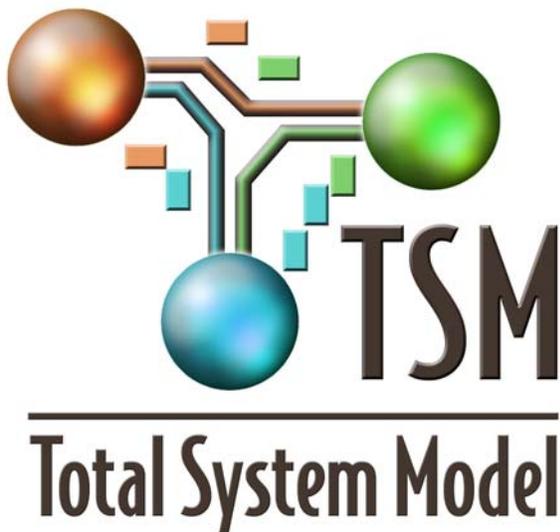




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Total System Model Version 6.0 Transportation Validation Report



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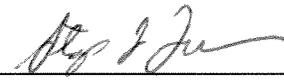
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ACRONYMS AND ABBREVIATIONS

BSC	Bechtel SAIC Company, LLC
BWR	Boiling Water Reactor
CALVIN	CRWMS Analysis and Logistics Visually Interactive Model
CaS	Create-a-Soft™
CRCF	Canister Receipt Closure Facility
CRWMS	Civilian Radioactive Waste Management System
CSNF	Commercial Spent Nuclear Fuel
DOE	U.S. Department of Energy
DPC	Dual-Purpose Canister
FEIS	Final Environmental Impact Statement
FHF	Fuel Handling Facility
FMF	Fleet Management Facility
GROA	Geologic Repository Operations Area
GUI	Graphical User Interface
HH	Heavy Haul
IS	Initial State
LWT	Legal Weight Truck
MGR	Monitored Geologic Repository
mph	Miles per hour
MTHM	Metric Tons of Heavy Metal
OCRWM	Office of Civilian Radioactive Waste Management (DOE)
ONT	Office of National Transportation
OV	Overpack
PWR	Pressurized Water Reactor
Q	Queue or queue wait time
RF	Receipt Facility
SP	Single Purpose
TAD	Transportation, Aging, and Disposal
TCRRF	Transportation Cask Receipt and Return Facility
TSLCC	Total System Life Cycle Cost

ACRONYMS AND ABBREVIATIONS (CONTINUED)

TSM	Total System Model
TSRG	Transportation Shipment Report Generator
VAT	Value Added Time
WAST	Waste Acceptance, Storage, and Transportation
WHF	Wet Handling Facility
WNP	Waiting for Next Process time

1. OBJECTIVE AND INTRODUCTION

The objectives of this report are to document the development of data and assumptions used in developing the transportation modules of the Total System Model (TSM) and to demonstrate that transportation and transportation timing work correctly. This validation supports the Transportation Design and Basis Report (BSC 2007a) and is issued with Version 6.0 of the TSM.

This report is largely based on the analysis approach and content in the transportation calculation provided for TSM Version 4.0 (BSC 2006a). Much of the information in that report is repeated here to provide all transportation details in a single document. Repeating the analyses made for Version 4.0 should detect any inadvertent impacts from TSM revisions and updates. These analyses were not repeated to issue TSM Version 5.0 because other checks were deemed adequate. However, it is prudent to do a complete and comprehensive check every few versions to prevent long-term propagation of any problems not detected by a cursory check.

This validation in conjunction with reference BSC 2007a describes the development, calculations, references, and assumptions for connector distances, conveyance speeds, and connector time steps used in the TSM Version 6.0 transportation module. Both rail routes and routes for legal weight trucks (LWT) are discussed. Refer to *Total System Model Version 6.0 Transportation Design and Bases* (BSC 2007a) and *User Manual for the Total System Model Version 6.0* (BSC 2007b) for higher level information on the transportation module in the TSM. Also see the figures in Appendix A for the transportation elements represented by TSM processes and connections.

The attachments and appendices in this validation also provide lists of other TSM settings and values that are too detailed to include in the higher level manuals.

This validation also addresses the time that a cask is being used by various processes in the TSM also called “cask transit time.” Cask transit time is the total time that a cask spends in transit and is a key driver to estimate the size of the casks fleet required for the simulation. For example, for simulations or cases with unlimited casks, longer turn-around times at the waste sites, the Geologic Repository Operations Area (GROA), or other places may cause a shortage of casks and will require a subsequent cask purchase to ensure the wastes are accepted and shipped when demanded by the Initial State (IS) file start time input. Long turn around times can cause very large cask fleets (>1,000 in cases without bounding assumptions).

The transit time discussed in this validation impacts the Waste Acceptance, Storage, and Transportation (WAST) costs estimated by the TSM as described in *Total System Model Version 6.0 Cost Estimating Routines* (BSC 2007c). For example, the time for transportation from the waste site to the GROA is the basis for the time the security resources are used and this is the key factor to estimate security costs. Other data for barge, heavy haul (HH) use, and state line crossings on this validation are direct inputs to the cost algorithms in BSC 2007c.

This validation also compares the TSM Version 4.0 cask transit time results to the TSM Version 6.0 results and interim versions. Cask transit times are a good way to check for inadvertent impacts from TSM or SimCAD™ updates and revisions.

This report also validates a post-run report generator called the TSM Transportation Shipment Report Generator (TSRG), see Appendix H.

This validation assumes the reader has a basic knowledge of the TSM functionality and conventions. See the *User Manual for the Total System Model Version 6.0* (BSC 2007b) for more information and an overview of the TSM. TSM uses the SimCAD™ process simulation software developed by Create-a-Soft™ (CaS). More information on SimCAD™ conventions is in reference CaS 2006.

This validation also assumes the reader has a working knowledge of the transportation elements of the Office of Civilian Radioactive Waste Management (OCRWM) transportation system and the *Total System Model Version 6.0 Transportation Design and Bases* (BSC 2007a).

This validation was performed in accordance with AP-ENG-006, *Total System Model (TSM) - Changes to Configuration Items and Base Case*.

1.1. CHANGES FOR VERSION 6.0

The Section 6.0, “Observations” in the TSM Version 4.0 transportation calculation (BSC 2006a) recommended some refinements in the transportation elements. Other changes to transportation elements were made during the development of TSM Version 6.0 to improve fidelity.

- Changes to TSM Version 6.0 connectors and timings are:
 1. Moved the connector for Beaver Valley to route via Columbiana vs. Youngstown,
 2. Moved the connector from Indian Point to route via Schenectady and changed the connector to 1 time unit,
 3. Changed time on the connector from Barstow to NVR to 1 from 0 time steps,
 4. Changed time on the connector from Fort Calhoun to Blair from 0 time units to 1 time unit to allow for counting 1 state line crossing,
 5. Changed time on the connector from Diablo Canyon to Barstow by changing distance to 1,906,080 feet from 1,087,680 feet,
 6. Changed timing on the connector from Kewanee to Blair by changing distance to 3,711,840 feet from 2,845,920 feet.
- Changes for Humboldt Bay were also needed in the analysis of the timings in Appendix B because a number was transposed (270 versus 207). The TSM Version 4.0 calculations also recommended changes to Palisades and Point Beach routes but on further review no changes were needed.
- The route for the rail cask return from the GROA was modified to skip the “Basket Return” return process and its downstream connector to reduce the travel time of the casks from the GROA to the Fleet Management Facility (FMF) and improve fidelity with the anticipated route since there is actually no separate basket return.

- Several of the GROA processes along the cask return processes are no longer required in the updated GROA design. This reduces the time for the cask to be returned from the GROA.

The above changes were made prior to performing the timing tests in this validation and the potential impacts were considered in the evaluation of the timing tests.

1.2. CHANGES TO TSM VERSION 6.0 AFTER VALIDATION

The following refinements and changes were made after the runs for this validation were completed. These changes have minor effects on the overall cycle time, which are assessed in the validation for the integrated TSM Version 6.0, see Reference BSC 2007d.

- The process connection from the Truck Cask 1 distribution was revised from 1 to 5 time steps. This provides a more reasonable time to transport the empty cask to the waste site for loading and shipment. This does not impact the validation.
- The timings for the Humboldt Bay barge route connectors were changed from 8 time steps to 7 time steps. This has no impact on the validation but is a refinement to reflect the analysis in Appendix B as discussed above.
- The timings in the GROA were adjusted to improve fidelity with the design. This does not have a major impact on the detailed process times but impacts the overall simulation times. For example, improving truck cask processing logistics at the GROA can increase the throughput and reduce delays (and therefore Q wait times) for shipping the truck cask loads.
- There were several changes to the names of processes in the routes used for the cask transit time checks. These do not impact the validation and notes are added to the results tables to indicate the final name used in the released TSM Version 6.0.

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2. METHOD

This section describes the methods to develop, quantify, and validate the transportation elements of the TSM. The bases for the transportation and supporting data are also included to provide context for the discussion. The supporting data are inputs to the TSM and are included in this validation since the input information is too detailed for higher level TSM manuals such as BSC 2007a and BSC 2007b.

The acceptance criteria is that any differences in the results must be within the typical range of simulation variations in TSM simulations based on the judgment of the report preparer and checker and that any major differences be explained. Also, the acceptance for the fidelity check is that transportation routes are drawn as intended and the transit times are as expected within the variations in TSM simulations and given the 8-hour time step resolution.

2.1. TRANSPORTATION ROUTES AND PARAMETERS

The transportation routes were drawn in SimCAD™ using Figures 6-11 and 6-12 of the Yucca Mountain Final Environmental Impact Statement (FEIS, DOE 2002) as guidance. The U.S. was divided into five sections (i.e., Northwest, Southwest, Midwest, Southeast, and Northeast). Note that changes in site transportation mode for two sites (Beaver Valley and Humboldt Bay) required identification of two initial transportation routes that are not described in the FEIS. In these cases, new routes were identified to a rail access point as described in the emails to S. Turner from R. Best listed in the electronic attachments in Section 8.

For TSM Version 4.0, commercial waste site data was reviewed in discussions held between Bechtel SAIC Company, LLC (BSC), RW-20, and the DOE Office of National Transportation (ONT) in January 2005 (Gillespie, S. 2005). This data included the mode of transportation preferred such as LWT or rail and including needs for barge and HH assistance. These data and inputs have been retained for TSM Version 6.0.

2.2. TRANSPORTATION DISTANCES

This section discusses the origin of the transportation distances used in the TSM and in Appendices B-D.

2.2.1. Rail Distances

Distances for the rail connectors (node-to-node) on the TSM maps are from INTERLINE data files used by DOE for the FEIS and listed in the electronic file attachments listed in Section 8. The files include ec_n15.prn, ec_n15b.prn, FW Route Questions.txt, RE Route Questions.txt, and FW Humboldt Bay and Beaver Valley Intermodal.txt. NOTE: Throughout the EXCEL workbooks used for this validation data from the databases are designated as “Source” values.

2.2.2. LWT Distances

Distances for truck connectors (node-to-node) on the TSM maps are from HIGHWAY data file used by BSC for the FEIS and listed as file belt_1.prn in the electronic attachments in Section 8.

2.2.3. Barge Distances

Distances for barge connectors (barge site to rail site) on the TSM maps are from INTERLINE data files used by BSC for the FEIS and listed in the electronic attachments in Section 8. The files include ec_n15.prn, ec_n15b.prn, FW Route Questions.txt, and RE Route Questions.txt. These values were used with barge speeds to establish the transit times used in the TSM and as the basis for the barge activities that provide the basis for the cost estimates as discussed in Reference BSC 2007c.

2.2.4. HH Distances

Distances for HH connectors (HH site to rail site) on the TSM maps are from INTERLINE data file used by BSC for the FEIS and listed as file belt_1.prn in the electronic attachments in Section 8. These values were used with HH speeds to establish the transit times used in the TSM and as the basis for the HH activities that provide the basis for the cost estimates as discussed in Reference BSC 2007c.

2.3. CONVEYANCE SPEEDS

This section discusses the origin of the conveyance speeds used in the TSM and used for validations in Appendices B-E, and G.

2.3.1. Rail Speeds

The Civilian Radioactive Waste Management System (CRWMS) mission can be modeled using two different types of rail shipments (dedicated and general freight). For the TSM rail travel for the empty casks from the GROA to the waste sites is roughly modeled by the time in the connectors from the cask distribution processes to the cask join processes. It is assumed that the loaded casks travel from the waste site to the GROA by dedicated rail. See References BSC 2007a and BSC 2007b for more explanation.

Table 2 of MIS-WAT-SE-000001 (BSC 2003a) lists the dedicated rail speed as 23.787 mph rounded in the development of the TSM to 24 mph (for the TSM model this is converted to 35.2 feet per second). This small rounding should have a negligible impact on the simulation.

2.3.2. LWT Speeds

The LWT speed used in TSM is 40 mph from page 34 of MIS-WAT-SE-000001 (BSC 2003a).

2.3.3. Barge Speeds

The barge speed used in the TSM is 7 mph from page 34 of MIS-WAT-SE-000001 (BSC 2003a).

2.3.4. Heavy Haul Speeds

The heavy haul travel speed is 7 mph from page 34 of MIS-WAT-SE-000001 (BSC 2003a).

2.4. CONNECTOR TIMING

2.4.1. Rail and Truck Time Steps

Some connectors in the TSM use speeds and distances as discussed above to estimate the connector transit time. Other connectors use time steps that are directly input into the connector properties settings. Time steps of 0 or 1 are used when the distance from node to node is less than the distance traveled in one TSM time step (8 hours) at the conveyance speed. Appendix E lists the timing method and the parameters for the connectors in the transportation maps.

2.4.2. Barge Time Steps

The connectors to/from a rail site and the associated barge site for the barge carrier include time steps for the travel time and the load/unload time. For the load/unload time, the method on page A-26 of MIS-WAT-SE-000001 (BSC 2003a) uses 48 hours meaning 24 hours for the load (3 time steps) and 24 hours for the unload. Therefore the total time steps for the rail site to the barge site is 3 time steps plus travel time. The return from the barge site to the rail site is 3 time steps plus travel time.

2.4.3. HH Time Steps

The connectors to/from a rail site and the associated HH site for the HH carrier include time steps for the travel time and the load/unload time. Using the distances shown in Appendix D, all the HH travel times were determined to be less than 1 time step and were therefore rounded up to 1 time step. Loading/unloading times are 24 hours for the loading (3 time steps) and 24 hours for the unloading. The total time steps for the rail site to the HH site and back are 3 time steps plus 1 step travel time in each direction. Therefore, all heavy haul sites use the same 4 time step transit time from the rail site to the waste site and back.

2.5. STATE LINE CROSSINGS

The state lines that are crossed are totaled by incrementing, using a cumulative sum of the number of state line crossings that are hard coded into the connector extensions. This sum is then used to estimate fees for crossing state lines, see Reference BSC 2007c. As the conveyances move across the transportation maps, resources that represent the number of state lines crossed by each connector are assigned. The state line resources are then activated to provide a visual indication of the state lines to be crossed on the GUI during simulations. However, these resources are not used for cost estimating purposes.

State line crossings were set for each connector by manual inspection of the truck and rail route listings in the FEIS route data. Each route in the FEIS data is detailed and a state line was “counted” for each state listed in the FEIS route including the origin state. For the TSM Version 4.0 calculation (BSC 2006a) these settings were compared to the total state line crossings from the data from a database that had been used for many years for logistics modeling (“Calvin_2k.mdb” listed in Section 8). This validation expands that analysis to include the connector refinements made in TSM Version 6.0 as discussed in Section 1.1.

2.6. TSM TRANSPORTATION ANALYSIS TESTING

The analysis and tests include timing tests for various TSM versions and an assessment of the overall cask transit times as discussed in this section. The tests include data from the TSM Version 4.0 transportation calculation (BSC 2006a) using SimCAD™ Version 7.0 and tests with TSM Version 4.0 and SimCAD™ 7.1, TSM Version 5.0 and SimCAD™ 7.1, and TSM Version 6.0 and SimCAD™ 7.1.

2.6.1. Timing Tests

This section describes timing tests that were done to understand the behavior of the TSM transportation elements and compare results between various versions of TSM and SimCAD™.

All the timing tests used the same IS file, “IS timetesting-060707.xls” that used cask load line items for the reactor sites of interest. TSM Version 4.0 was run in SimCAD™ 7.0 and 7.1 to assess the impact of updating SimCAD™. TSM Version 5.0 was run in SimCAD™ Version 7.1 and compared to TSM Version 4.0 run in SimCAD™ 7.1. Also, TSM Version 5.0 was tested twice to illustrate the run-to-run variations of the TSM simulations. TSM Version 6.0 was then run in SimCAD™ 7.1 and compared to TSM V5.0 run in SimCAD™ 7.1.

Step 1: TSM Version 5.0 and Version 6.0 Visual Basic (VB) are modified to disable the command for the TSM Control Center functions to allow manual operation.

Step 2a: A “Pause Simulation” extension was added at the “R” sites unless the site used heavy haul (HH) or barges then the “Pause Simulation” was placed on the “HH” or “B” site. This first “Pause Simulation” was added as a process extension and placed under the “Object Next Process Defined” event handler. This extension pauses the TSM at the time step where the rail shipment departs from the site to the GROA.

Step 2b: A second “Pause Simulation” extension was added at the NVR and YMT processes under the “Object Activated” event handler. This pauses the simulation at the time step where the shipment object enters NVR or YMT.

Step 3: An IS file (IS timetesting-060707.xls) was prepared that included three cask loads for the rail site (five cask loads for DOE rail sites) to be tested or a single cask load for the truck site to be tested. The IS file was loaded and the TSM was run three times.

Step 4: Time steps were manually recorded in EXCEL at each pause. The EXCEL workbook “App. G TimeTesting_comparison_7_26_07_slr.xls” shows the results of the tests and this workbook was used for the timing test results shown in Appendix G.

Notice that the pause at the R, B or HH indicates the simulation time for transport of empty casks to the site, loading of the casks, and formation of the consist. The TSM time step at the second pause indicates the time the shipment arrives at the GROA. The difference between the two values is the travel time from the site to the GROA.

2.6.2. Cask Cycle Time Analysis

Cask cycle time refers to the total time steps in TSM that a cask requires from the time it is requested by a waste site until the cask is ready for dispatch to another site. The cask cycle time is one key driver for the system response as modeled by the TSM because it encompasses elements of the entire CRWMS. It can also be used to compare the results of various versions of TSM and SimCAD™ to look for inadvertent effects. Runs using the same TSM version and IS file should give similar timing results or, if there are differences, the differences can be justified by intentional model changes or differences.

The method to assess the cycle time (“cycle time testing”) is:

- Step 1: Complete a run and document the transit times for each element in the transportation portion of the TSM by manually recording the time steps in an MS Word table or EXCEL workbook. The data can be obtained from the .simdata file or by reading the timings directly off the GUI with the model paused. Ensure that all shipments have been completed (completing the return of items from aging is not necessary).
- Step 2: Prepare tables or an EXCEL workbook to compare the transit times from step 1 to results from various simulations or versions of TSM and/or SimCAD™.
- Step 3: Compare the TSM element timings and consider “model time” and the overall effect of any model time on the cask cycle times. Assess why there are differences in the timings if none were expected.

For Step 1, scenario 25B used in the so-called “Phase 1 TAD Study” (BSC 2005a) was run to 26,000 steps using TSM Version 4.0 and SimCAD™ 7.0 and the various process and connector timings from the simulation were recorded for analysis. Subsequent runs were made for other TSM and SimCAD™ versions.

The cycle time analysis method presented herein are slightly modified from the methods used for TSM Version 4.0 and SimCAD™ 7.0 in previous cycle time analyses in BSC 2006a. More detail is provided for detailed process times (queue times, value added time, waiting for next time, etc). Also, the estimate for the total cycle time has been modified to eliminate some double counting of times in some areas. These changes are minor and would cause small changes in the numerical results and no impact on the conclusions of the previous analysis in BSC 2006a. So, the results from BSC 2006a are not used herein. The Version 4.0 SimCAD™ 7.0 results are used as the “starting point” for comparisons in this validation.

The timing tests support evaluation of the TSM “Model time.” Model time is composed of simulation steps required by the TSM to model the logistics of a process or action where there is no actual real process or action for the step. Effectively, these additional times and processes may cause the TSM simulation to overestimate the cask cycle times.

The TSM is designed to reduce model time and the associated overestimates of the transit times. For example, some process elements that are abstractions of actual processes have reduced processing time to allowing this time to be “used” by the elements that include model time. For

example, the Nevada rail transit time is set to zero to compensate for the model time in the unbatching processes that precede it.

The impact of model time and overall comparison of TSM timings was initially evaluated by comparing the TSM simulation time to the 2003 TSLCC time for the transportation actions in the TSM Version 4.0 transportation calculation (BSC 2006a). The Version 4.0 analysis showed that model time had no major impacts on the overall system timing. This validation assesses any impacts of model time on the cask cycle time results to ensure there have been no inadvertent changes to model time.

3. ASSUMPTIONS AND LIMITATIONS

This section covers the general assumptions used in the construction and testing of the TSM transportation module elements. Detailed assumptions are noted throughout the text.

The average conveyance speeds take into account various impediments in the routes such as rail interchange switches, incidental delays, and other time impacts typical for transportation. Specifics for these time impacts are not modeled in each connector; all connectors use the same average speed for a particular transportation mode. For example, routes through open country likely have fewer of these time impacts than routes near major metropolitan areas. Impacts from using average speeds are negligible considering the uncertainty in the available routes over the 20-40 year future as simulated in the TSM.

Characteristics of the Nevada rail route and transportation are not specifically modeled. The connector representing Nevada Rail is modeled with a 0 time step to compensate for the model time in the unbatching processes that precede it.

The TSM transit times include model time (simulation steps required by the TSM to model the logistics of a process or action where there is no actual real process or action for the step) but these have an acceptable impact on the simulation fidelity since they are balanced using process times in the same path or route that are intentionally low.

For barge and heavy haul sites, only 1 cask load or 1 empty cask is transferred on each trip.

The methods for loading Transportation, Aging, and Disposal (TAD) canisters at the waste sites and the associated loading times are not established. For TAD canisters the TSM effectively assumes that the loading will be done before the overpack (OV) arrives to ship it and that the loading time is short. Note that assuming that the loading will be done before the OV arrives also covers any cases where the TAD canister has been loaded for dry storage like a Dual Purpose Canister (DPC) (although this loading may be years before the shipment occurs). This assumption implies that the empty TAD canisters will be shipped to the waste site from the manufacturer and can be filled before pickup. It is most efficient to ship the empty TAD canister directly to the site to avoid additional shipping costs, double handling of the TAD canisters, and possible external contamination of the new TAD canister in the OV on the way to the site. The TAD canister can be filled before the OV arrives which also implies that the site has space to store the loaded TAD canisters for a few days.

Another option for loading a TAD canister is that it can be shipped to DOE at the repository (or the rail head for Nevada rail) and then carried in the OV to the waste site for loading. If this is the case, the loading time in the TSM will need to be increased. After the OCRWM program develops more concrete plans for TAD logistics, the timing in the TSM can be changed as required to improve the fidelity. Previous TSM analyses indicate that the main impact of longer TAD canister loading times is typically the need for 3 to 6 more TAD overpacks to maintain the planned acceptance rates. Current analyses indicate about 40-50 overpacks are needed so this is a small impact.

