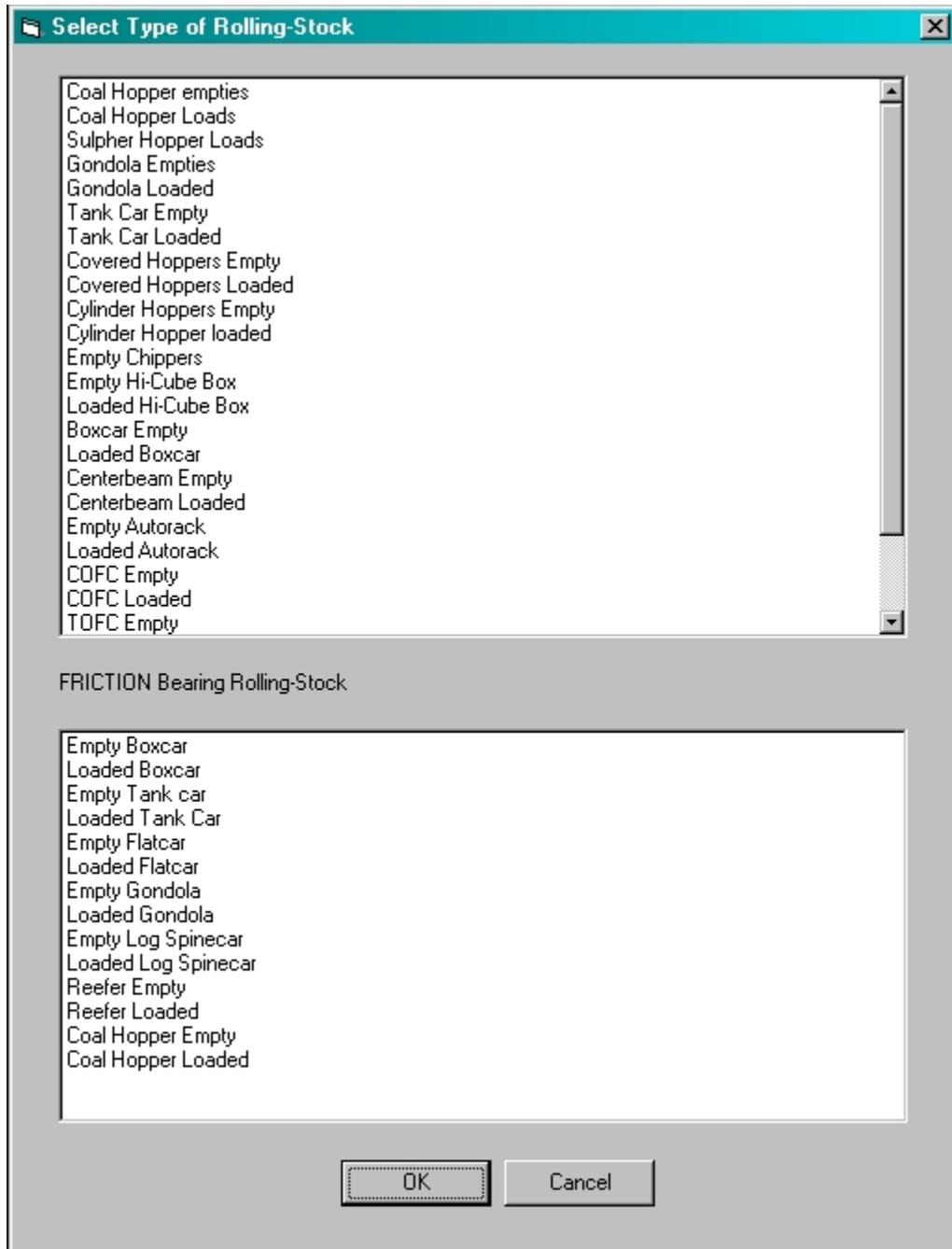


Figure 203

13. Once you have all the items highlighted, left-click the "Update Friction" Button and you will see a new window as shown in Figure 203. As you can see I have already calculated the Friction values for several pieces of rolling stock including Friction Bearing Equipped rolling stock.

Find and left-click the "Loaded Boxcar" option and press the OK button. Choose the "Yes" button, or press the "Enter" button on your keyboard, in the next window if you are satisfied with the **wag** files highlighted and the Friction values option you have chosen for them. The editor will now automatically upgrade the friction values in the wagons you

have highlighted. The *"Report Form"* window will display when the editor has completed the upgrade.

12. Repeat step 13 to do all the empty wagons in the editor's list window. I always do loaded wagons first then the empties so I know what is upgraded and what still needs upgrading.

14. If you want, you can open the **wag** files you have upgraded using a Unicode editor such as Context and look at the *Coupler*, *Brakes* and *Friction* regions of the files. There should now be new *"Comment"* lines at the beginning of each region describing the options you have chosen for each region.

Now move your completed wagon folders that are in your *"TRAINSET"* folder to your *"XTRAINSET"* folder and instruct Windows to allow the files to be overwritten.

I do hope you enjoy the new level of realism the SIM will exhibit with your new **"Pro Series"** equipped rolling stock!!!

May all you signals be green and your roll-by's black.

BILL PRIEGER AKA TURBO BILL