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4. USE OF COMPUTER SOFTWARE AND MODELS

The following computer software and models are used in this validation:

- SimCADPro™ 7.0 with SimData analyzer
- SimCADPro™ 7.1 with SimData analyzer
- MS EXCEL 2003
- MS Access 2003
- TSM Versions 4.0, 5.0, and 6.0D7

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5. RESULTS

This section presents the results for the methods applied in Section 2. Results are presented in tables at the end of this section and in the appendices.

5.1. TRANSPORTATION ROUTES AND PARAMETERS

Truck and rail routes were drawn on separate maps as shown in Appendix A. Impacts from the changes in Section 1.1 (if any) are noted in the sections below.

5.2. TRANSPORTATION DISTANCES

5.2.1. Rail Distances

The spreadsheets in Appendix B show the distances used in the TSM versus the data from the INTERLINE files. Appendix B results are from the attached EXCEL workbook “Appendix B_Rail distances by node_7_20_07.xls”. The key results are summarized in Appendix B which presents the model time compared to timing based on data used in the FEIS. The workbook shows that based on the timing in the transit path from the waste site to the repository, the TSM model simulates distances about 5-6% lower on average than those in the FEIS. This is caused by the need to use 8-hour time steps in the TSM. of the validation for TSM Versions 4.0 and 5.0 (BSC 2006a) showed an 8% lower value, indicating that the refinements described in Section 1.1 improved the fidelity of the TSM for these transportation elements.

5.2.2. LWT Distances

The node-to-node distances used in the TSM truck maps are in Appendix C. Appendix C results are from the attached EXCEL workbook “Truck Details_Appendix Cd_9-4-06.xls”. The key results summarized in Appendix C present the model time compared to timing based on data used in the FEIS. The workbook shows that based on the timing in the transit path from the waste site to the repository, the TSM model simulates distances about 10% lower on average than those in the FEIS. This is caused by the need to use 8-hour time steps in the TSM.

5.2.3. Barge Distances

The barge distances are shown in Appendix D.

5.2.4. HH Distances

The HH distances are shown in Appendix D.

5.3. CONVEYANCE SPEEDS

5.3.1. Rail Speeds

The TSM uses a dedicated rail speed of 24 mph which converts to 35.2 feet per second.

5.3.2. LWT Speeds

TSM uses an LWT speed of 40 mph.

5.3.3. Barge Speeds

TSM uses a barge speed of 7 mph.

5.3.4. Heavy Haul Speeds

TSM uses a HH speed of 7 mph.

5.4. CONNECTOR STEPS

5.4.1. Rail Time Steps

See Appendix E for specific information on connectors that use time steps in the TSM.

5.4.2. LWT Time Steps

See Appendix E for specific information on connectors that use time steps in the TSM.

5.4.3. Barge Time Steps

The total time steps for the rail site to the barge site is 3 time steps plus travel time and the return from the barge site to the rail site is 3 time steps plus travel time. For example, for the case of Browns Ferry used in this validation the total time is 1 step for travel and 3 for load/unload for a total of 4. See Appendix E for specific information on connectors that represent the route and Appendix D for barge distances.

5.4.4. HH Time Steps

All heavy haul sites use the same 4 time step transit time from the rail site to the waste site and back. This includes the load or unload time. For example, the value of 4 is used in this validation for the travel time plus load time for Peach Bottom. See Appendix E for specific information on connectors that represent the route and Appendix D for HH distances.

5.5. STATE LINE CROSSINGS

Appendix F shows the state lines that are crossed from each waste site to the repository using the resources in the TSM. These are compared to the number of crossings from the database Calvin_2k.mdb attached in Section 8 originally used as input for the TSM and for TSM Version 4.0 (where the state lines were last checked).

As shown in Appendix F, the state line crossings in the TSM are generally consistent with the data base Calvin_2k.mdb. There was a problem with the settings that was not fixed in TSM Version 4.0. The rail connector from Barstow to NVR has two state lines properly programmed in the extensions to increment the state line cost for this connector. However, this connector was also changed to zero steps during development to improve the transit time fidelity, which means the extension in this connector will not run (zero connectors cannot run extensions). Based on a typical TAD canister scenario run, this connector handles about 200-250 shipments for a 63,000 MTHM CSNF scenario. This means the state line cost for this connector may be as much as \$1.5M low with the assumed unit cost of \$1000 per cask. The total state line cost for this type of scenario is about \$85M, so this is about a 1.8% error, well within other uncertainties in the

OCRWM mission. However, even though the error is small, the connector from Barstow to NVR was changed to 1 time step in TSM Version 6.0 to improve fidelity.

All of the state line changes for TSM Version 6.0 in Section 1.1 have a minor impact on costs. Based on the results and supporting documents in the TSM Version 4.0 cost check (BSC 2006b) for the TSM Version 4.0 Base Case, a total of state line costs for 2,596 cask loads are impacted:

- Fort Calhoun add 1 state line for 291 cask loads
- Beaver Valley add 1 state line for 1,364 cask loads
- Indian Point subtract 1 state line for 941 cask loads
- Barstow to NVR add 1 state line for 700 cask loads

The total state line crossing costs at \$1000 per cask load would increase the state line costs by a total of \$1.4M [$\$1000 \times (291 + 1,364 - 941 + 700)$]. The cost check for TSM Version 4.0 indicated that state line costs was lower than previous systems analyses by about \$1.8 so these changes improve the fidelity of the TSM. The small errors from the issues with these connectors in previous analyses and reports are negligible.

Appendix F also shows that there were corrections in the previous checking spread sheet for the state line crossings. These errors impacted the check accuracy but did not require changes in the simulation model. The route changes identified in Section 1.1 also contributed to the changes in the state line crossings.

5.6. TSM TRANSPORTATION ANALYSIS AND TESTING

This section presents the results of the timing tests and cask cycle time using the methods presented in Section 2.6. The tests include data from the TSM Version 4.0 transportation calculation (BSC 2006a) using SimCAD™ Version 7.0 and tests with TSM Version 4.0 and SimCAD™ 7.1, TSM Version 5.0 and SimCAD™ 7.1, and TSM Version 6.0 and SimCAD™ 7.1.

5.6.1. Timing Tests

Results of the timing tests are provided in attached EXCEL workbook “App. G TimeTesting_comparison_7_26_07_slt.xls” with information and analysis provided in Appendix G. The objective of this validation was to compare the results for various versions of TSM and SimCAD™.

Based on the variations inherent in these tests, consideration of outliers in the tests, and observations of the model behavior during tests, the results between the variations show no model-to-model inconsistencies. However, this result must be qualified as being only a general indication of consistency given the large variation in identical tests caused by using only 3 data points and the inherent variability in TSM simulations where there are actions on every time step. Cycle time tests discussed in the next section effectively run thousands of objects through the processes providing more statistically meaningful results than these timing tests.

5.6.2. Cask Cycle Time Analysis

A TSM simulation for scenario 25B used in the Phase 1 TAD Study (BSC 2005a) using TSM was run to 26,000 steps for various versions of TSM and SimCAD™ and the various process and connector timings for the cask transit actions were recorded for analysis. The cask transit actions for rail shipments and truck shipments are shown in Tables 1 and 2. These results are from various EXCEL workbooks attached to this validation (see section 8).

Tables 1 and 2 include the following information for the sequence of tests for various versions of TSM and SimCAD™:

<i>OCRWM/TSM Action</i>	The general description of the OCRWM program element, action, or process
<i>Process/Connectors</i>	The process or connector in the TSM. In most cases, processes are abstractions of actual actions but in some cases, these are logistic processes used by TSM to implement a simulation action. Connectors typically represent flow paths for objects or routes for transportation but may also be included for TSM logistics modeling purposes.
<i>Figure</i>	Figure in Appendix A of this validation that shows the process, connector, or route.
<i>TSM Programmed Steps</i>	Number of 8-hour time steps specified in the programming of the process or connector.
<i>TSM Simulation Steps</i>	Number of 8-hour time steps from the simulation. Usually not equal to programmed time because the system enablers such as resources or other needs may not be available. Times may be broken out by queue wait time (Q), Value Added Time (VAT), Waiting for Next Process (WNP) and Lead time of items where detailed timing comparisons are needed.
<i>Discussion</i>	Clarifications or important characteristics about the behavior of the action or TSM modeling of the action. Also indicates if the TSM action includes “model time” as discussed below.

The cask cycle time analyses are provided for rail sites that ship only TADs and ship them in 3's (cask loads have the same Start Time in the IS file). This is because these sites will have very efficient batching to form the 3-cask loads since the TAD overpacks are not limited in the test (“open buy”) and the shipments in 3 ensure the batch is completed quickly. If the transportation overpack or cask is not available, the cask loads to fill the consist may be delayed and decrease the batching efficiency and increase the batching time. If the shipment includes only 1 or 2 cask loads in the same step, the batching processing at the site waits the fully allotted time set to complete the batch then leaves the process. The resulting time variations caused by inefficient batching make analysis and comparison difficult. So, sites with optimum cask load conditions

are analyzed. Sites with less than optimum timing would show increases in the site batch process times over those in Table 1.

For this analysis the Summer rail site (SUMR), Browns Ferry barge site (BFB), and Peach Bottom HH site (PEAHH) were selected for analysis. These sites best meet the criteria in the preceding paragraph as indicated by the total simulation timing at the batching site. Each of these sites had the lowest simulation times for all the batching sites for R, B and HH indicating that the batching was most efficient for these sites, see BSC 2006a.

Truck sites for the analysis do not have to be as carefully selected as rail sites because there is no “overpack competition” during cask allocation and no batching of multiple cask loads at the site (there is no 3 cask consist so there is no wait for all 3 casks to complete the cask allocation process). For this case, the Ginna truck (GINT) site was selected for analysis.

For both rail and truck, results are shown for sites near the east coast since these have the longest travel times and are of the most interest to show comparisons. Ultimately the results show that the waste site to GROA transit times are about 20% of the overall cask cycle time indicating that assumptions related to routes will not cause significant impacts on the overall system analysis results.

Tables 1 and 2 show that the programmed time in TSM does not always match the simulation time since the simulation time includes the effects of the TSM logistics. Simulation time shows the impact of the interaction of multiple objects in the process that compete for the same processes or resources.

The tables show how the transit of the casks through the TSM may include processes with “model time” that may cause the total simulated transit time to be overestimated if there are not TSM constructs to compensate for the elements that introduce model time. The TSM is designed to reduce model time that may cause over estimates of the transit times by intentionally reducing processing times to allow this time to be included in the additional time added by processes that include model time. For example, notice how the Nevada rail times in Item 5 of Table 1 are low to compensate for the model times in Item 6.

Results indicated that SimCAD™ Version 7.1 has a bug wherein the cycle time and other key time measures are not recorded for processes and connections that are assigned zero process times. TSM has several such processes and connectors and therefore it is hard to make a comprehensive comparison of all the timings for runs that use SimCAD™ Version 7.1. This was discussed with CaS and the problem is fixed in SimCAD™ Version 8.0. However, there is inadequate time to implement and test SimCAD™ 8.0 for the issuance of TSM Version 6.0.

To overcome the impact of the SimCAD™ Version 7.1 bug, the simulation models for the tests in SimCAD™ Version 7.1 were revised to change zero-time processes and connectors to have one time step for processing so the timing data would properly record. The one time step is factored into the evaluation of the results. Note that usually zero process time elements require 0.5-1.0 time steps for completion based on the Table 3 and 4 results. Note that the changes to add one time step are not included in the delivered TSM Version 6.0; otherwise the cycle time

would be wrongly increased by about 15 time steps for the 15 elements where the additional step that was added impact the results.

The results also indicated that SimCAD™ Version 7.1 was revised to add the “Waiting for Next Process” simulation time to connectors and jumps. This is also considered in the evaluation of the results in Tables 1 and 2.

When the run is completed the processes in the cycle time testing have typically completed at least 500 objects, and as many as several thousand objects. This helps reduce the run-to-run variations typically observed in TSM and the large population to increases the validity of the timing averages. Still, some variation is evident in the second decimal of the times. For example, zero time items with some logic typical show 0.52-0.56 time steps. The three or more significant digits provided in the results do not reflect the accuracy of the TSM the digits are included for easy correlation to results. The timings calculated by TSM should only be considered to have one or two significant digits depending on the process. The key observation in the test is to compare the results and explain any differences being careful not to imply accuracy by considering small differences reflected in the third or higher significant digit.

The key results from Tables 1 and 2 are:

- The version to version differences in individual process times and overall cycle time are typically within a few percent and any difference can be justified as explained in Tables 1 and 2. The timing of transportation elements in TSM Version 6.0 have the same behavior as previous TSM versions.
- SimCAD™ Version 7.1 changed the handling of the recording of VAT for processes with process capacity greater than one object. These VAT values were not used in any previously published TSM analyses and the change will not impact any published conclusion or results.
- Accounting for the additional one time step added to 16 simulation elements, the timings agree very well indicating no unexpected impacts when updating to SimCAD™ Version 7.1.
- The change to multiple TAD lines in TSM Version 5.0 has a notable effect on the turnaround time for TAD canisters in the GROA.
- The TSM Version 6.0 GROA is based on a revised design that markedly slows the GROA throughput for truck and rail casks in the facilities. However, the cycle times did not appreciably increase from TSM Version 6.0 because several processes on the GROA cask return route were removed in Version 6.0.

Table 1. Rail Cask Cycle Time

As discussed in Section 5.6.2 some process steps were changed from 0 to 1 (indicated by #) to overcome a bug in SimCAD™ Version 7.1 where 0 process times do not write out the wait time or the lead time. So, the result for 7.1 should have one more time step vs. 7.0 for processes with "#". The nomenclature (xx+yy) indicates a process time plus a connector time. See Section 8.0 for run files.

				Version 4 7.0	Version 4 7.1	Version 5 7.1	Version 6 7.1	Rail
Rail OCRWM/ TSM Action	Process	Fig	TSM Prog	TSM Sim Steps	TSM Sim Steps	TSM Sim Steps	TSM Sim Steps	Discussion (Note 1)
-1. Cask staging at FMF	# 253Dist (TAD department)	A-13	0	Q: 40.0 VAT: 0 WNP: 3.63 Lead: 44.30	Q: 40.25 VAT: 1.00 WNP: 18.32 Lead: 44.88	Q: 41.37 VAT: 1.00 WNP: 3.62 Lead: 45.99	Q: 55.26 VAT: 1.00 WNP: 3.62 Lead: 58.88	Lead times for V4 and V6-7.1 does not add properly. This was also observed on several other undocumented cases. Problem has been reported to CaS.
-2. Cask Loading at site			0	0				
	TADLargeB Bare and connector	A-13	3+1	Q: 3.16 VAT: 3.00 WNP: 0.46 Lead: 6.62 Conn.: 1.0	Q: 3.16 VAT: 3.00 WNP: 0.47 Lead: 6.62 Conn.: 1.0	Q: 3.15 VAT: 3.00 WNP: 0.47 Lead: 6.62 Conn: 1.0	Q: 3.16 VAT: 3.00 WNP: 0.45 Lead: 6.61 Conn: 1.0	This is for the TAD canister loading process and is typical for loading where a cask is always available. Input point for cask load from IS file.
	251 load	A-13	1	1.55	1.53	1.55	1.56	Join for the cask load and the transportation cask
-3. Waste Site	SUMR, SERail	A-10	0	14.33	14.67	14.67	14.00	Simulation time from testing in Appendix G.
Typical rail, barge, HH sites that use TADs are shown. See Note 2 for program time basis.	BFR-BFB, SERail	A-10	23	35.00	35.00	33.00	35.00	Testing included Items 1 and 2 above so Items 1 and 2 are not added to the cycle time.
	PEAR-PEAHH, NERail	A-11	23	36.67	34.33	34.33	33.00	Total steps at the sites depend on the time to make the 3-consist-not on programmed steps.

				Version 4 7.0	Version 4 7.1	Version 5 7.1	Version 6 7.1	Rail
Rail OCRWM/ TSM Action	Process	Fig	TSM Prog	TSM Sim Steps	TSM Sim Steps	TSM Sim Steps	TSM Sim Steps	Discussion (Note 1)
-4. Transit to Repository Transit from waste site to "ToNevIMF" jump in SWrail map	SUMR	A-8	13	15.33	16.67	15.33	15.00	Programmed time is Appendix B, Time Step, rounded. Simulation time is from time testing, see Appendix G, add 1 step for NVR to "ToNevIMF" connector.
	BFB		11	13.67	14.00	14.00	13.33	
	PEAHH		13	15.33	15.33	15.67	15.33	
-5. IMF Depot transfer to Nevada Rail	IMFDepot+connector	A-14	0	0				Not included in cask cycle time since the NVR jump teleports objects to Arrivals 3 below.
	Rail Unbatch 3 Department	A-15						Department Process, time set by each process below
	Arrivals3+connector	A-15	0+0	0.50+0= .50	0.53+0= .53	0.52+0= .52	0.52+0= .52	This is "model time"
	#IMFUnbatch+connector	A-15	0+0	1.29+ 0= 1.29	2.29+ 0= 2.29	2.30+0= 2.30	2.29+0= 2.29	This is "model time".
	#IMFrailshipment+connector	A-15	0+1	0.62+1.25= 1.87	1.61+1.24= 2.85	1.60+1.27= 2.87	1.61+1.26= 2.87	This is "model time". Cask load proceeds past this point, transport cask remains in the Rail Unbatch department waiting for trigger to return.
-6. Nevada/DOE Rail	#DOERail including to/from connectors	A-14	0+0	.54+0+0= 0.54	1.52+0+0= 1.52	1.52+0+0= 1.52	1.51+0+0= 1.51	Time is reduced in this process to compensate for model time in processes in Item 5.
	#GROARailSecurity+connector	A-14	0+1	.91+1.14= 2.15	1.88+1.15= 3.03	1.89+1.15= 3.04	1.90+1.14= 3.04	Security inspection at gate.
	GROAUnbatchR2	A-17						Department Process, time set by each process below
	DOERailArrivals 21+connector	A-17	3+0	3.52+0= 3.52	3.52+0= 3.52	3.51+0= 3.51	3.52+0= 3.52	This is "model time".

				Version 4 7.0	Version 4 7.1	Version 5 7.1	Version 6 7.1	Rail
Rail OCRWM/ TSM Action	Process	Fig	TSM Prog	TSM Sim Steps	TSM Sim Steps	TSM Sim Steps	TSM Sim Steps	Discussion (Note 1)
	GROARailUnbatch221+connector	A-17	3+1	3.79+1.3= 5.12	3.81+1.31= 5.12	3.80+1.32= 5.12	3.80+1.31= 5.11	This is "model time".
Note 4	#InputtoTCRRF including to/from connectors	A-14	0+1	1.15+0+1.18= 3.27	2.1+0+1.17= 3.27	2.16+0+1.18= 3.34	2.01+0+1.17= 3.18	This is "model time".
-7. GROA Operations	GROABlending Department Note 4	A-14						Deliver cask load to unload in a process line. The process sequence below is the GROA processing for a TAD cask load.
	#Rail-TruckArrivalBuffer+connector		0+0	0.52+0= 0.52	1.52+0= 1.52	1.52+0= 1.52	1.52+0= 1.52	
	#Deploymenttime+connector		0+0	0.54+0= 0.54	1.54+0= 1.54	1.52+0= 1.52	N/A	Not applicable for V6.0.
	#FHFOpen+connector		0+0	0.53+0= 0.53	1.53+0= 1.53	1.54+0= 1.54		Routes cask load to proper buffer.
	#Parking (V6.0)		0+0				1.54+0= 1.54	
	#FHFTADBuffer+conn. #TADBuffer+connector (V6.0)		0+0 0+0	Q: 24.08 VAT: 0.00 WNP: 2.06 Lead: 26.14 Conn: 0	Q: 23.99 VAT: 1.00 WNP: 2.03 Lead: 27.26 Conn: 0	Q: 2.42 VAT: 1.00 WNP: 0.85 Lead: 4.27 Conn: 0	Q: 9.08 VAT: 1.00 WNP: 3.34 Lead: 13.42 Conn:0	Logistics require that TADS wait in queue for processing and this drives the simulation time. Varies depending on case- do not add to total time. V5.0 implemented more TAD lines so faster. V6.0 multiple lines also faster.

				Version 4 7.0	Version 4 7.1	Version 5 7.1	Version 6 7.1	Rail
Rail OCRWM/ TSM Action	Process	Fig	TSM Prog	TSM Sim Steps	TSM Sim Steps	TSM Sim Steps	TSM Sim Steps	Discussion (Note 1)
	#TADHeatOK + Conn. (V4.0, V5.0)		0+0	Q: 0.58 VAT= 0.00 Net 0.58	Q: 0.59 VAT: 1.00 Net 0.59	Q: 0.71 VAT: 1.00 Lead: 1.71 1.71+0= 1.71	N/A	Represents inspection of the TAD canister at the process line. V4.0: Cask release is on object activated so Q is the net time item.
	#RF +connector (V6.0)		0+0	N/A	N/A	N/A	Q: 0.88 VAT: 1.00 WNP: 0 Lead: 1.88 Conn: 0 1.88+0= 1.88	Not Applicable for V4.0, V5.0. Receiving Facility (RF)
	TADxfertoWP 2 (V6.0)		0+0	N/A	N/A	N/A	Q: 0.54	CRCF2 handles most of the TADs. V6.0 "Object activated" triggers releases for cask from the cask hold process.
-8. GROA Operations to return empty cask								These processes are the time to prep the cask for return.
Note 4.	TCRRFCaskReturn +connector	A-19	3+0	3.52+0= 3.52	3.52+0= 3.52	3.51+0= 3.51	3.51+0= 3.51	All casks return through TCRRF.
	#DistinTCRRF +connector	A-19	0+0	0.50+0= 0.50	1.52+0= 1.52	1.52+0= 1.52	Not used in V6.0.	
	ToSRTC+connector	A-19	2+0	2.54+0= 2.54	2.57+0= 2.57	2.54+0= 2.52	Not used in V6.0.	Longest SRTC process time is used
	BufferDistribute +connector	A-19	1+0	1.55+0= 1.55	1.53+0= 1.53	1.54+0= 1.54	Not used in V6.0.	

				Version 4 7.0	Version 4 7.1	Version 5 7.1	Version 6 7.1	Rail
Rail OCRWM/ TSM Action	Process	Fig	TSM Prog	TSM Sim Steps	TSM Sim Steps	TSM Sim Steps	TSM Sim Steps	Discussion (Note 1)
	CaskReturnJumpToTSM+connector	A-19	3+1	1.16+1.00= 2.16	3.63+1.00= 4.63	3.65+1= 4.65	3.76+1= 4.76	V4 routers have a bug where VAT time is spread among all items in process-process cap. is 5 in this case.
	RailCaskReturn	A-19	1	1.52	1.52	1.51	1.52	This is not a jump- it is a generic process that teleports. So, include the process time in the cask cycle time.
-9. Cask Transport from GROA to FMF								Time from the GROA to the FMF via DOE rail.
	BasketReturn+connector	A-14	3+0	3.55+0= 3.55	3.53+0= 3.53	3.45+0= 3.45	N/A	Process skipped in V6.0 to reduce model time.
	#GROACaskReturn+connector	A-14	0+0	0.52+0= 0.52	1.65+0= 1.65	1.52+0= 1.53	1.53+0= 1.53	The RailCaskReturn process in the GROA teleports to here in V6.0.
	#IMFCaskreceive1+connector	A-14	0+1	Q:0.54 VAT: 0.00 WFN=.45 Lead=.99 Conn: 1.12 .99+1.12= 2.11	Q: 0.55 VAT: 1.00 WFN: .46 Lead=2.01 Conn: 1.13 2.01+1.13= 3.14	Q: 0.53 VAT: 1.00 WFN: 0.47 Lead=2.00 Conn: 1.13 2.00+1.13= 3.13	Q: 0.53 VAT: 1.00 WFN: 0.38 Lead= 1.91 Conn: 1.11 1.91+1.11= 3.02	
-10. Cask Maintenance at FHF		A-21						
	CaskSort+connector	A-21	3+0	3.53+0= 3.53	3.52+0= 3.52	3.53+0= 3.53	3.52+0= 3.52	This represents the routine inspection and arrival actions at the FMF.
	#SCaskCheck+connector	A-21	0+1	0.66+1.0= 1.66	1.65+1.0= 2.65	1.64+1.0= 2.64	1.67+1.0= 2.67	If maintenance is needed add 6.6 steps.

				Version 4 7.0	Version 4 7.1	Version 5 7.1	Version 6 7.1	Rail
Rail OCRWM/ TSM Action	Process	Fig	TSM Prog	TSM Sim Steps	TSM Sim Steps	TSM Sim Steps	TSM Sim Steps	Discussion (Note 1)
	#SReturn+connector	A-21	0+1	0.6+1.0= 1.6	1.59+1.0= 2.59	1.58+1.0= 2.58	1.59+1.0= 2.59	Jump from here to cask distribute (Item 1) to repeat cycle.
TOTAL ITEMS 3-10	SUMR BFB PEAHH		48 69 71 Note 3	73.85 92.86 96.19	91.02 108.68 109.34	90.62 107.62 110.62	79.64 98.97 98.97	The sums here are for bold items above. Without FMF maintenance. Add 6.6 steps to include time for a cask that requires maintenance.
TOTAL ITEMS 3-10 Corrected for 7.1 cases.	SUMR BFB PEAHH		N/A	(-0) 73.85 92.96 96.19	(-13) 78.02 95.68 96.34	(-14) 76.62 93.62 96.62	(-12) 67.64 86.97 86.97	Line above corrected for the one step added to the 7.1 cases as shown in (). Difference is justified by Items 8 and 9 .and considering run-to-run variations.

Note 1. Results are from Phase 1 TAD Study Scenario 25B from run file in Section 8 for most results supplemented by Appendix B for route program times, and Appendix G for some simulation times, as shown. TAD canister scenario is reported since there are no cask shortages to impact the logistics.

Note 2. For Item 3, typical rail, barge, HH sites that use TAD canisters are shown. TSM programmed time is to complete the 3-cask consist and includes barge/HH transport cycles as follows:

Rail: Zero time steps programmed.

Barge: 3 casks routed with Rsite arrival (0) then Rsite to Bsite with unload (4), Bsite (1), then Bsite to Rsite with load (4), RSite (0), then Rsite to BSite with unload (4), Bsite (1), then BSite to Rsite with load (4) , RSite (0), then Rsite to Bsite with unload (4), Bsite (1). $0+4+1+4+0+4+1+4+0+4+1= 23$ based on 3 steps for load/unload and 1 step for travel for BFB, see Section 5.4.3. BSite has 1 step for adding the cask to the rail car.

HH: 3 casks with each routed as RSite arrival (0) then Rsite to HHsite with unload (4), HHSite (1), then HHsite to Rsite with load (4), RSite (0), then Rsite to HHSite with unload (4), HHsite (1), then HHSite to Rsite with load (4), Rsite (0), then Rsite to HHsite with unload (4), HHsite (1). $0+4+1+4+0+4+1+4+0+4+1=23$ based on 4 steps for travel and 1 for unload, see Section 5.4.4. HHSite has 1 step for adding the cask to the rail car.

Note 3. Program time for all items in total. The program times did not change from Version 4.0 to Version 6.0.

Note 4: Names are as tested. The released TSM Version 6.0 name changes are: TCRRFCaskReturn to GROACaskReturn, GROABlending to GROA, InputtoTCRRF to InputtoGROA.

Table 2. Truck Cask Cycle Time

				Version 4 7.0	Version 4 7.1	Version 5 7.1	Version 6 7.1	Truck
Truck OCRWM /TSM Action	Process	Fig	TSM Prog Steps	TSM Sim Steps	TSM Sim Steps	TSM Sim Steps	TSM Sim Steps	Discussion
-1. Cask staging at FMF and transport from FMF to site	Cask6distribute +connector		1+5	Q: 17.35 VAT:0.01 WNP: 3.58 Lead: 20.94	Q: 16.60 VAT:1.00 WNP: 8.47 Lead: 35.27	Q: 42.60 VAT: 1.00 WNP: 8.13 Lead: 51.73	Q: 7.21 VAT:1.00 WNP: 9.8 Lead: 29.87	WNP for 7.1 case does not always add properly. Problem has been reported to CaS.
-2. Cask Loading at site								Do not add to cycle time - tests done in Item 3 include the simulation time for these elements.
	GA-4 + connector		3+1	Q: 1012 VAT:3.00 WNP: 7.02 Lead: 1023 Conn: 1	Q: 1057 VAT:3.00 WNP: 7.98 Lead: 1068 Conn: 1	Q: 620 VAT: 3.00 WNP: 5.63 Lead: 629 Conn: 1.00	Q: 6006 VAT: 3.00 WNP: 15.51 Lead: 6024 Conn: 1.00	This is for the truck loading process. Simulation time includes time waiting for cask to be available. Input point for cask load from IS file. GROA in V6.0 processes trucks more slowly, large Q of several thousand forms.
	6 Tload		1	1.51	1.51	1.50	1.51	Simulation includes the cask staging/waiting for the event call for arriving cask loads. Join process that teleports to maps.
-3. Waste Site	GINT	A-6	1.5	10.00	10.33	11.00	11.00	Programmed time From Appendix C. Simulation time is from time testing in Appendix G VAT is 1.5 but depends on batching. Testing included Items 1 and 2 above so Items 1 and 2 are not added to the cycle time.

				Version 4 7.0	Version 4 7.1	Version 5 7.1	Version 6 7.1	Truck
Truck OCRWM /TSM Action	Process	Fig	TSM Prog Steps	TSM Sim Steps	TSM Sim Steps	TSM Sim Steps	TSM Sim Steps	Discussion
-4. Transit to Repository Transit from waste site to "ToGROATruck9" jump in NW Truck map	GINT to NVT	Fig. A-6 to Fig. A-2	9	11.67	11.00	11.33	11.67	Programmed time is from Appendix C. Simulation time is from time testing, Appendix G, add 1 step for NVT to "ToGROATruck9" connector.
-5. Not applicable								
-6. Truck Entry to GROA	GROATruckD epot +connector	A-14	0+0					Not included in cask cycle time since the ToGROATruck9 jump teleports objects to TruckArrivals1 below.
	GROATruckS ecurity +connector	A-14	0+1					Not included in cask cycle time since the ToGROATruck9 jump teleports objects to TruckArrivals1 below. Security check time is compensated by model time below.
	GROAUnbatc hTruck	A-18						Department Process, time set by each process below
	TruckArrivals1 +connector	A-18	0+0	0.52+0= 0.52	0.52 +0= 0.52	0.51+0= 0.51	0.52+0= 0.52	This is "model time".
	#TruckUnbatc h2 1+ connector	A-18	0+1	.11+1.02= 1.13	0.11+1.01= 1.12	0.11+1.01= 1.12	Q: 0.11 VAT: 1 WNP: 0.23 Lead: 1.34 Conn: 1.00 1.34+1.00= 2.34	This is "model time". #Added time step in V6.0 only.

				Version 4 7.0	Version 4 7.1	Version 5 7.1	Version 6 7.1	Truck
Truck OCRWM /TSM Action	Process	Fig	TSM Prog Steps	TSM Sim Steps	TSM Sim Steps	TSM Sim Steps	TSM Sim Steps	Discussion
	#IMFCaskreceive1+ connector	A-14	0+1	Q:.54 VAT: 0 WFN=.45 Lead=.99 Conn:1.12 .99+1.12= 2.11	Q:.54 VAT: 1 WFN=.45 Lead=1.99 Conn: 1.13 1.99+1.13= 3.12	Q:.55 VAT: 1 WFN=.45 Lead=1.99 Conn: 1.13 2.0+1.13= 3.13	Q:.53 VAT: 1 WFN=.38 Lead=1.91 Conn: 1.11 1.91+1.11= 3.02	Same for truck and rail.
-10. Cask Maint. at FHF		A-21						
	CaskSort+connector	A-21	3+0	3.53+0= 3.53	3.52+0= 3.52	3.53+0= 3.53	3.52+0= 3.52	This represents the routine inspection and arrival actions at the FMF. Same for rail and truck.
	#TCaskCheck+connector	A-21	0+1	0.53+1= 1.53	0.51+1.0= 1.51	0.52+1.0= 1.52	1.51+1.0= 2.51	If maintenance is needed add 6.6 steps. #Added time step in V6.0 only
	TReturn+connector	A-21	0+1	0.54+1= 1.54	0.53+1.0= 1.53	0.53+1.0= 1.53	0.51+1.0= 1.51	Jump from here to cask distribute (Item 1) to repeat cycle.
TOTAL ITEMS 3-10	GINT		46 Note 2	56.30	64.40	63.87	60.16	Without FHF maintenance. Add 6.6 steps to include time for a cask that requires maintenance. Totals are rounded up.
TOTAL ITEMS 3-10 Correct for +1 step in test in 7.1	GINT		N/A	(-) 56.30	(-6) 58.40	(-6) 57.87	(-7) 53.16	Corrected for 1 time step as shown by (-). Differences justified by Item 8 and longer processing times (Item 1).

Note 1. Results are from Phase 1 TAD Study Scenario 25B from run file in Section 8 for most results supplemented by Appendix C for route program times, or Appendix G for some simulation times, as shown.

Note 2. TSM Version 5.0 and Version 6.0 have one more time step in the GROA process.

Note 3: Names are as tested. The released TSM Version 6.0 name changes are: TCRRFCaskReturn to GROACaskReturn, GROABlending to GROA, InputtoTCRRF to InputtoGROA.

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6. OBSERVATIONS

The transportation elements in TSM Version 6.0 behave consistently with previous TSM versions considering changes in the transportation elements and GROA operations. Future studies using TSM Version 6.0 can be directly compared with historical analyses and results.

As noted in Table 1 and 2, the cycle times for TSM Version 6.0 are lower than previous versions because some processes for GROA operations to return empty cask processes were removed when the GROA simulation was revised. These processes were model time contributors and the revised model provides better fidelity. These changes do not have any major impact on the conclusions of previous studies that used the slower cycle times, since the casks fleets and waste acceptance would not be greatly changed by these small changes in cycle times.

Upgrading to SimCAD™ Version 8.0 should be done as soon as practical to correct the bug that causes no recording of process timing data when a process is programmed with zero process time. At that point, a post-run report generator that duplicates the method in Table 1 and 2 can be implemented to quickly perform cycle time testing and allow easy run-to-run and model-to-model comparisons of transportation timing.

The TSRG is validated and ready for use (see Appendix H).

Refinements can never achieve complete fidelity between the simulated with calculated transit times for the sites because multiple sites use the same connectors. Notice that as the routes represented by connectors converge on the MGR the connectors near the MGR carry loads from many sites. This means that the timings in these connectors can influence many sites and it is not practical to develop chains of connectors that provide the proper connector setting for all connectors to match the calculated transit times for all sites. It is also difficult to make accurate connectors with 8-hour time steps to simulate the routes for the short distances from reactors near the MGR. This situation is further complicated that SimCAD™ connectors prior to a jump need at least one time step (thus the 8-hour steps in the final connectors mentioned above).

All of the assumptions and connector construction that influence connector timing and therefore the overall simulation timing can reduce the fidelity of the simulation. The uncertainty in the routes, speeds, and methods for transportation 20 years in the future also have considerable uncertainty, so any lack of fidelity is not very critical, especially for studies where relative results between scenarios are used as the analysis basis.

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7. REFERENCES

7.1. DOCUMENTS CITED

BSC 2003a. *User Manual for the CRWMS Analysis and Logistics Visually Interactive Model – Version 4.0*, MIS-WAT-SE-000001 Rev 00, Bechtel SAIC Company, LLC, Washington, D.C. Nov. 2003. ACC: DOC.20040908.0004

BSC 2005a. *TSM System Study: Impact of a Canister-Based System on the CRWMS, Phase 1*. MIS-CRW-SE-000003 REV 00. Washington, D.C.: BSC. ACC: DOC.20051213.0001.

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BSC 2007b. *User Manual for the Total System Model Version 6.0*, 50040-UM-01-6.0-00, Bechtel SAIC Company, LLC, Washington, D.C. ACC: Submit to RPC.

BSC 2007c. *Total System Model Version 6.0 Cost Estimating Routines Design and Bases*, 50040-DD-03-6.0-00, Bechtel SAIC Company, LLC, Washington, D.C. ACC: Submit to RPC.

BSC 2007d. *Total System Model Version 6.0 TSM Validation*, 50040-VAL-01-6.0-00, Bechtel SAIC Company, LLC, Washington, D.C. ACC: Submit to RPC

CaS 2006. *SimCAD Process Simulator Users' Manual*, V 7.1, Create-a-Soft, Chicago, Illinois, May 2005. ACC: MOV.20071016.0003.

DOE 2002. *Final Environment Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada*. DOE/EIS-0250. Washington, DC: U.S. DOE Office of Civilian Radioactive Waste Management. ACC: MOL.20020524.0314 through MOL.20040524.0320.

Gillespie, S. 2005. "Status of Transportation Data Needs for TSM System Study." E-mail from S. Gillespie (BSC) to D. Kim (RW-20). February 10, 2005, with Attachments. ACC: MOV.20050802.0003, MOV.20050802.0004.

7.2. CODES, STANDARDS, REGULATIONS, AND PROCEDURES

AP-ENG-006 Revision 1 ICN 0, *Total System Model (TSM) - Changes to Configuration Items and Base Case*. Washington, DC: U.S. Department of Energy Office of Civilian Radioactive Waste Management. ACC: Submit to RPC.

8. ATTACHMENTS

The files in the table below are included electronically. The file dates in the table are the time the file was finalized for the attachment to this validation. Size for files in .zip files is as zipped.

Table 3. Electronic Attachments

Files Name	Description	Size (kB)	Date
Calvin_2k.mdb	Access database used by Calvin for many of the inputs in TSM. File "Copy of Work_03V3.1Tslcc03.mdb" provided by BSC 12-23-03.	6,036	9/30/04
RE Route Questions.txt	"Route Questions" Email from R. Best (BSC) to S. Turner (SAIC), August 18, 2004 Used for the route bases.	8	6/16/2006
FW Route Questions.txt	"Route Questions" Email from R. Best (BSC) to S. Turner (SAIC), August 23, 2004. Used for the route bases.	10	6/16/2006
FW Humboldt Bay and Beaver Valley Intermodal.txt	Email from R. Best (BSC) to S. Turner (SAIC), February 17, 2005 Used for the route bases.	2	8/30/2006
ec_n15.prn	"INTERLINE Input File Name: ec_n15.prn" Provided by R. Best (BSC) to S. Turner (SAIC), May, 2004 via hand delivery. Used for the route bases.	836	8/1/2000
ec_n15b.prn	"INTERLINE Input File Name: ec_n15b.prn" Provided by R. Best (BSC) to S. Turner (SAIC), via email August 23, 2004. Used for the route bases.	873	8/23/2004
belt_1.prn	"HIGHWAY Input File Name belt_1.prn" Provided by R. Best (BSC) to S. Turner (SAIC), May, 2004, via hand delivery. Used for the route bases.	1218	1/16/2001
Appendix B_Rail distances by node_7_20_07.xls	Node to Node distance comparison for rail.	426	7/20/2007
Truck Details_Appendix Cd_9-4-06.xls	Node to Node distance for trucks There is an updated file for this.	57	9/4/2006
Barge and HH_Appendix Dd_6_21_06_revd_8_31_07.xls	Time step calculation for Barge and HH.	397	8/31/2006
Appendix E_V6 Connector Timing.xls	Documentation of time steps used in TSM.	306	7/24/2007
Appendix F_statelines_7_20_07.xls	Comparison of number of state lines crossed for truck and rail.	66	7/20/2007
App. G TimeTesting_comparison_7_26_07_slr.xls	This spreadsheet compares the different versions (V4.0 in 7.0, V4.0 in 7.1, V5.0 in 7.1, and V6.0 in 7.1) to show the consistence in the transportation route timings (i.e., timing tests with pauses). Do not activate links.	434	7/26/2007
TSM_V4.0_timetesting_7.0.zip RUN FILE Containing:	Time testing with pauses to verify timing on routes. (TSM V4.0 in 7.0) File contains model.	8,557	7/13/2007

Files Name	Description	Size (kB)	Date
TSM_V4.0_timetesting_7.0.SIM		98,060,288	6/11/2007
IS_timetesting-060707.xls	The Initial State file used for the Time Tests with Pauses	4,077	6/11/2007
TSM_V4.0_8_25_06_timetesting_6_8_07_in_7.1.zip RUN FILE including:	Time testing with pauses to verify timing on routes. (TSM V4.0 in 7.1) File contains model.	8,400	7/13/2007
TSM_V4.0_8_25_06_timetesting_6_8_07_in_7.1.SIM		98,093,568	6/11/2007
TSM_V5.0_71_timetesting.zip RUN FILE including:	Time testing with pauses to verify timing on routes. (TSM V5.0 in 7.1) File contains model.	8,562	7/13/2007
TSM_V5.0_71_timetesting.SIM		101,873,152	6/22/2007
TSM_V6.0D7_71_timetesting.zip RUN FILE including:	Time testing with pauses to verify timing on routes. (TSM V6.0 in 7.1) File contains model.	8,325	7/24/2007
TSM_V6.0D7_71_timetesting.SIM		96,649,728	7/23/2007
TSM_V4.0_timetesting_7.0.zip RUN FILE including:	TSM Version 4.0 run in 7.0. Includes .simdata file, .mdb file, and model	8,557	7/13/2007
TSM_V4.0_timetesting_7.0.SIM		98,060,288	6/11/2007
TSM_V4.0.simdata		1,388,544	6/11/2007
TSM.mdb		479,232	6/11/2007
TSM_V3.0G7_25B_Timing Test 060807.zip (Cycle Time) RUN FILE including:	TSM Version 4.0 run in 7.1. Includes .simdata file, .mdb file, model and IS	22,551	6/8/2007
TSM_V3.0G7_25B.simdata		73,703,424	6/8/2007
TSM_V30G7_Scn25B_8_23_05-Process Time 1.SIM		97,501,184	6/8/2007
TSM_25B.mdb		89,821,184	6/8/2007
IS_WO_V3.0G_TAD_Scn25B_DOE_082205.xls		8,348,160	8/23/2005
TSM_V5.0_71_timing 1.zip (Cycle Time) RUN FILE including:	TSM Version 5.0 run in SimCAD™ 7.1. Includes .simdata file, .mdb file, and model	19,395	6/18/2007
TSM_V5.0_71_timing 1.simdata		68,927,488	6/14/2007
TSM.mdb		28,741,632	6/14/2007
TSM_V5.0_71_timing 1.SIM		102,010,368	6/14/2007
TSM_V6.0D8B_71_timetest_step1_7-25-07pm.zip	TSM Version 6.0 run in SimCAD™ 7.1. Includes .simdata file, .mdb file, model, IS, and .xml	16,120	7/25/2007
TSM_V6.0D8B_71_timetest_step1.SIM		47,939,072	7/25/2007
IS_WO_V3.0G_TAD_Scn25B_DOE_082205.xls		8,348,160	8/23/2007
TSM.mdb		38,670,336	7/25/2007
Tsm_v6.xml		2,188	7/25/2007
TSM_V6.0D7_71.simdata		62,042,112	
TSM_V30J2_Scn29B_russ_082605.zip RUN FILE Containing:	Appendix H TSRG validation. The run file used for TSRG validation..	39,940	8/26/2005
TSM_V3.0J2_Scn29B.simdata	Simdata file to assess shipments.	177,737,728	8/26/2005
IS_Scn29B_LE104_DOE_WO_082205.xls	Initial State file	8,376,320	8/23/2005

Files Name	Description	Size (kB)	Date
TAD_Study Setup_Sheet29B.doc	Setup sheet for run	25,088	8/23/2005
TAD_Throughput.xls		2,230,272	8/26/2005
TSM_Scn29B.mdb	.mdb file for run	87,822,336	8/26/2005
TSM_V3.0J_Scn29B.simdata	.simdata file for run	177,737,728	8/26/2005
IS_Scn29B_LE104_DOE_WO_082205 for checking generator with pivot.xls	Pivoted IS file to assess shipping tons.	5,819	5/15/2007
App. H TSRG Val notes.pdf	Appendix H TSRG validation. Hardcopy manual checks (scanned in) of TSM Transportation Shipment Report Generator_with ref mods_TSRG 012507_TestingJ2_Scn29b.xls worksheets: 5. Shipment State-Rail 6. Shipment State-Truck Sheet Ref Rail State Sheet Ref Rail City	2,463	8/30/2007
TSM Transportation Shipment Report Generator_with ref mods_TSRG 012507_TestingJ2_Scn29b.xls	Preliminary TSRG workbook used for manual file above	617	1/26/2007
TSM Transportation Shipment Report Generator__Scn29b_08_22_05_Gen 110806.xls	Preliminary TSRG workbook used for manual file above	603	11/13/2006
TSM Transportation Shipment Report Generator_050807_validation.xls	Primary workbook used to validation TSRG	4,903	5/22/2007
TSM TSRG_1-5_050807.zip	TSRG validated	191	5/9/2007
TSM Transportation Shipment Report Generator.xls	Generator	705,024	5/8/2007

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APPENDIX A
TSM TRANSPORTATION MAPS AND PROCESSES

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APPENDIX A

TSM TRANSPORTATION MAPS AND PROCESSES

This appendix shows screenshots from the TSM V4.0, V5.0 and V6.0 for the transportation module “maps” with the LWT and rail routes. Barge and heavy haul sites are also shown. These are presented approximately in sequence for cask motions as the cask pass through the simulation.

The screenshots in this appendix may have small differences from the current version of the TSM as screenshots are not updated in updates of the validation report if the changes for the current version are minor. It is suggested that the current TSM be opened and used to see the current details.

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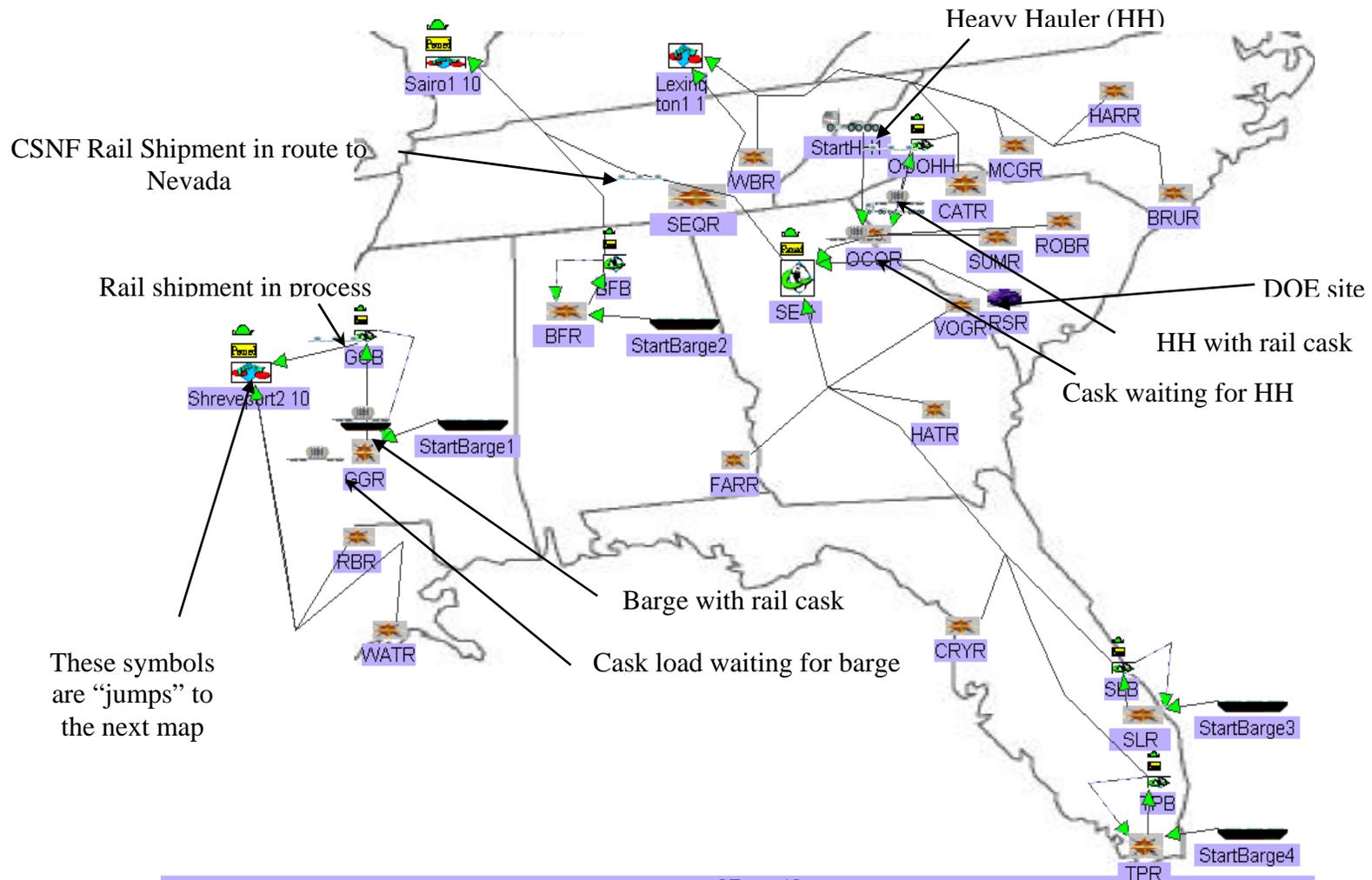


Figure A-1. Typical Transportation Department Map

This map shows the visual indicators for the status of the transportation resources and elements during a run. The lines connecting the sites have information on the distances between the nodes and with the associated vehicle speed are used to estimate transit times. Waste Sites are given by 3 or 4-letter identifiers.

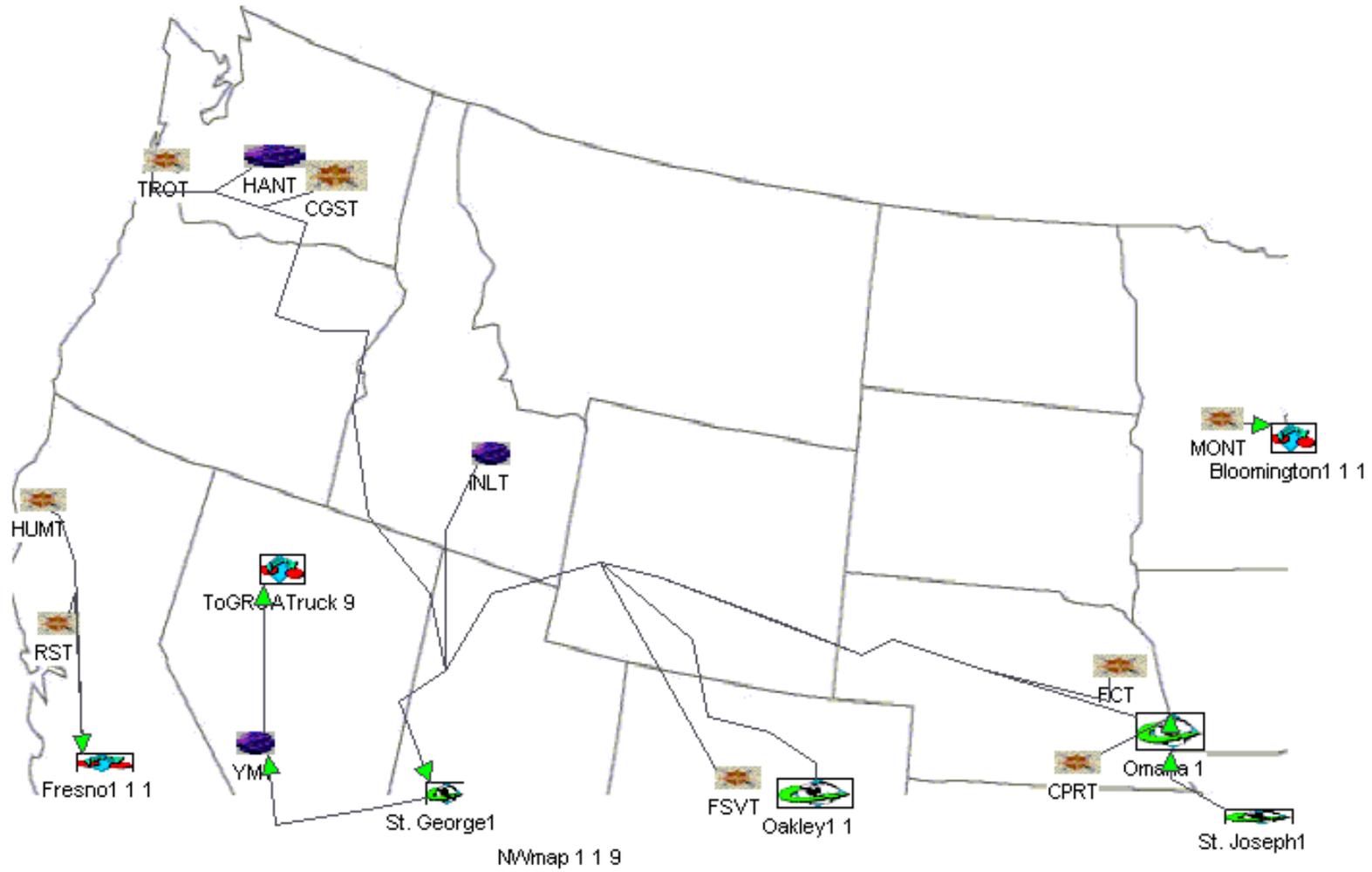
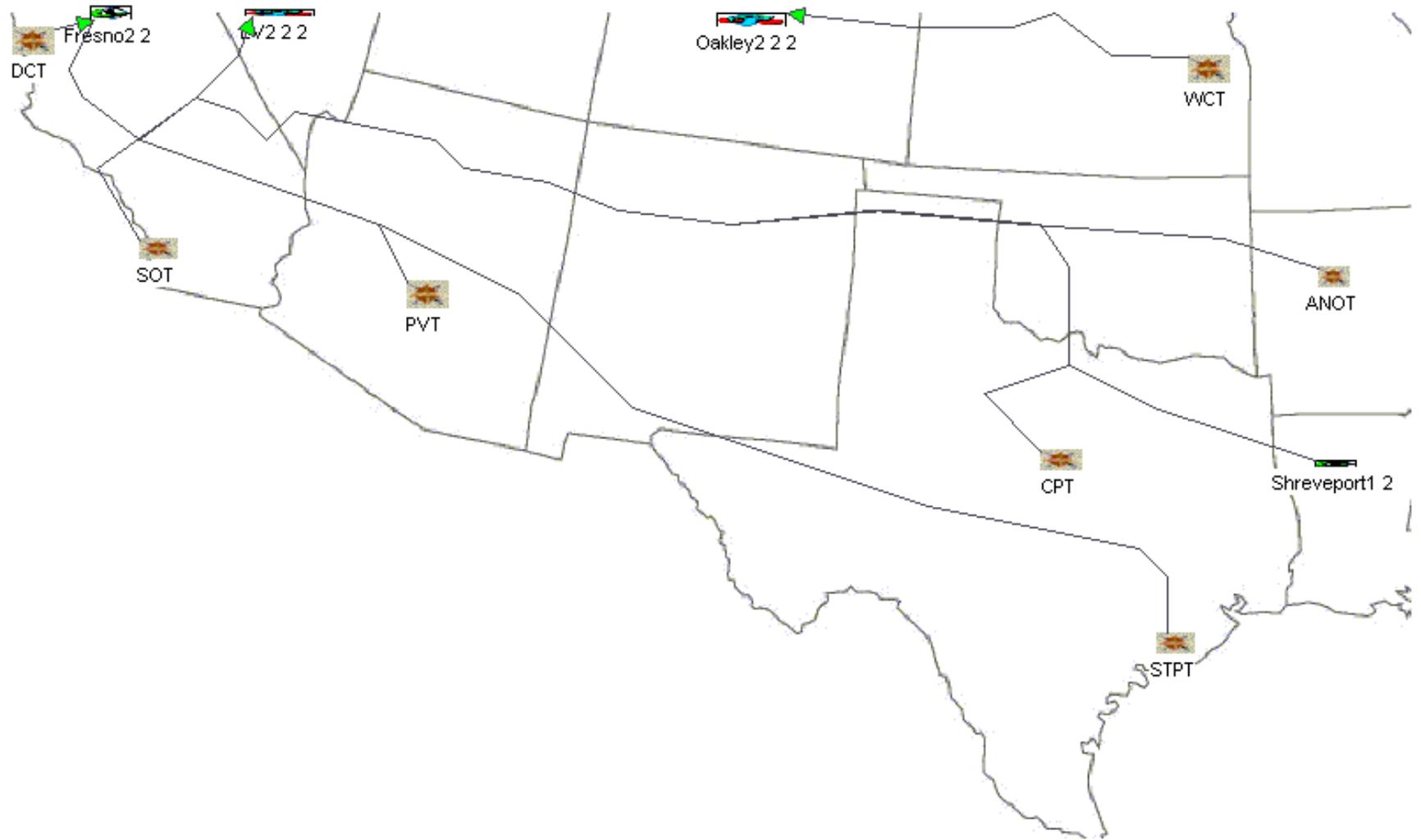


Figure A-2. Truck Northwest Routes

All truck shipments are eventually routed to the “YMT” process where the “truckshipment” objects jump to the main TSM GUI process “GROATruckDepot”.



SWmap 2 2 10

Figure A-3. Truck Southwest Routes

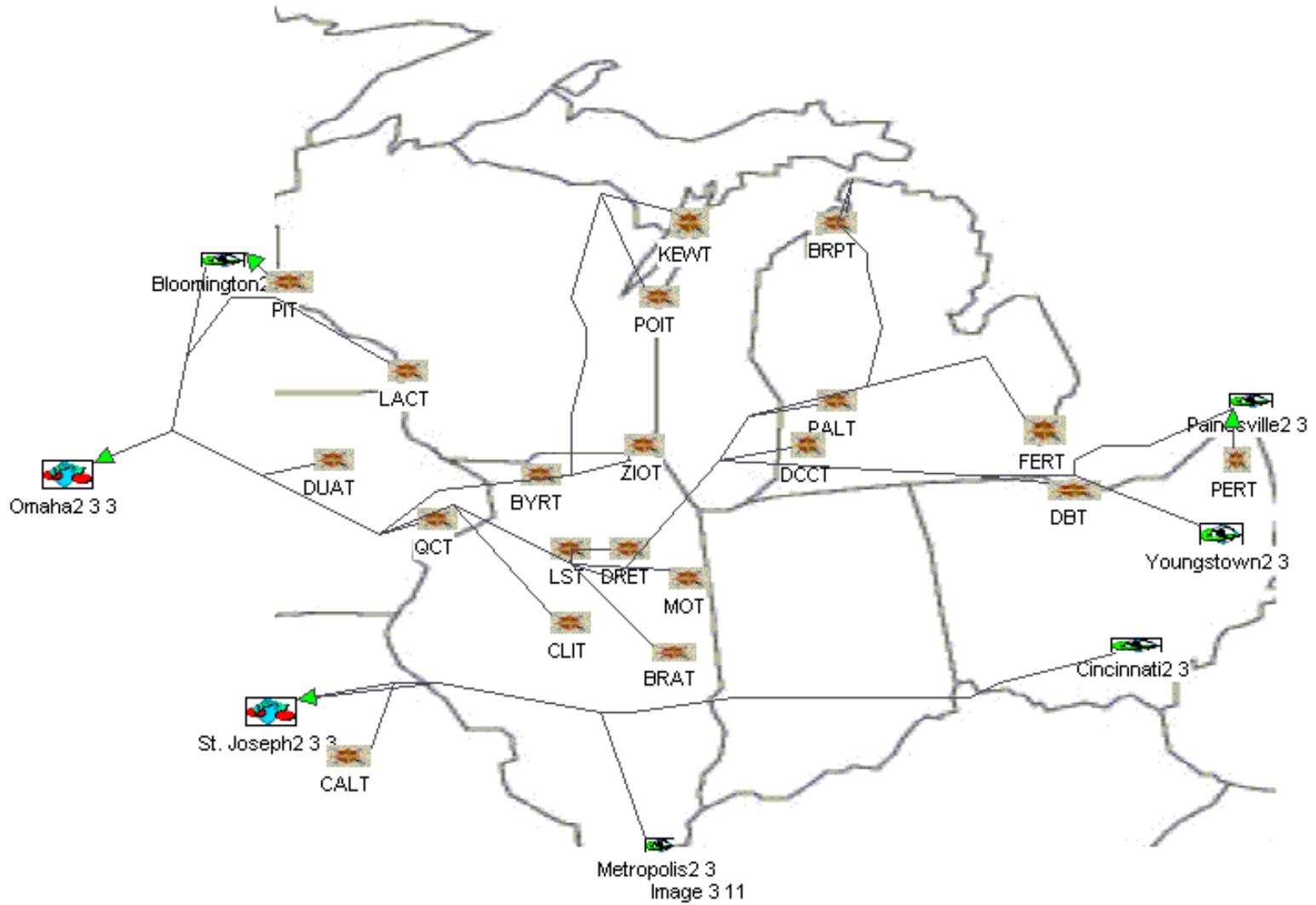
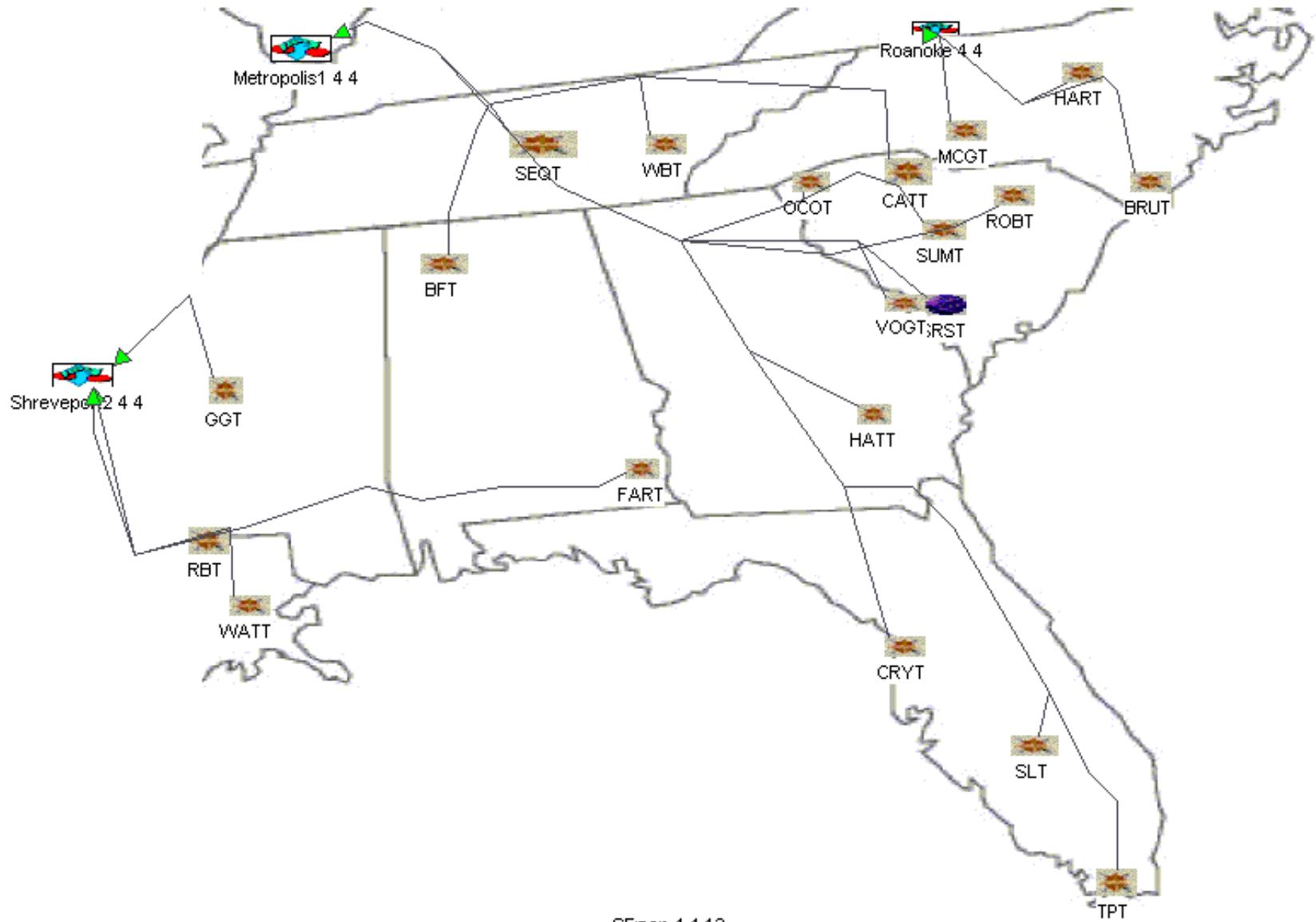


Figure A-4. Truck Midwest Routes



SMap 4 4 12

Figure A-5. Truck Southeast Routes

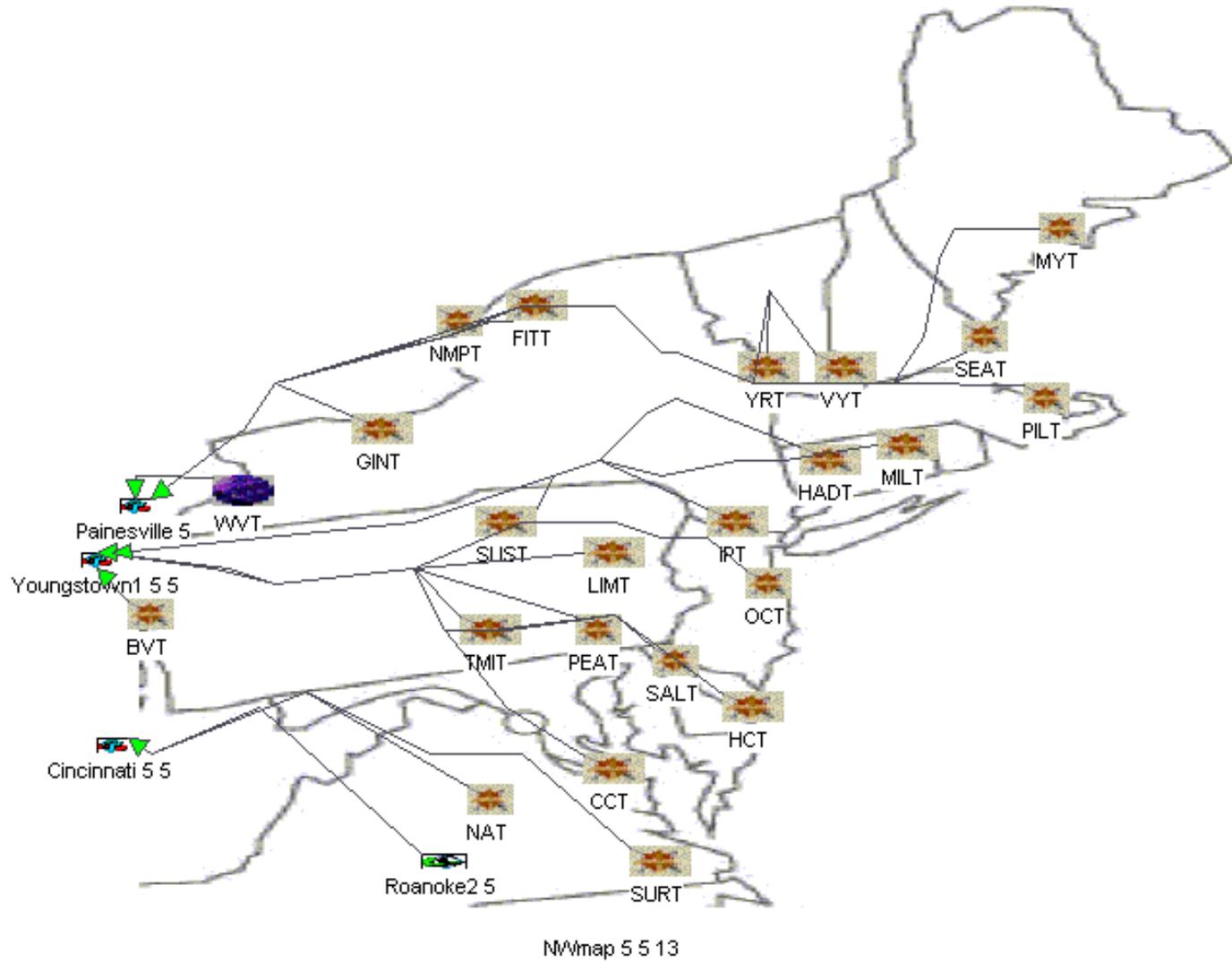


Figure A-6. Truck Northeast Routes

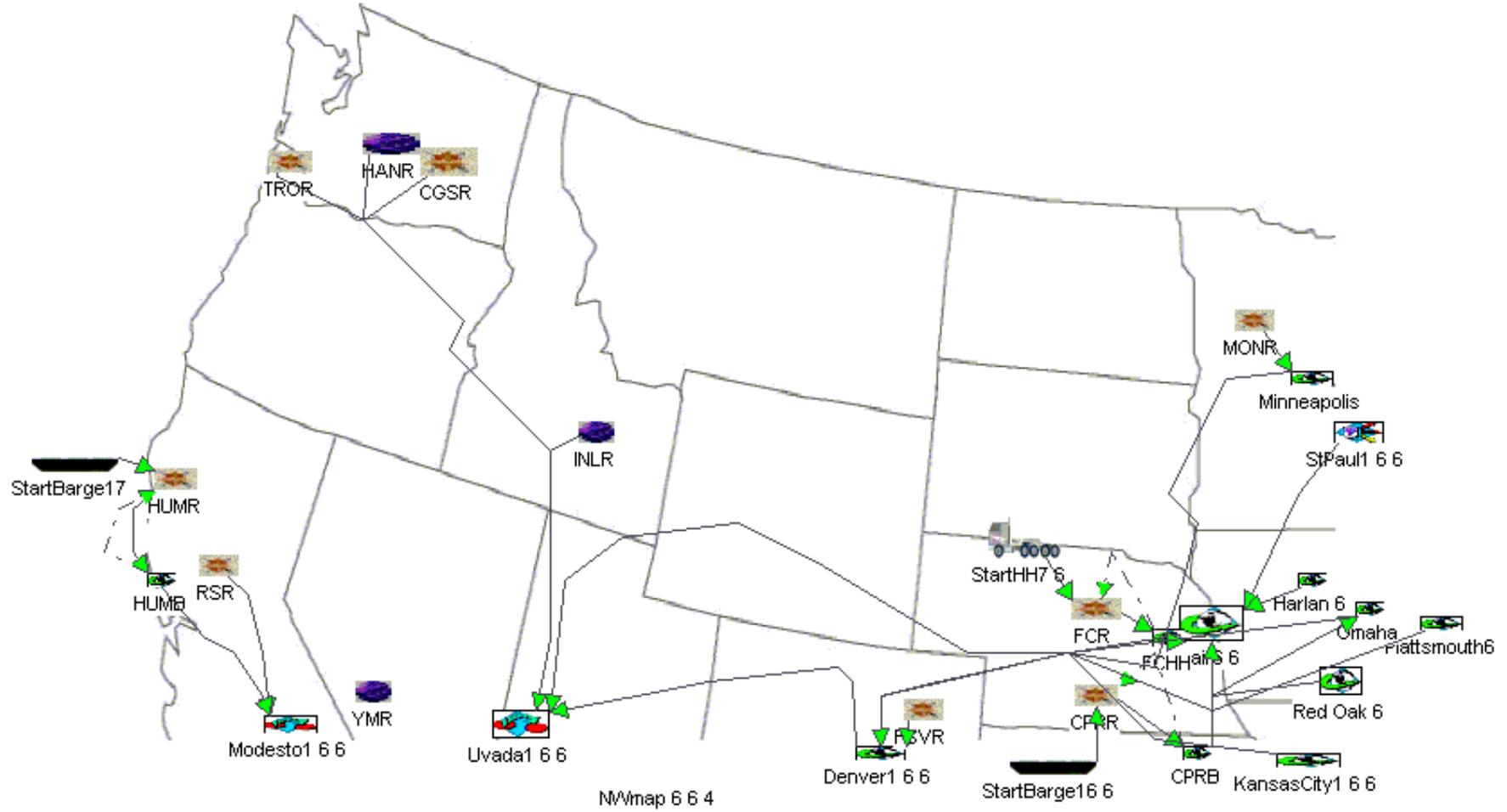
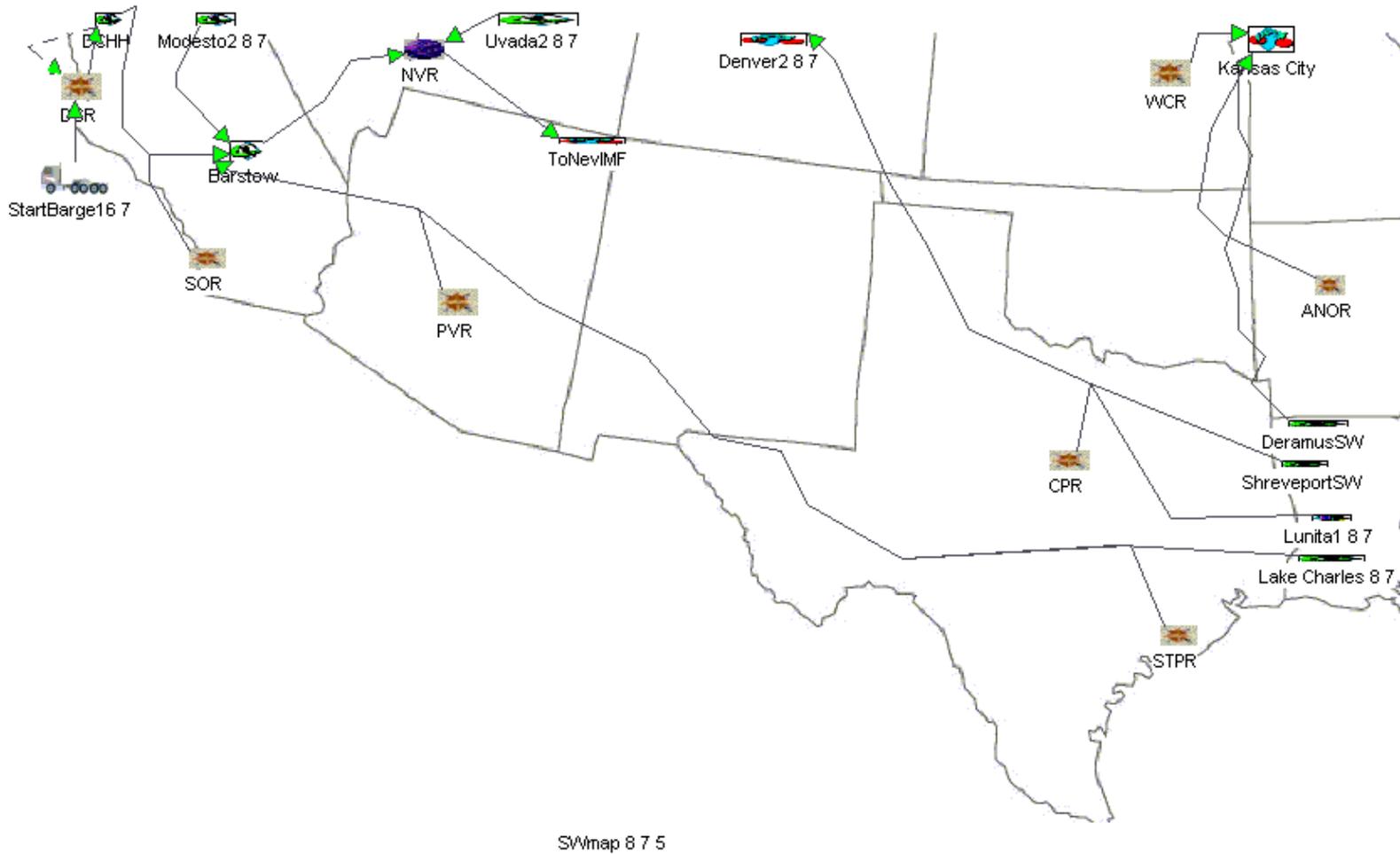


Figure A-7. Rail Northwest Routes

The repository “YMR” is shown to provide a landmark but is not an active process. For rail shipments, the jump from the rail routes to the main TSM GUI is in the Southwest rail map.



SWmap 8 7 5

Figure A-8. Rail Southwest Routes

All rail shipments are eventually routed to the “NVR” process where the “railshipment” objects jump to the main TSM GUI process “IMFDepot” process.

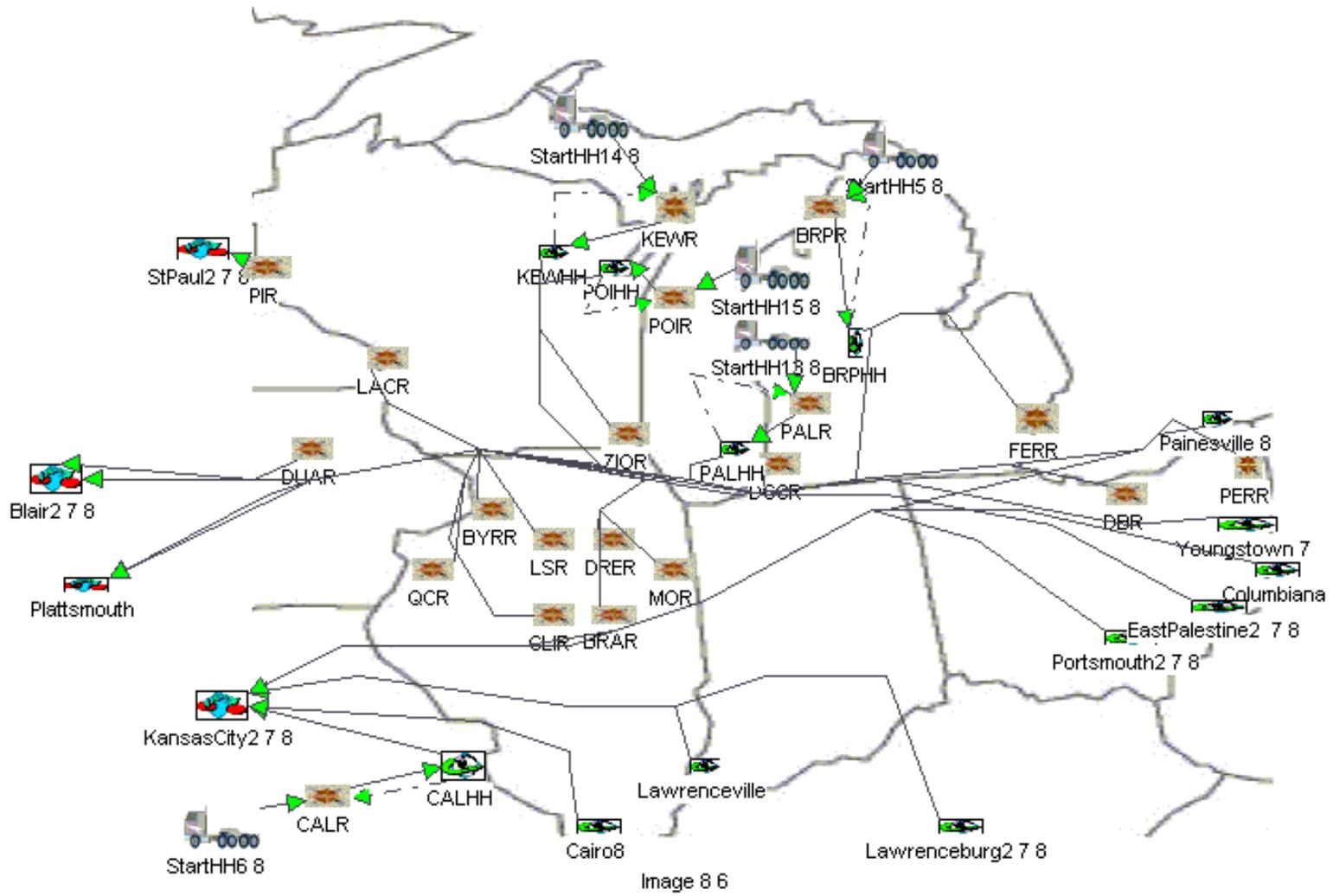


Figure A-9. Rail Midwest Routes

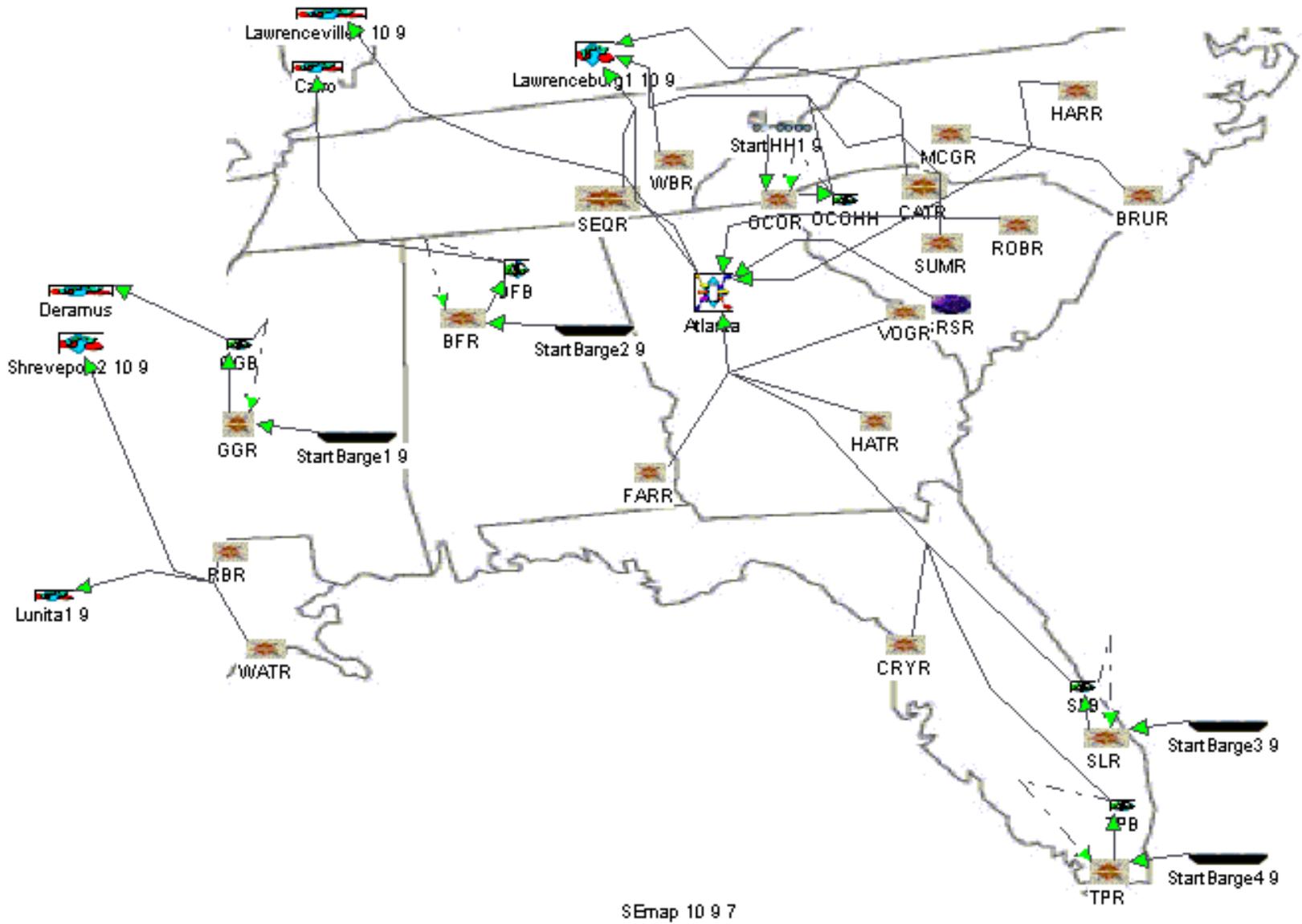


Figure A-10. Rail Southeast Routes

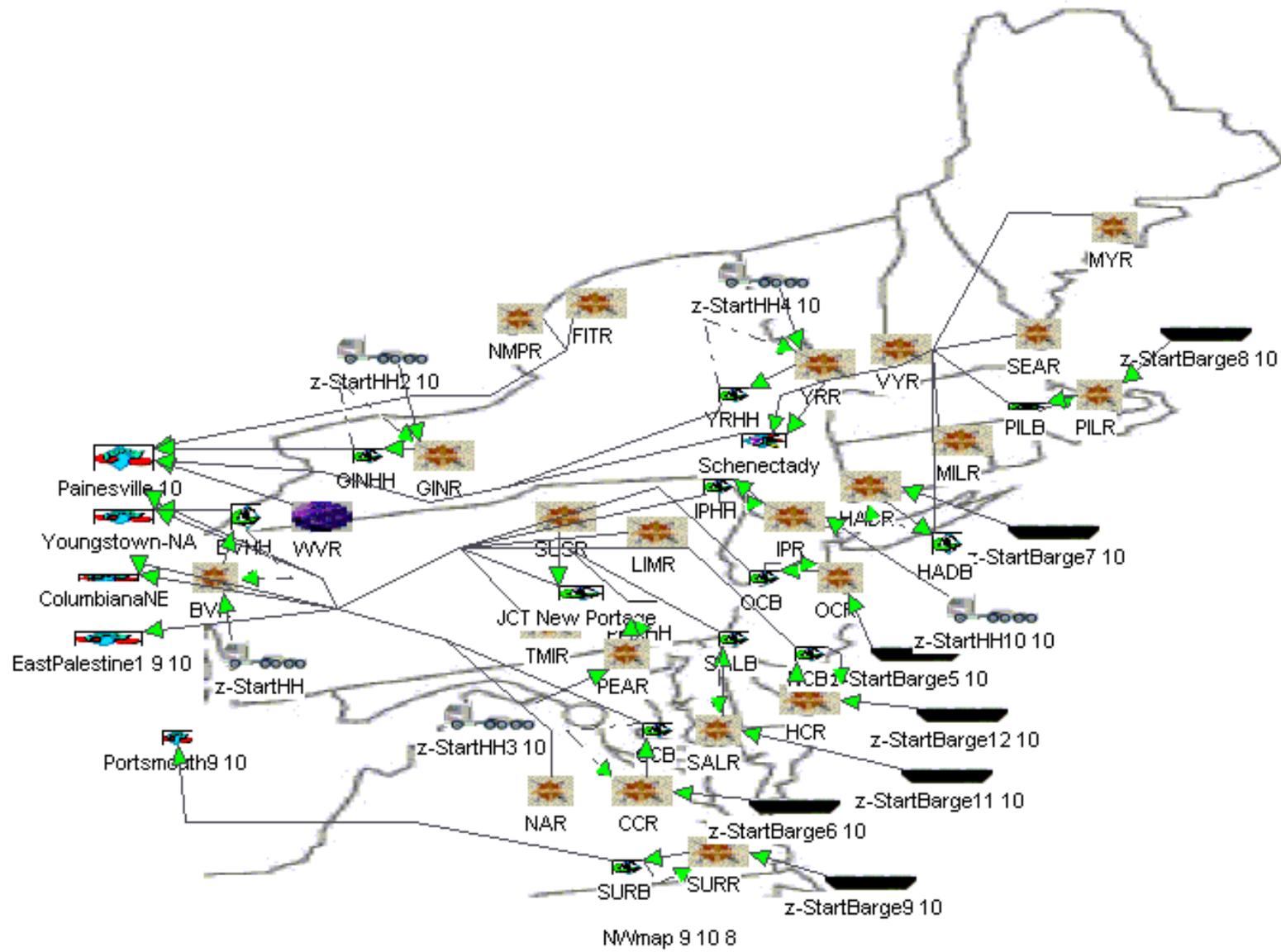


Figure A-11. Rail Northeast Routes

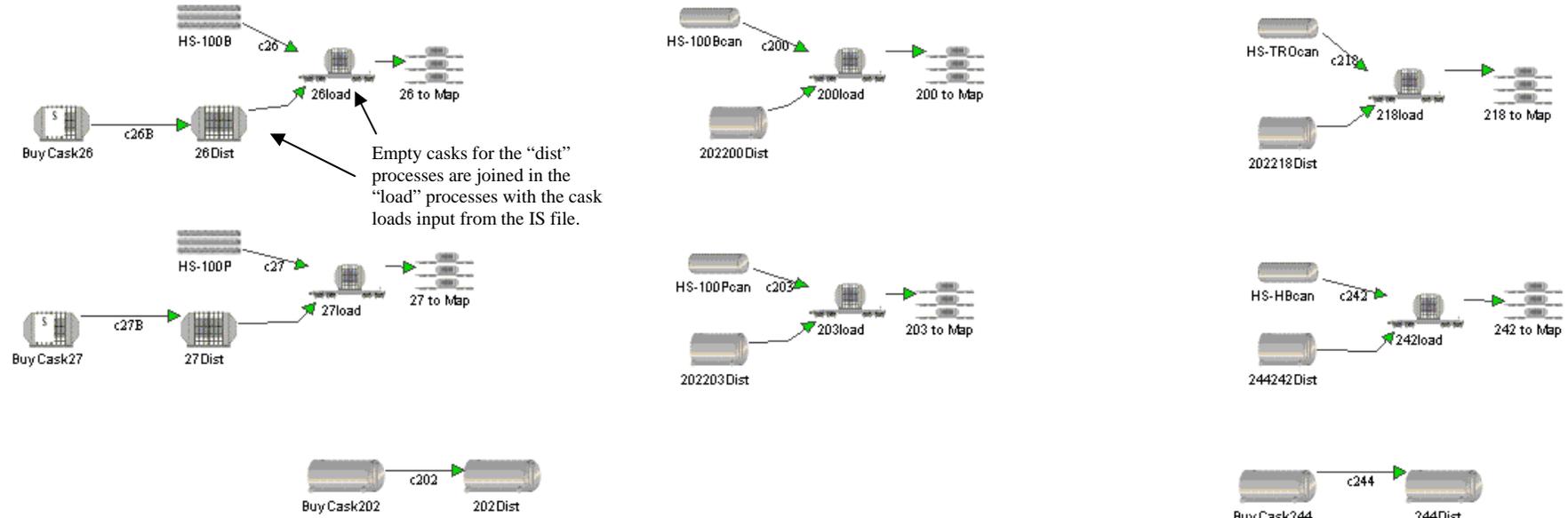


Figure A-12. HiStar Department

This figure shows the HiStar cask allocation department with 2 types of bare fuel baskets, 4 types of DPCs and 2 types of overpacks (shells). All baskets and cans except the HS-HBcan use shell 202. The SimCAD™ triggers (events and auto events) control the calls or "triggers" for the shells and the allocation. See Reference BSC 2007a for more details on the trigger actions.

The bare fuel load arrives at the upper processes in the left most column (such as HS-100B) and initiates the trigger sequence to call a basket (Cask 26 for the HS-100B) and an overpack (in this case Cask 202). If no basket or can is available, the call is deferred until the basket or can is available else the overpack would be unnecessarily allocated for a shipment that is not ready to ship. Notice that bare fuel processes use a "basket" (such as cask 26 and 27) that is purchased by OCRWM.

For DPC cans (the two right columns), the DPC is joined with the shell to make the cask load. In the DPC cases, the utility has purchased the DPC and OCRWM has purchased the Cask 202 or 244 overpacks so no "buy" processes are needed for the DPC. Other cask allocation departments have similar structure and actions.

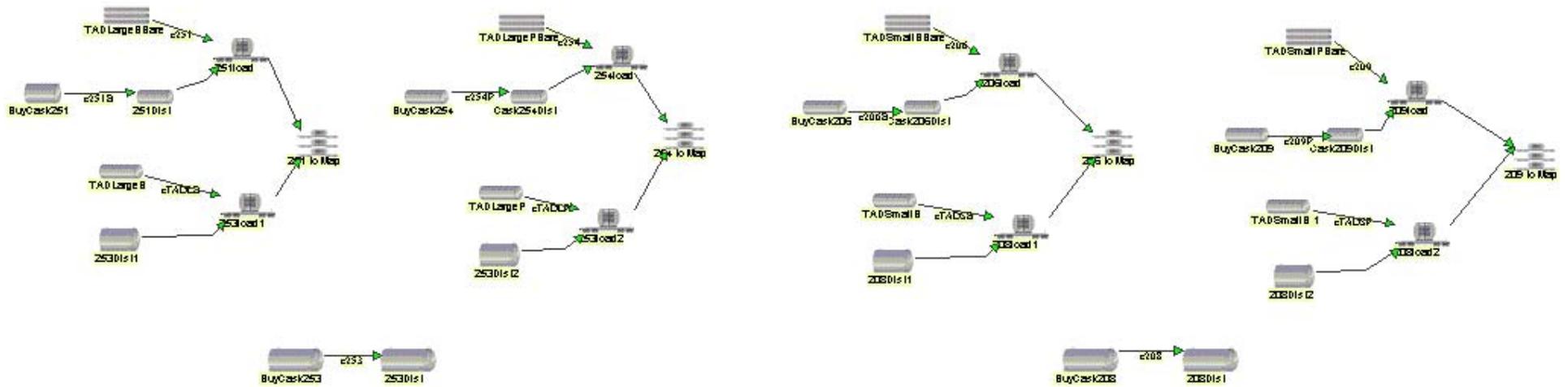


Figure A-13. TAD Department

This figure shows a TAD department. In the upper processes, bare fuel picked up from a pool is placed in a TAD canister that is purchased by OCRWM. Therefore, unconstrained “buy” processes are included. In the lower processes, the TAD cask loads are from storage and the TAD canister is purchased by the utility.

In all processes, overpacks are allocated to make the cask load that is sent to the map to simulate transportation to the GROA. In this case, the same overpack Cask 253 is used for all large TAD canisters and Cask 208 is used for all small TAD canisters. For TAD canisters only the overpacks (shells) are returned for reuse.

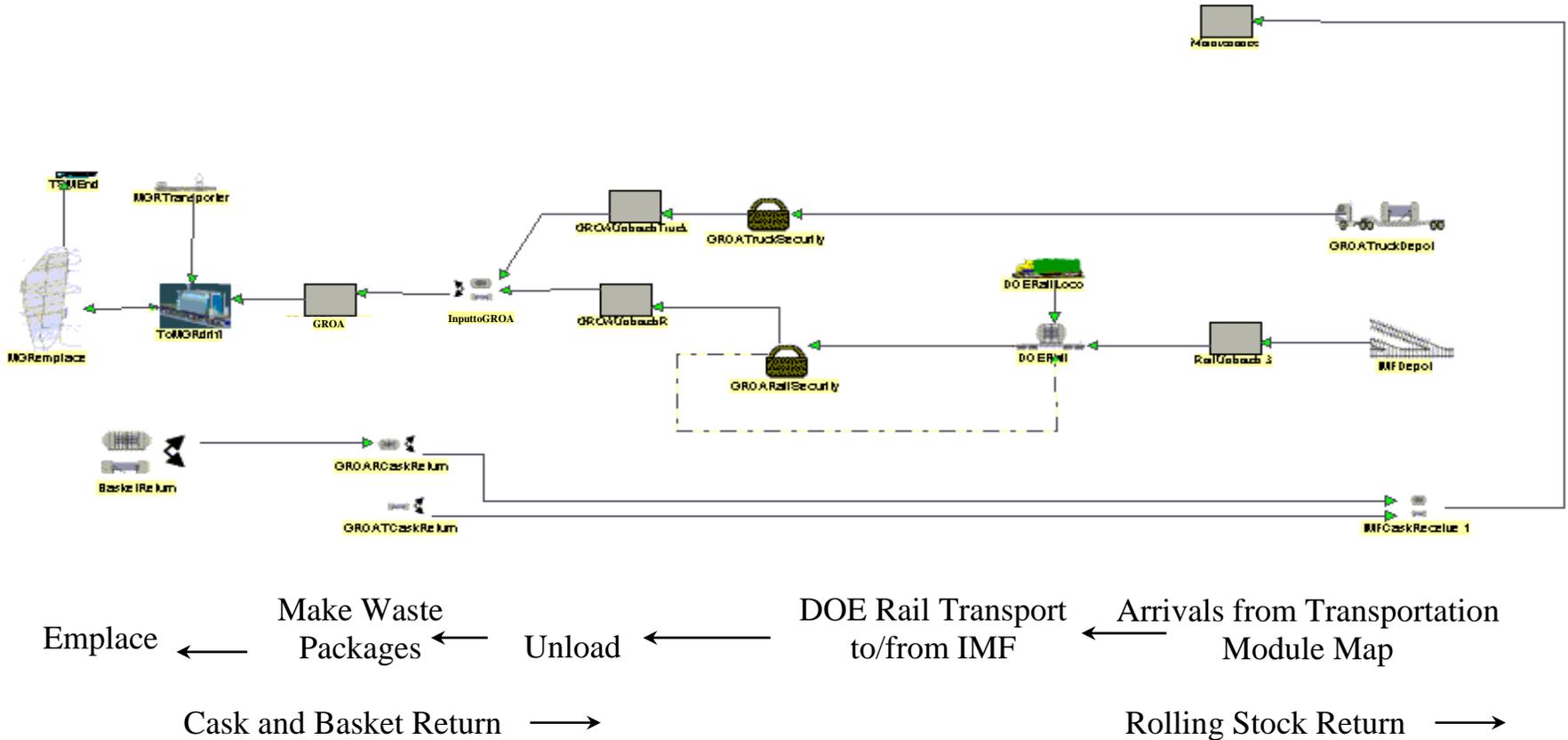


Figure A-14. Transportation Interfaces at Repository

The repository module includes the final transportation to the GROA. On receipt of rail shipments at the Nevada Intermodal Facility (“IMFDepot”), the shipments are placed on the DOE Rail for delivery to the GROA. Rolling stock is returned. For rail there are two departments that unbatch and route objects to the GROA. Truck shipments require only 1 department along this path. The TruckUnbatch and RailUnbatch departments have “Cask Hold” processes discussed in Figures A-15, A-16, and A-18. The detailed logistics cask handling aspects for the GROA are shown in Figure A-19. Cask maintenance logistics in the Maintenance Department (upper right of this figure) is discussed in Figure A-20.

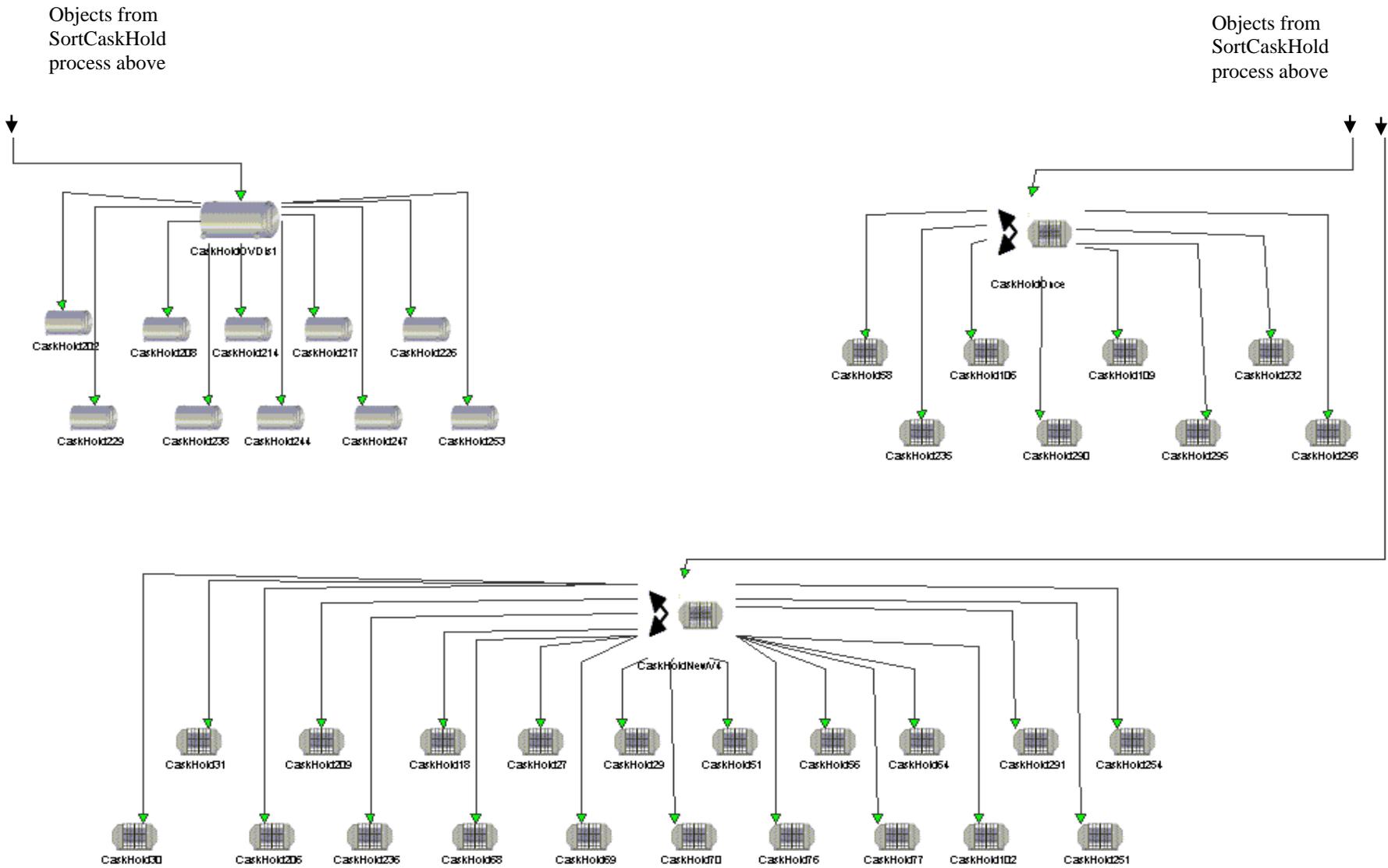


Figure A-16. Repository Module: Rail Unbatch Department Continued

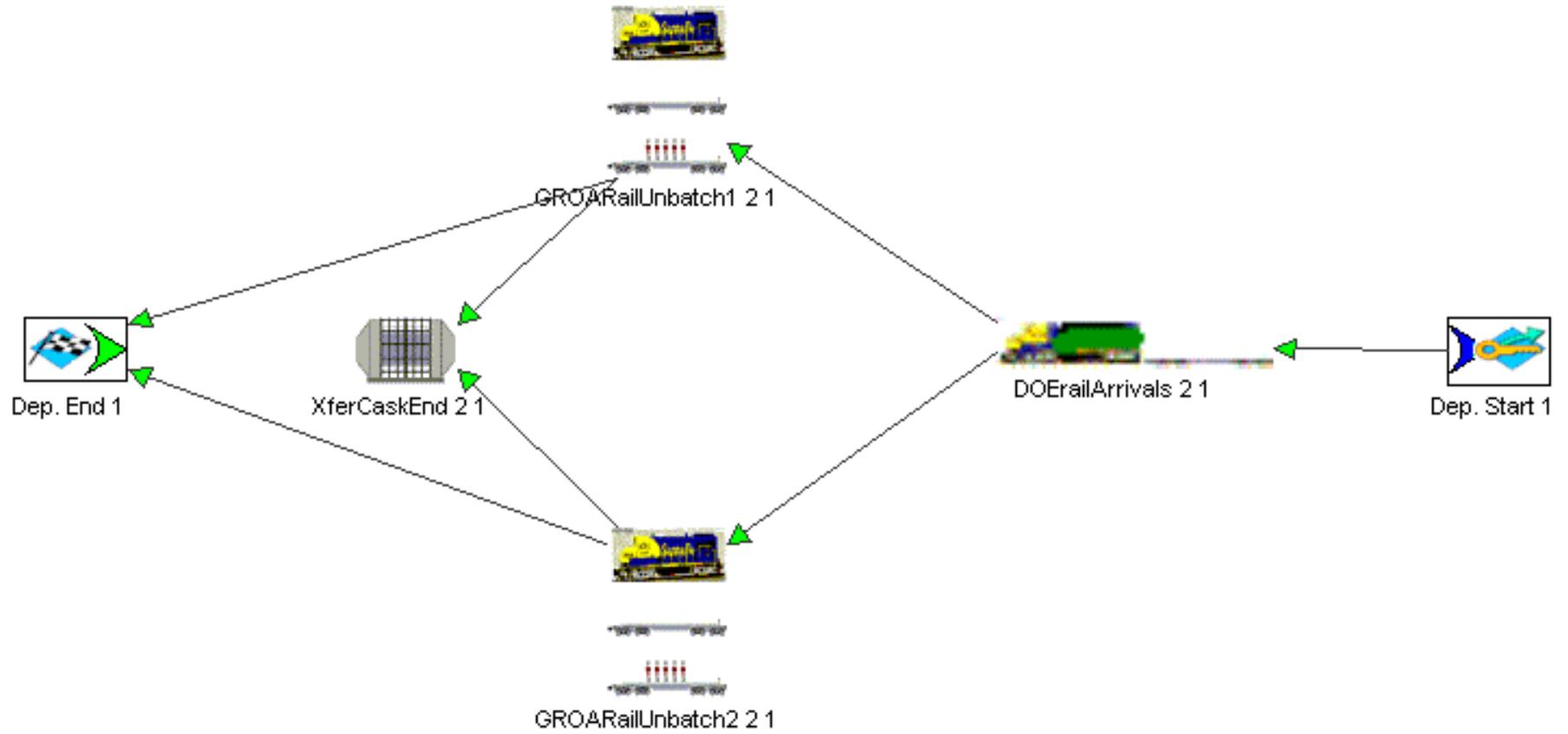


Figure A-17. Repository Module: GROAUnbatchR Department

A second rail unbatch department is used to unbatch the “xfercask”, destroy the “xfercask” object, and send the waste cask load to the GROA via the TCRRF input process.

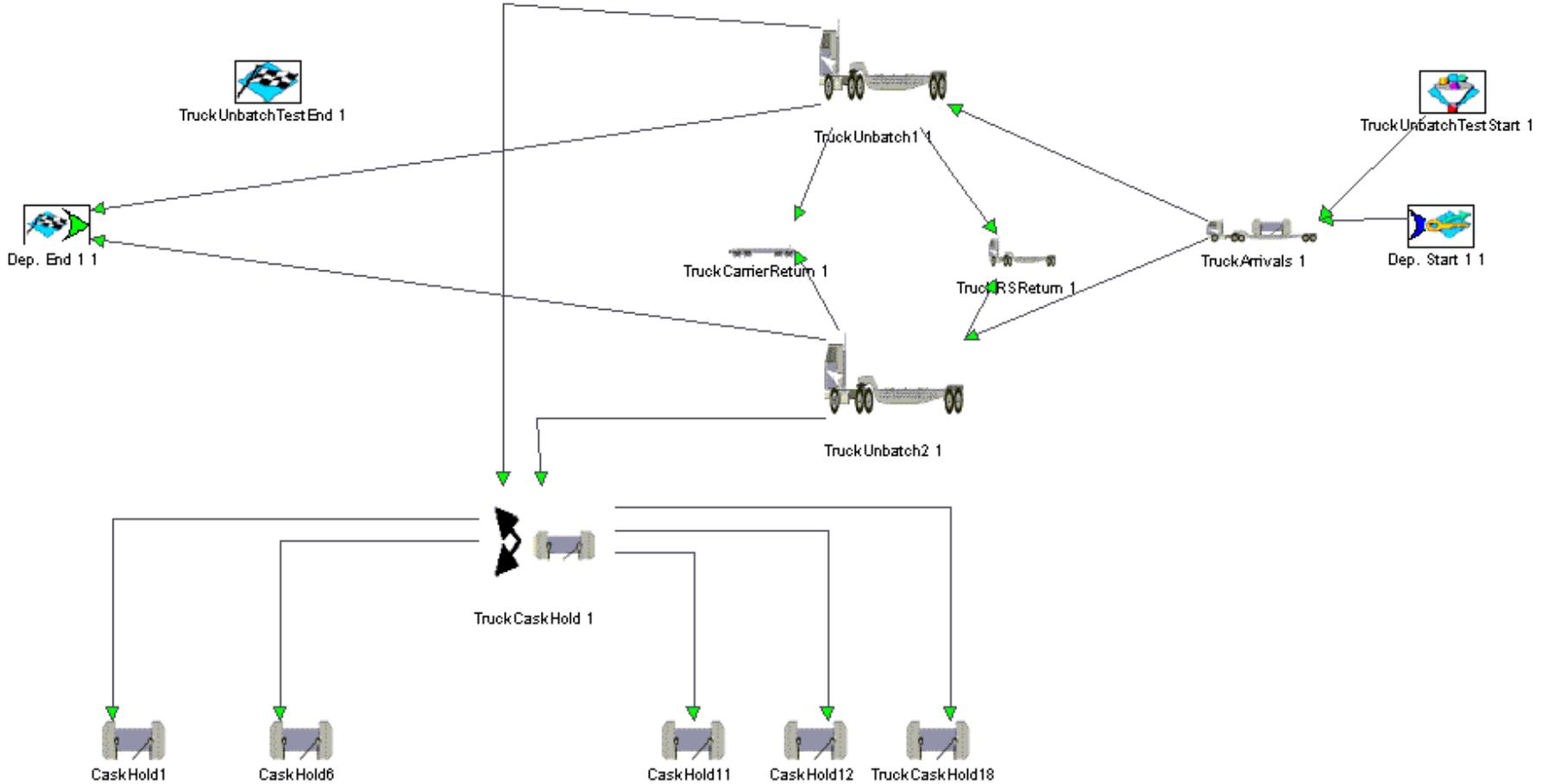


Figure A-18. Repository Module: Truck Unbatch Department

After arrival at the repository, the truckshipment objects are unbatched and the constituents are appropriately routed. Rolling stock is returned via jumps; casks are placed in “caskhold” functions to await a trigger after the fuel is processed in the GROA; and the waste object is sent to the GROABlending department via the TCRRF input.

Transportation casks from the surface facilities are returned here via a jump.

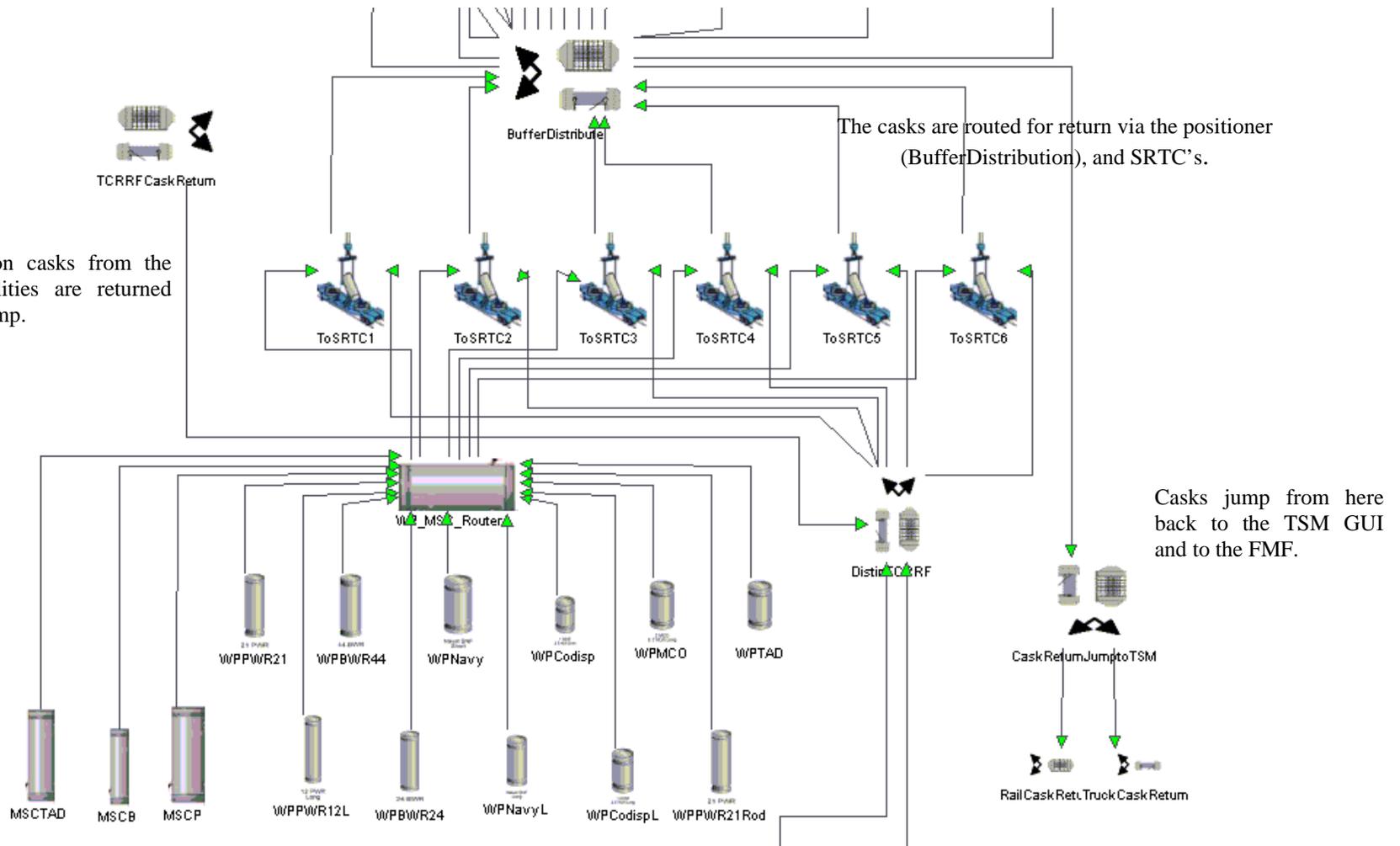


Figure A-19. Repository GROA: Cask Return TSM V4.0, V5.0

After unloading at the transfer facilities, the transportation casks from the surface facilities are returned. The returning casks are jumped from the CaskHold processes to the TCRRF Cask Return process in the upper left. The returning cask typically proceeds via the positioner and the SRTC's to be returned to the FMF in the main TSM GUI via the RailCaskReturn and TruckCaskReturn jumps in the lower right. Casks returning from FHF bypass the positioner and SRTC's.

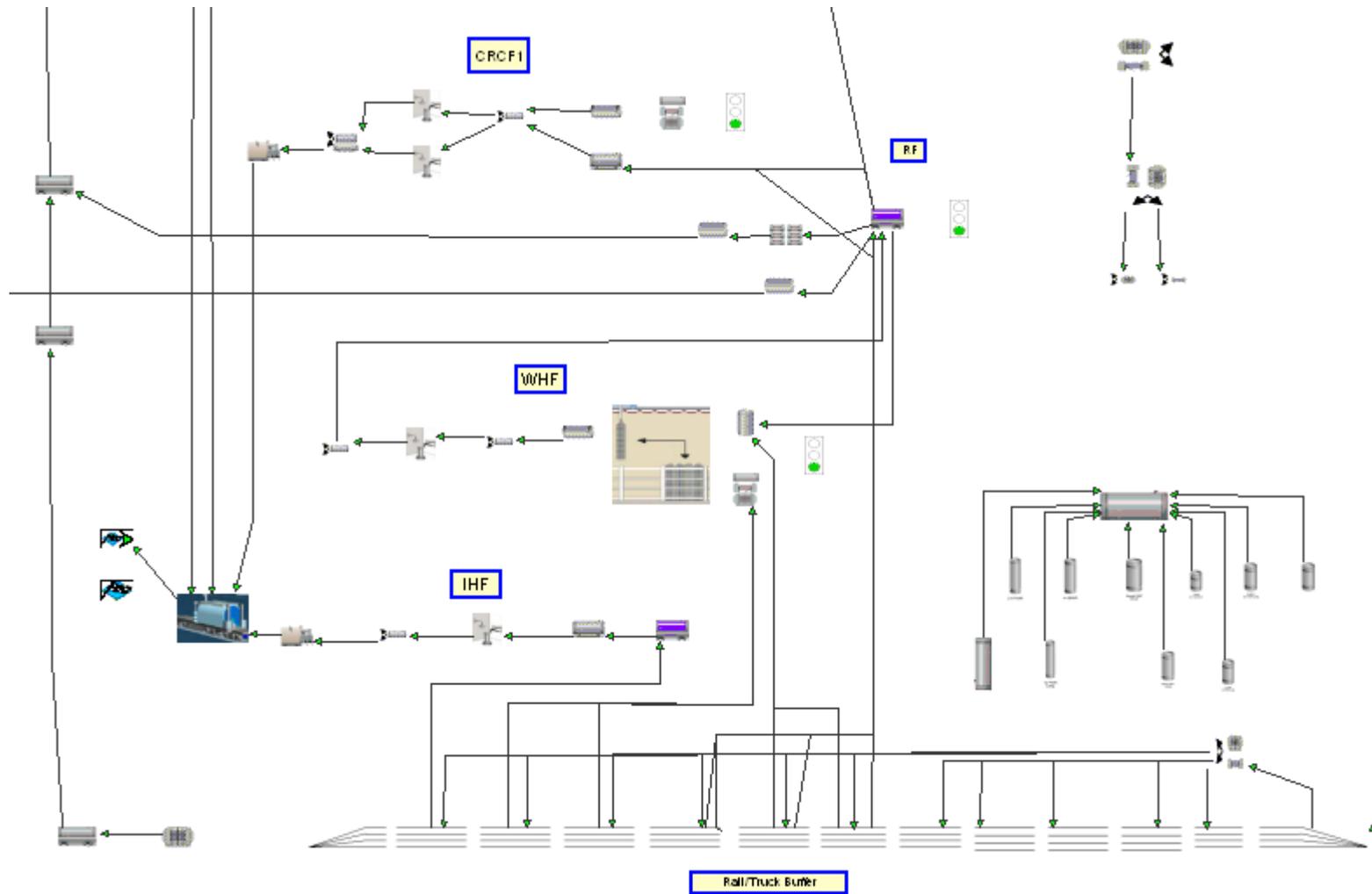


Figure A-20. Repository GROA and Cask Return TSM V6.0

The cask return in the revised GROA design does not pass through the SRTC that have been removed from the design. The cask return only involves the jump processes in the upper right. This reduces the cask cycle times in Version 6.0 as shown in Tables 1 and 2.

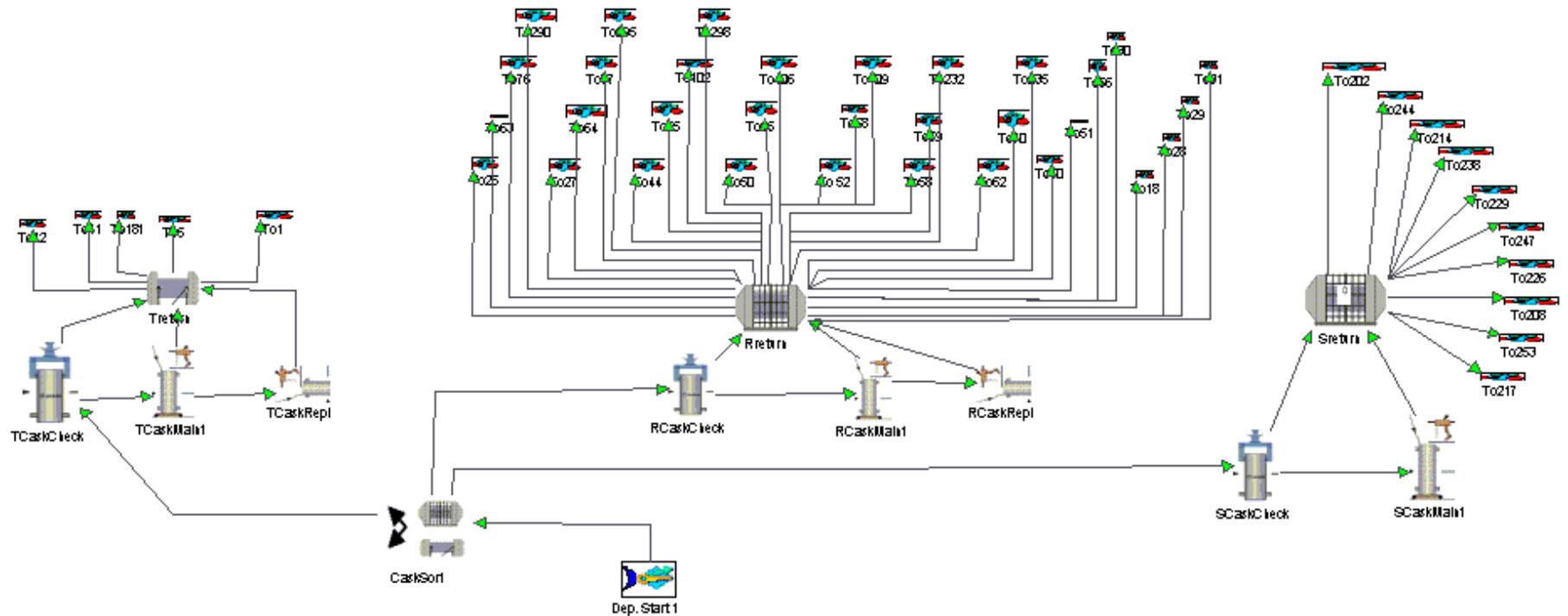


Figure A-21. Cask Maintenance

Empty casks are returned from the GROA to the “Maintenance” department on the main GUI. Casks are sorted by truck (T), rail or basket (R) and shell/overpack (S). The need for cask maintenance (based on time or number of trips) is assessed in the “CaskCheck” processes. In the CaskMaint processes, T and R casks more than 25 years old are sent to a “CaskRepl” process for major overhaul. After maintenance, the casks are returned to the “dist” processes in the cask allocation departments for reuse by the multiple jumps at the top of this department. The “dist” processes are shown in Figure A-13.

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APPENDIX B
RAIL DISTANCES

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APPENDIX B RAIL DISTANCES

This appendix contains the output of the EXCEL file “Appendix B_Rail distances by node_7_20_07.xls. (Modified Rail Connectors) as discussed in Section 5.2.1. For sites that have been changed from barge to heavy haul or heavy haul to barge, the assumption was made that the railhead remained the same when other data was not available.

This appendix lists each rail site and node-to-node or connector details of the rail route from the sites to the Caliente railhead listed here and in the TSM as NVR. The sources of this data were provided by R. Best in ec_n15.prn, ec_n15b.prn and emails responding to route questions, see the referenced files in Section 8. Notes and comments provide additional information regarding the listed data.

Column A (FROM): Lists the starting point of each connector.

Column B (To): Lists the end point of each connector.

Column C (SPEED): Provides the rail speed in ft/sec. Table 2 of MIS-WAT-SE-000001 (BSC 2003a)

Column D (DISTANCE (FT)): This is the distance used in the TSM.

Column E (Time Step): The speed is converted to the number of feet that could be traveled in one time unit or 8 hours. The distance from Column D is divided by this number to determine the number of time units (8 hour increments) required to travel the point to point distance at the given speed. There are cases where time units rather than speed and distance are used in the TSM. For this comparison, the time units are converted to feet based on given speed for 8 hours or 1 time unit. This is shown in Column D.

Column F (Round Up): This column shows the time steps from Column E rounded up.

Column G (miles): The mileage between points based on the source is listed here. The source is identified below each site name.

Column H (feet): The mileage in column G is converted to feet for comparison.

Column J (source(Col H)-model(Col D)): This column shows the difference between the data provided in the Source and the actual mileage used in the TSM.

Column K (miles): Converts the feet in Column J to miles.

Column M (hours): Convert the feet in Column D to hours using the speed in Column C

Column N (hours): Converts the feet in Column H to hours using the speed in Column C

The final rows of the spreadsheet indicate the average difference in the TSM and FEIS distances based on the transit time using a constant transit speed. Both an absolute average and relative average are provided. The differences are $(M-N)/N$.

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A	B	C	D	E	F	G	H	I	J	K	L	M	N
Site Name	Big Rock Point			Note: Source miles based on using Petoskey rail node (electronic attachment FW Route Questions.txt)									
Source	ec_n15b.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
BRPHH	Blair2 7 8	35.2	4994880	4.93	5	946	4994880		0	0		39.42	39.42
Blair6 6	Uvada1 6 6	35.2	4055040	4.00	4	1288	6800640		2745600	520		32.00	53.67
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			11077440	10.93	11							87.42	93.08
												Model to Source diff	-6.1%
Site Name	Braidwood												
Source	ec_n15.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
BRAR	Blair2 7 8	35.2	2793120	2.76	3	529	2793120		0	0		22.04	22.04
Blair6 6	Uvada1 6 6	35.2	4055040	4.00	4	1287	6795360		2740320	519		32.00	53.63
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			8875680	8.76	9							70.04	75.67
												Model to Source diff	-7.4%
Site Name	Browns Ferry												
Source	ec_n15b.prn			Note: Source miles based on using Sheffield, AL rail node (Port for barge at Wilson L/D AL)									
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
BFB	Cairo	35.2	1161600	1.15	2	220	1161600		0	0		9.17	9.17
Cairo8	KansasCity2 7 8	35.2	2381280	2.35	3	451	2381280		0	0		18.79	18.79
KansasCity1 6 6	Uvada1 6 6	35.2	4055040	4.00	4	1414	7465920		3410880	646		32.00	58.92
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			9625440	9.49	11							75.96	86.88
												Model to Source diff	-12.6%

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Site Name	Brunswick												
Source	ec_n15.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
BRUR	Atlanta	35.2	2439360	2.41	3	462	2439360		0	0		19.25	19.25
Atlanta	Lawrenceville1 10 9	35.2	2629440	2.59	3	498	2629440		0	0		20.75	20.75
Lawrenceville	KansasCity2 7 8	35.2	2170080	2.14	3	410	2164800		-5280	-1		17.13	17.08
Kansas City1 6 6	Uvada1 6 6	35.2	4055040	4.00	4	1415	7471200		3416160	647		32.00	58.96
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			13321440	13.14	15							105.13	116.04
												Model to Source diff	-9.4%
Site Name	Byron												
Source	ec_n15.prn												
			model			Source			Difference (ft)				
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
BYRR	Blair2 7 8	35.2	2191200	2.16	3	415	2191200		0	0		17.29	17.29
Blair6 6	Uvada1 6 6	35.2	4055040	4.00	4	1287	6795360		2740320	519		32.00	53.63
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			8273760	8.16	9							65.29	70.92
												Model to Source diff	-7.9%
Site Name	Calloway								Note: Source miles based on starting at Fulton, MO node (electronic attachment RE Route Questions.txt)				
Source	ec_n15b.prn												
			model			Source			Difference (ft)				
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
CALHH	KansasCity2 7 8	35.2	1013760	1.00	1	181	955680		-58080	-11		8.00	7.54
KansasCity1 6 6	Uvada1 6 6	35.2	4055040	4.00	4	1414	7465920		3410880	646		32.00	58.92
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			7096320	7.00	7							56.00	66.46
												Model to Source diff	-15.7%

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Site Name	Calvert Cliff												
Source	ec_n15b.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
CCB	Youngstown-NA	35.2	1980000	1.95	2	375	1980000		0	0		15.63	15.63
Youngstown 7	Blair2 7 8	35.2	4683360	4.62	5	887	4683360		0	0		36.96	36.96
Blair6 6	Uvada1 6 6	35.2	4055040	4	4	1288	6800640		2745600	520		32.00	53.67
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			12745920	12.57	13							100.58	106.25
												Model to Source diff	-5.3%
Site Name	Catawba												
Source	ec_n15.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
CATR	Lawrenceburg 1 10 9	35.2	2877600	2.84	3	545	2877600		0	0		22.71	22.71
Lawrenceburg2 7 8	KansasCity2 7 8	35.2	3289440	3.24	4	623	3289440		0	0		25.96	25.96
KansasCity1 6 6	Uvada1 6 6	35.2	4055040	4	4	1415	7471200		3416160	647		32.00	58.96
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			12249600	12.08	13							96.67	107.63
												Model to Source diff	-10.2%
Site Name	Washington Nuclear												
Source	ec_n15.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
CGSR	Uvada1 6 6	35.2	4055040	4	4	1060	5596800		1541760	292		32.00	44.17
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			6082560	6	6							48.00	44.17
												Model to Source diff	8.7%

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Site Name	Clinton												
Source	ec_n15.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
CLIR	Blair2 7 8	35.2	2819520	2.78	3	534	2819520		0	0		22.25	22.25
Blair6 6	Uvada1 6 6	35.2	4055040	4	4	1288	6800640		2745600	520		32.00	53.67
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			8902080	8.78	9							70.25	75.92
												Model to Source diff	-7.5%
Site Name	Comanche Peak												
Source	ec_n15.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
CPR	Denver2 8 7	35.2	3041280	3	3	878	4635840		1594560	302		24.00	36.58
Denver1 6 6	Uvada1 6 6	35.2	2027520	2	2	769	4060320		2032800	385		16.00	32.04
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			7096320	7	7							56.00	68.63
												Model to Source diff	-18.4%
Site Name	Cooper Station												
Source	ec_n15b.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
CPRB	Omaha	35.2	1013760	1	1	0			-1013760	-192		8.00	0.00
Omaha	Uvada1 6 6	35.2	4055040	4	4	1308	6906240		2851200	540		32.00	54.50
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			7096320	7	7							56.00	54.50
												Model to Source diff	2.8%

Note: Source miles based on using Omaha, NE rail node (Port for barge at Port of Omaha, NE)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Site Name	Crystal River												
Source	ec_n15.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
CRYR	Atlanta	35.2	2539680	2.51	3	481	2539680		0	0		20.04	20.04
Atlanta	Lawrenceville1 10 9	35.2	2629440	2.59	3	498	2629440		0	0		20.75	20.75
Lawrenceville	Kansas City	35.2	2170080	2.14	3	411	2170080		0	0		17.13	17.13
Kansas City1 6 6	Uvada1 6 6	35.2	4055040	4	4	1414	7465920		3410880	646		32.00	58.92
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			13421760	13.24	15							105.92	116.83
												Model to Source diff	-9.3%
Site Name	Davis-Beese												
Source	ec_n15.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
DBR	Blair2 7 8	35.2	3875520	3.82	4	734	3875520		0	0		30.58	30.58
Blair6 6	Uvada1 6 6	35.2	4055040	4	4	1288	6800640		2745600	520		32.00	53.67
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			9958080	9.82	10							78.58	84.25
												Model to Source diff	-6.7%
Site Name	Diablo Canyon			Note: Source miles based on Heavy haul starting from San Luis Obispo per RE Route Questions.txt. Source based on ec_n15.prn									
Source	ec_n15.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
DCHH	Barstow	35.2	1906080	1.88	2	361	1906080		0	0		15.04	15.04
Barstow	NVR	35.2	1013760	1	1	302	1594560		580800	110		8.00	12.58
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			3933600	3.88	4							31.04	27.63
												Model to Source diff	12.4%

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Site Name	Farley												
Source	ec_n15.prn												
			model			Source			Difference(ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-Model)	miles		Model Hours	Source Hours
FARR	Atlanta	35.2	1367520	1.35	2	259	1367520		0	0		10.79	10.79
Atlanta	Lawrenceburg 1 10 9	35.2	2180640	2.15	3	412	2175360		-5280	-1		17.21	17.17
Lawrenceburg 2 7 8	KansasCity 2 7 8	35.2	3289440	3.24	4	623	3289440		0	0		25.96	25.96
KansasCity 1 6 6	Uvada 1 6 6	35.2	4055040	4	4	1415	7471200		3416160	647		32.00	58.96
Uvada 2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			12920160	12.74	15							101.96	112.88
												Model to Source diff	-9.7%
Site Name	Fort Calhoun								Note: Source miles based on starting at Blair, NE node (electronic attachment RE Route Questions.txt)				
Source	ec_n15b.prn												
			model			Source			Difference(ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-Model)	miles		Model Hours	Source Hours
FCHH	Blair 6 6	35.2	1013760	1	1							8.00	0.00
Blair 6 6	Uvada 1 6 6	35.2	4055040	4	4	1288	6800640		2745600	520		32.00	53.67
Uvada 2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			6082560	7	7							56.00	53.67
												Model to Source diff	4.3%
Site Name	Enrico Fermi												
source	ec_n15.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		Source-model			Model Hours	Source Hours
FERR	Blair 2 7 8	35.2	4387680	4.33	5	831	4387680		0			34.63	34.63
Blair 6 6	Uvada 1 6 6	35.2	4055040	4	4	1288	6800640		2745600			32.00	53.67
Uvada 2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			10470240	10.33	11							82.63	88.29
												Model to Source diff	-6.4%

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Site Name	Fitzpatrick												
Source	ec_n15.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		Source-model	miles		Model Hours	Source Hours
FITR	Painesville 10	35.2	1779360	1.76	2	337	1779360		0	0		14.04	14.04
Painesville 8	Blair2 7 8	35.2	4445760	4.39	5	842	4445760		0	0		35.08	35.08
Blair6 6	Uvada1 6 6	35.2	4055040	4	4	1287	6795360		2740320	519		32.00	53.63
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			12307680	12.14	13							97.13	102.75
												Model to Source diff	-5.5%
Site Name	Grand Gulf			Note: Source miles based on using Vicksburg MS rail node (Port for barge at Port of Vicksburg MS)									
Source	ec_n15b.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
GGB	Deramus	35.2	1013760	1	1	176	929280		-84480	-16		8.00	7.33
DeramusSW	Kansas City	35.2	2904000	2.86	3	550	2904000		0	0		22.92	22.92
KansasCity1 6 6	Uvada1 6 6	35.2	4055040	4	4	1415	7471200		3416160	647		32.00	58.96
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			10000320	9.86	10							78.92	89.21
												Model to Source diff	-11.5%
Site Name	Ginna			Note: Source miles based on starting at Webster, NY node (electronic attachment RE Route Questions.txt)									
Source	ec_n15b.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
GINHH	Painesville 10	35.2	1473120	1.45	2	279	1473120		0	0		11.63	11.63
Painesville 8	Blair2 7 8	35.2	4445760	4.39	5	841	4440480		-5280	-1		35.08	35.04
Blair6 6	Uvada1 6 6	35.2	4055040	4	4	1288	6800640		2745600	520		32.00	53.67
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			12001440	11.84	13							94.71	100.33
												Model to Source diff	-5.6%

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Site Name	Haddam Neck			Note: Source miles based on starting at New Haven, CT node (electronic attachment RE Route Questions.txt)									
Source	ec_n15.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
HADB	Schenectady	35.2	966240	0.95	1	183	966240		0	0		7.63	7.63
Schenectady	Painesville 10	35.2	2629440	2.59	3	432	2280960		-348480	-66		20.75	18.00
Painesville 8	Blair2 7 8	35.2	4445760	4.39	5	841	4440480		-5280	-1		35.08	35.04
Blair6 6	Uvada1 6 6	35.2	4055040	4	4	1288	6800640		2745600	520		32.00	53.67
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			14124000	13.93	15							111.46	114.33
												Model to Source diff	-2.5%
Site Name	Hanford												
Source	ec_n15.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
HANR	Uvada1 6 6	35.2	4055040	4	4	1052	5554560		1499520	284		32.00	43.83
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			6082560	6	6							48.00	43.83
												Model to Source diff	9.5%
Site Name	Harris												
Source	ec_n15.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(model-Source)	miles		Model Hours	Source Hours
HARR	Atlanta	35.2	2112000	2.08	3	400	2112000		0	0		16.67	16.67
Atlanta	Lawrenceville1 10 9	35.2	2629440	2.59	3	498	2629440		0	0		20.75	20.75
Lawrenceville	KansasCity2 7 8	35.2	2170080	2.14	3	411	2170080		0	0		17.13	17.13
Kansas City1 6 6	Uvada1 6 6	35.2	4055040	4	4	1415	7471200		3416160	647		32.00	58.96
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			12994080	12.82								102.54	113.50
												Model to Source diff	-9.7%

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Site Name	Hatch												
Source	ec_n15.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	MILES	FEET		(Source-model)	miles		Model Hours	Source Hours
HATR	Atlanta	35.2	1061280	1.05	2	201	1061280		0	0		8.38	8.38
Atlanta	Lawrenceburg 1 10 9	35.2	2180640	2.15	3	413	2180640		0	0		17.21	17.21
Lawrenceburg2 7 8	KansasCity2 7 8	35.2	3289440	3.24	4	623	3289440		0	0		25.96	25.96
KansasCity1 6 6	Uvada1 6 6	35.2	4055040	4	4	1414	7465920		3410880	646		32.00	58.92
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			12613920	12.44	15							99.54	110.46
												Model to Source diff	-9.9%
Site Name	Hope Creek			Note: Source miles based on using Wilmington, DE rail node (Port for barge at Port of Wilmington, DE)									
Source	ec_n15b.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
HCB	ColumbianaNE	35.2	2196480	2.17	3	416	2196480		0	0		17.33	17.33
Columbiana	KansasCity2 7 8	35.2	4461600	4.40	5	845	4461600		0	0		35.21	35.21
KansasCity1 6 6	Uvada1 6 6	35.2	4055040	4	4	1415	7471200		3416160	647		32.00	58.96
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			12740640	12.57	14							100.54	111.50
												Model to Source diff	-9.8%
Site Name	Humboldt		Note: Source and model data uses Humboldt as the rail head. The barge distance is approximately 207 miles to Coos Bay. Electronic attachment FW Humboldt Bay and Beaver Valley Intermodal.txt indicates that Coos Bay, OR or Oakland, CA could be used.										
Source	ec_n15.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
HUMB	Modesto1 6 6	35.2	1013760	1	1	410	2164800		1151040	218		8.00	17.08
Modesto2 8 7	Barstow	35.2	1784640	1.76	2	338	1784640		0	0		14.08	14.08
Barstow	NVR	35.2	1013760	1	1	302	1594560		580800	110		8.00	12.58
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			4825920	4.76	5							38.08	43.75
												Model to Source diff	-13.0%

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Site Name	INEEL-DOE			Note: Direct rail route not identified. Will use HH (i.e., Scoville, ID) info provided in RE Route Questions.txt.									
Source	ec_n15b.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
INLR	Uvada1 6 6	35.2	1013760	1	1	509	2687520		1673760	317		8.00	21.21
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			3041280	3	3							24.00	21.21
												Model to Source diff	13.2%
Site Name	Indian Point			Note: Source miles and route based on starting at Croton on the Hudson, NY which is used for heavy hauls from Indian Point per electronic attachments RE Route Questions.txt and ec_n15.prn									
Source	ec_n15.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
IPHH	Schenectady	35.2	1013760	1.00	1	122	644160		-369600	-70		8.00	5.08
Schenectady	Painesville 10	35.2	2629440	2.59	3	432	2280960		-348480	-66		20.75	18.00
Painesville 8	Blair2 7 8	35.2	4445760	4.39	5	841	4440480		-5280	-1		35.08	35.04
Blair6 6	Uvada1 6 6	35.2	4055040	4	4	1288	6800640		2745600	520		32.00	53.67
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			14171520	13.98	15							111.83	111.79
												Model to Source diff	0.0%
Site Name	Kewaunee			Note: The number for the source miles reflect using Kewaunee as the rail head for the heavy haul site. The heavy haul distance is 6 miles per Appendix J of DOE 2002. No information for an alternate rail head is currently available.									
Source	ec_n15.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED(ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
KEWHH	Blair2 7 8	35.2	3711840	3.66	4	703	3711840		0	0		29.29	29.29
Blair6 6	Uvada1 6 6	35.2	4055040	4	4	1288	6800640		2745600	520		32.00	53.67
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			9794400	9.66	10							77.29	82.96
												Model to Source diff	-6.8%

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Site Name	Lacrosse												
	ec_n15.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
LACR	Plattsmouth	35.2	2893440	2.85	3	548	2893440		0	0		22.83	22.83
Plattsmouth6	Denver1 6 6	35.2	2951520	2.91	3	559	2951520		0	0		23.29	23.29
Denver1 6 6	Uvada1 6 6	35.2	2027520	2.00	2	769	4060320		2032800	385		16.00	32.04
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			9900000	9.77	10							78.13	78.17
												Model to Source diff	-0.1%
Site Name	Limerick												
	ec_n15.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
LIMR	ColumbianaNE	35.2	2085600	2.06	3	395	2085600		0	0		16.46	16.46
Columbiana	KansasCity2 7 8	35.2	4461600	4.40	5	845	4461600		0	0		35.21	35.21
KansasCity1 6 6	Uvada1 6 6	35.2	4055040	4	4	1415	7471200		3416160	647		32.00	58.96
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			12629760	12.46	14							99.67	110.63
												Model to Source diff	-9.9%
Site Name	Lasalle												
Source	ec_n15.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
LSR	Plattsmouth	35.2	2244000	2.21	3	425	2244000		0	0		17.71	17.71
Plattsmouth6	Denver1 6 6	35.2	2951520	2.91	3	559	2951520		0	0		23.29	23.29
Denver1 6 6	Uvada1 6 6	35.2	2027520	2	2	769	4060320		2032800	385		16.00	32.04
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			9250560	9.13	10							73.00	73.04
												Model to Source diff	-0.1%

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Site Name	McGuire												
Source	ec_n15.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
MCGR	Atlanta	35.2	1689600	1.67	2	320	1689600		0	0		13.33	13.33
Atlanta	Lawrenceville1 10 9	35.2	2629440	2.59	3	497	2624160		-5280	-1		20.75	20.71
Lawrenceville	KansasCity2 7 8	35.2	2170080	2.14	3	411	2170080		0	0		17.13	17.13
Kansas City1 6 6	Uvada1 6 6	35.2	4055040	4	4	1415	7471200		3416160	647		32.00	58.96
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			12571680	12.40	14							99.21	110.13
												Model to Source diff	-9.9%
Site Name	Milstone												
Source	ec_n15.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
MILR	Schenectady	35.2	1188000	1.17	2	225	1188000		0	0		9.38	9.38
Schenectady	Painesville 10	35.2	2629440	2.59	3	432	2280960		-348480	-66		20.75	18.00
Painesville 8	Blair2 7 8	35.2	4445760	4.39	5	840	4435200		-10560	-2		35.08	35.00
Blair6 6	Uvada1 6 6	35.2	4055040	4	4	1288	6800640		2745600	520		32.00	53.67
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			14345760	14.15	16							113.21	116.04
												Model to Source diff	-2.4%
Site Name	Morris			Note: Direct rail route identified as G E REPRO Plant. Provided in RE Route Questions.txt.									
Source	ec_n15.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
MOR	Blair2 7 8	35.2	2529120	2.49	3	479	2529120		0	0		19.96	19.96
Blair6 6	Uvada1 6 6	35.2	4055040	4	4	1288	6800640		2745600	520		32.00	53.67
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			8611680	8.49	9							67.96	73.63
												Model to Source diff	-7.7%

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Site Name	Monticello												
Source	ec_n15.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
MONR	Minneapolis	35.2	1013760	1	1	44	232320		-781440	-148		8.00	1.83
Minneapolis	Denver1 6 6	35.2	4973760	4.91	5	942	4973760		0	0		39.25	39.25
Denver1 6 6	Uvada1 6 6	35.2	2027520	2	2	768	4055040		2027520	384		16.00	32.00
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			10042560	9.91	10							79.25	73.08
												Model to Source diff	8.4%
Site Name	Maine Yankee												
Source	ec_n15.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
MYR	Schenectady	35.2	1779360	1.76	2	337	1779360		0	0		14.04	14.04
Schenectady	Painesville 10	35.2	2629440	2.59	3	498	2629440		0	0		20.75	20.75
Painesville 8	Blair2 7 8	35.2	4445760	4.39	5	842	4445760		0	0		35.08	35.08
Blair6 6	Uvada1 6 6	35.2	4055040	4	4	1288	6800640		2745600	520		32.00	53.67
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			14937120	14.73	16							117.88	123.54
												Model to Source diff	-4.6%
Site Name	North Anna												
Source	ec_n15.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
NAR	Youngstown-NA	35.2	2560800	2.53	3	485	2560800		0	0		20.21	20.21
Youngstown 7	Blair2 7 8	35.2	4683360	4.62	5	887	4683360		0	0		36.96	36.96
Blair6 6	Uvada1 6 6	35.2	4055040	4	4	1288	6800640		2745600	520		32.00	53.67
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			13326720	13.15	14							105.17	110.83
												Model to Source diff	-5.1%

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Site Name	Nine Mile Point												
Source	ec_n15.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Roundup	miles	feet		(Source-model)	miles		Model Hours	Source Hours
NMPR	Painesville 10	35.2	1779360	1.76	2	337	1779360		0	0		14.04	14.04
Painesville 8	Blair2 7 8	35.2	4445760	4.39	5	841	4440480		-5280	-1		35.08	35.04
Blair6 6	Uvada1 6 6	35.2	4055040	4	4	1288	6800640		2745600	520		32.00	53.67
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			12307680	12.14	13							97.13	102.75
												Model to Source diff	-5.5%
Site Name	Oyster Creek			Note: Source miles based on using Oak Island, NJ rail node (Port for barge at Port of Newark, NJ)									
Source	ec_n15b.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
OCB	ColumbianaNE	35.2	2555520	2.52	3	484	2555520		0	0		20.17	20.17
Columbiana	KansasCity2 7 8	35.2	4461600	4.40	5	844	4456320		-5280	-1		35.21	35.17
KansasCity1 6 6	Uvada1 6 6	35.2	4055040	4	4	1415	7471200		3416160	647		32.00	58.96
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			13099680	12.92	14							103.38	114.29
												Model to Source diff	-9.6%
Site Name	Oconee			Note: Source miles based on starting at Clemson, SC node (electronic attachment RE Route Questions.txt)									
Source	ec_n15b.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
OCOHH	Lawrenceburg1 10 9	35.2	2613600	2.58	3	495	2613600		0	0		20.63	20.63
Lawrenceburg2 7 8	KansasCity2 7 8	35.2	3289440	3.24	4	623	3289440		0	0		25.96	25.96
KansasCity1 6 6	Uvada1 6 6	35.2	4055040	4	4	1414	7465920		3410880	646		32.00	58.92
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			11985600	11.82	13							94.58	105.50
												Model to Source diff	-10.3%

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Site Name	Perry												
Source	ec_n15.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
PERR	KansasCity2 7 8	35.2	4208160	4.15	5	797	4208160		0	0		33.21	33.21
KansasCity1 6 6	Uvada1 6 6	35.2	4055040	4	4	1415	7471200		3416160	647		32.00	58.96
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			10290720	10.15	11							81.21	92.17
												Model to Source diff	-11.9%
Site Name	Pilgrim		Note: Source miles based on using Boston, MA rail node (Port for barge at Port of Boston, MA)										
Source	ec_n15b.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
PILB	Schenectady	35.2	1140480	1.13	2	216	1140480		0	0		9.00	9.00
Schenectady	Painesville 10	35.2	2629440	2.59	3	432	2280960		-348480	-66		20.75	18.00
Painesville 8	Blair2 7 8	35.2	4445760	4.39	5	841	4440480		-5280	-1		35.08	35.04
Blair6 6	Uvada1 6 6	35.2	4055040	4	4	1288	6800640		2745600	520		32.00	53.67
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			14298240	14.10	16							112.83	115.71
												Model to Source diff	-2.5%
Site Name	Point Beach		Note: Source miles based on starting at Manitowoc, WI rail node (electronic attachment RE Route Questions.txt)										
Source	ec_n15.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
POIHH	Blair2 7 8	35.2	2845920	2.81	3	674	3558720		712800	135		22.46	28.08
Blair6 6	Uvada1 6 6	35.2	4055040	4	4	1288	6800640		2745600	520		32.00	53.67
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			8928480	8.81	9							70.46	81.75
												Model to Source diff	-13.8%

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Site Name	Robinson												
Source	ec_n15.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
ROBR	Atlanta	35.2	1599840	1.58	2	303	1599840		0	0		12.63	12.63
Atlanta	Lawrenceville1 10 9	35.2	2629440	2.59	3	498	2629440		0	0		20.75	20.75
Lawrenceville	KansasCity2 7 8	35.2	2170080	2.14	3	411	2170080		0	0		17.13	17.13
Kansas City1 6 6	Uvada1 6 6	35.2	4055040	4	4	1415	7471200		3416160	647		32.00	58.96
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			12481920	12.31	14							98.50	109.46
												Model to Source diff	-10.0%
Site Name	River Bend												
Source	ec_n15.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
RBR	Shreveport2 10 9	35.2	1436160	1.42	2	272	1436160		0	0		11.33	11.33
ShreveportSW	Denver2 8 7	35.2	4055040	4	4	1064	5617920		1562880	296		32.00	44.33
Denver1 6 6	Uvada1 6 6	35.2	2027520	2	2	769	4060320		2032800	385		16.00	32.04
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			9546240	9.42	10							75.33	87.71
												Model to Source diff	-14.1%
Site Name	Salem												
Source	ec_n15b.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
SALB	ColumbianaNE	35.2	2196480	2.17	3	416	2196480		0	0		17.33	17.33
Columbiana	KansasCity2 7 8	35.2	4461600	4.40	5	845	4461600		0	0		35.21	35.21
KansasCity1 6 6	Uvada1 6 6	35.2	4055040	4	4	1415	7471200		3416160	647		32.00	58.96
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			12740640	12.57	14							100.54	111.50
												Model to Source diff	-9.8%

Note: Source miles based on using Wilmington, DE rail node (Port for barge at Port of Wilmington, DE)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Site Name	St. Lucie			Note: Source miles based on using Fort Lauderdale, FL rail node (Port for barge at Port Everglades, FL)									
Source	ec_n15b.prn												
			model			Source				Difference (ft)			Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
SLB	Atlanta	35.2	3864960	3.81	4	732	3864960		0	0		30.50	30.50
Atlanta	Lawrenceville1 10 9	35.2	2629440	2.59	3	498	2629440		0	0		20.75	20.75
Lawrenceville	Kansas City	35.2	2170080	2.14	3	411	2170080		0	0		17.13	17.13
Kansas City1 6 6	Uvada1 6 6	35.2	4055040	4	4	1414	7465920		3410880	646		32.00	58.92
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			14747040	14.55	16							116.38	127.29
												Model to Source diff	-8.6%
Site Name	Savannah River Site												
Source	ec_n15.prn												
			model			Source				Difference (ft)			Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
SRSR	Atlanta	35.2	1145760	1.13	2	217	1145760		0	0		9.04	9.04
Atlanta	Lawrenceville1 10 9	35.2	2629440	2.59	3	498	2629440		0	0		20.75	20.75
Lawrenceville	KansasCity2 7 8	35.2	2170080	2.14	3	411	2170080		0	0		17.13	17.13
Kansas City1 6 6	Uvada1 6 6	35.2	4055040	4	4	1415	7471200		3416160	647		32.00	58.96
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			12027840	11.86	14							94.92	105.88
												Model to Source diff	-10.4%
Site Name	South Texas Project												
Source3	ec_n15.prn												
			model			Source				Difference (ft)			Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
STPR	Barstow	35.2	9313920	9.19	10	1764	9313920		0	0		73.50	73.50
Barstow	NVR	35.2	1013760	1	1	301	1589280		575520	109		8.00	12.54
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			11341440	11.19	12							89.50	86.04
												Model to Source diff	4.0%

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Site Name	Summer												
Source	ec_n15.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	TIME Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
SUMR	Lawrenceburg 1 10 9	35.2	2666400	2.63	3	505	2666400		0	0		21.04	21.04
Lawrenceburg2 7 8	KansasCity2 7 8	35.2	3289440	3.24	4	623	3289440		0	0		25.96	25.96
KansasCity1 6 6	Uvada1 6 6	35.2	4055040	4	4	1415	7471200		3416160	647		32.00	58.96
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			12038400	11.88	13							95.00	105.96
												Model to Source diff	-10.3%
Site Name	Surry			Note: Source miles based on using Norfolk, VA rail node (Port for barge at Port of Norfolk, VA)									
Source	ec_n15b.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
SURB	Portsmouth9 10	35.2	2777280	2.74	3	526	2777280		0	0		21.92	21.92
Portsmouth2 7 8	KansasCity2 7 8	35.2	4451040	4.39	5	843	4451040		0	0		35.13	35.13
KansasCity1 6 6	Uvada1 6 6	35.2	4055040	4	4	1415	7471200		3416160	647		32.00	58.96
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			13310880	13.13	14							105.04	116.00
												Model to Source diff	-9.4%
Site Name	Susquehanna												
Source	ec_n15.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
SUSR	JCT NewPortage	35.2	1267200	1.25	2	240	1267200		0	0		10.00	10.00
JCT NewPortage	EastPalestine1 9 10	35.2	1013760	1	1	154	813120		-200640	-38		8.00	6.42
EastPalestine2 7 8	Blair2 7 8	35.2	4783680	4.72	5	906	4783680		0	0		37.75	37.75
Blair6 6	Uvada1 6 6	35.2	4055040	4	4	1287	6795360		2740320	519		32.00	53.63
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			13147200	12.97	14							103.75	107.79
												Model to Source diff	-3.7%

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Site Name	Three Mile Island												
Source	ec_n15.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
TMIR	ColumbianaNE	35.2	1737120	1.71	2	329	1737120		0	0		13.71	13.71
Columbiana	KansasCity2 7 8	35.2	4461600	4.40	5	845	4461600		0	0		35.21	35.21
KansasCity1 6 6	Uvada1 6 6	35.2	4055040	4	4	1415	7471200		3416160	647		32.00	58.96
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			12281280	12.11	13							96.92	107.88
												Model to Source diff	-10.2%
Site Name	Turkey Point			Note: Source miles based on using Miami, FL rail node (Port for barge at Port of Miami, FL)									
Source	ec_n15b.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
TPB	Atlanta	35.2	4002240	3.95	4	758	4002240		0	0		31.58	31.58
Atlanta	Lawrenceville1 10 9	35.2	2629440	2.59	3	498	2629440		0	0		20.75	20.75
Lawrenceville	KansasCity2 7 8	35.2	2170080	2.14	3	411	2170080		0	0		17.13	17.13
Kansas City1 6 6	Uvada1 6 6	35.2	4055040	4	4	1414	7465920		3410880	646		32.00	58.92
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			14884320	14.68	16							117.46	128.38
												Model to Source diff	-8.5%
Site Name	Trojan												
Source	ec_n15.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
TROR	Uvada1 6 6	35.2	4055040	4	4	1275	6732000		2676960	507		32.00	53.13
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			6082560	6	6							48.00	53.13
												Model to Source diff	-9.6%

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Site Name	Vogle												
Source	ec_n15.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
VOGR	Atlanta	35.2	1246080	1.23	2	236	1246080		0	0		9.83	9.83
Atlanta	Lawrenceburg 1 10 9	35.2	2180640	2.15	3	413	2180640		0	0		17.21	17.21
Lawrenceburg2 7 8	KansasCity2 7 8	35.2	3289440	3.24	4	623	3289440		0	0		25.96	25.96
KansasCity1 6 6	Uvada1 6 6	35.2	4055040	4	4	1414	7465920		3410880	646		32.00	58.92
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			12798720	12.63	15							101.00	111.92
												Model to Source diff	-9.8%
Site Name	Vermont Yankee												
Source	ec_n15.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
VYR	Schenectady	35.2	1013760	1	1	115	607200		-406560	-77		8.00	4.79
Schenectady	Painesville 10	35.2	2629440	2.59	3	498	2629440		0	0		20.75	20.75
Painesville 8	Blair2 7 8	35.2	4445760	4.39	5	843	4451040		5280	1		35.08	35.13
Blair6 6	Uvada1 6 6	35.2	4055040	4	4	1287	6795360		2740320	519		32.00	53.63
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			14171520	13.98	15							111.83	114.29
												Model to Source diff	-2.2%
Site Name	Waterford												
Source	ec_n15.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
WATR	Lunita1 9	35.2	1135200	1.12	2	215	1135200		0	0		8.96	8.96
Lunita1 8 7	Denver2 8 7	35.2	5068800	5	5	1217	6425760		1356960	257		40.00	50.71
Denver1 6 6	Uvada1 6 6	35.2	2027520	2	2	768	4055040		2027520	384		16.00	32.00
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			10259040	10.12	11							80.96	91.67
												Model to Source diff	-11.7%

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Site Name	Yankee-Rowe			Note: Source miles based on starting at Hoosac Tunnel, MA node (electronic attachment RE Route Questions.txt)									
Source	ec_n15b.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
YRHH	Painesville 10	35.2	2977920	2.94	3	564	2977920		0	0		23.50	23.50
Painesville 8	Blair2 7 8	35.2	4445760	4.39	5	842	4445760		0	0		35.08	35.08
Blair6 6	Uvada1 6 6	35.2	4055040	4	4	1288	6800640		2745600	520		32.00	53.67
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			13506240	13.32	14							106.58	112.25
												Model to Source diff	-5.0%
Site Name	Zion												
Source	ec_n15.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
ZIOR	Blair2 7 8	35.2	2645280	2.61	3	501	2645280		0	0		20.88	20.88
Blair6 6	Uvada1 6 6	35.2	4055040	4	4	1288	6800640		2745600	520		32.00	53.67
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			8727840	8.61	9							68.88	74.54
												Model to Source diff	-7.6%
Site Name	Fort St. Vrain	No shipment so not included in averages. For Reference only.											
Source	ec_n15.prn												
			model			Source			Difference (ft)				Calculated
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	Time Step	Round Up	miles	feet		(Source-model)	miles		Model Hours	Source Hours
FSVR	Denver1 6 6	35.2	1013760	1	1	878	4635840		3622080	686		8.00	36.58
Denver1 6 6	Uvada1 6 6	35.2	2027520	2	2	769	4060320		2032800	385		16.00	32.04
Uvada2 8 7	NVR	35.2	1013760	1	1							8.00	0.00
NVR	ToNevIMF	35.2	1013760	1	1							8.00	0.00
Totals			5068800	5	5							40.00	68.63
												Model to Source diff	-41.7%
						Exclude FSV from Average				Average Difference		-5.6%	
										Absolute Average Diff		8.1%	

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APPENDIX C
TRUCK DISTANCES

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APPENDIX C TRUCK DISTANCES

This appendix contains the output of EXCEL workbook “Truck Details_Appendix Cd_9-4-06.xls”.

Note that there are many truck sites that are not used and are not programmed in TSM Version 6.0. Only the active truck sites are shown in Table 2 of BSC 2007a are programmed and included in this appendix. Programming for truck shipments is added when the site is first used in a scenario.

Column A (FROM): This column lists the site name and the beginning point for the connector.

Column B (TO): This column lists the ending point for the connector.

Column C (SPEED (ft/sec)): This column lists the speed used in the TSM as defined on page 34 of MIS-WAT-SE-000001 (BSC 2003a)

Column D (DISTANCE (FT)): This column lists the distance of the connectors in the TSM.

Column E (DISTANCE (MILES)): This column converts distance in feet from Column D to miles.

Column F (Time Step): This column lists time units. There are cases where time units rather than speed and distance are used in the TSM. For this comparison, the time units are converted to feet based on given speed for 8 hours or 1 time unit. This is reflected in Column D.

Column G (Rounded Up): This column rounds up the time steps calculated in Column F.

Column H (DISTANCE (MILES)): This column lists the distance from electronic attachment belt_1.prn (Highway).

Column J (DISTANCE (MILES)): This column lists the difference in miles from the TSM distance and the Highway distance (Col E – Col H).

Column K (DISTANCE (MILES)): One time unit or 320.02 miles is a modeling effect added on the connector YMT to ToGROATruck. It is subtracted in this column so that a direct comparison can be made to the distances in Highway.

Column N (HOURS): This column calculates the number of hours for a shipment using the total from Column F and subtracting the modeling distance of 320.02 miles. This distance is converted to hours using the defined rate of travel in cell B1 which is from page 34 of MIS-WAT-SE-000001 (BSC 2003a).

Column O (HOURS): This column calculates the number of hours for a shipment using the total from Column H. This distance is converted to hours using the defined rate of travel in cell B1 which is from page 34 of MIS-WAT-SE-000001 (BSC 2003a).

The final rows of the spreadsheet indicate the average difference in the TSM and FEIS distances based on the transit time using a constant transit speed. Both an absolute average and relative average are provided. The percent differences are (N-O)/O.

See Section 5.6.1 for a discussion of the timing test results in Appendix G and the calculated times presented in this appendix.

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A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Speed (ft/sec)=	58.67		Highway distances from belt_1.prn (Highway)											
Site Name	Cooper Station								Difference	Subtract 320.02			Subtracting 320.02 hours	
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	DISTANCE (mi)	Time Step	Rounded Up	Highway		(Dist-Highway)	YMT to ToGROATruck			Model Hours	Source Hours
CPRT	Omaha 1	58.67	1689696	320.02	1	1	136		184.02					
Omaha 1	St. George1	58.67	6431040	1218.00	3.81	4	1218		0.00					
St. George1	YMT	58.67	0	0.00	0	0	214		-214.00					
YMT	ToGROATruck	58.67	1689696	320.02	1	1			320.02					
Totals			9810432	1858.04	5.81	6	1568		290.04	-29.98			38.45	39.20
													Difference	-1.9%
Site Name	Crystal River								Difference	Subtract 320.02			Subtracting 320.02 hours	
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	DISTANCE (mi)	Time Step	Rounded Up	Highway		(Dist-Highway)	YMT to ToGROATruck			Model Hours	Source Hours
CRYT	Metropolis1 4 4	58.67	4260960	807.00	2.52	3	807		0.00					
Metropolis2 3	St Joseph2 3 3	58.67	2555520	484.00	1.51	2	484		0.00					
St. Joseph1	Omaha 1	58.67	718080	136.00	0.42	1	182		-46.00					
Omaha 1	St. George1	58.67	6431040	1218.00	3.81	4	1218		0.00					
St. George1	YMT	58.67	0	0.00	0	0	214		-214.00					
YMT	ToGROATruck	58.67	1689696	320.02	1	1			320.02					
Totals			15655296	2965.02	9.27	11	2905		60.02	-260.00			66.12	72.62
													Difference	-9.0%
Site Name	Fort Calhoun								Difference	Subtract 320.02			Subtracting 320.02 hours	
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	DISTANCE (mi)	Time Step	Rounded Up	Highway		(Dist-Highway)	YMT to ToGROATruck			Model Hours	Source Hours
FCT	St. George1	58.67	6573600	1245.00	3.89	4	1245		0.00					
St. George1	YMT	58.67	0	0.00	0	0	214		-214.00					
YMT	ToGROATruck	58.67	1689696	320.02	1	1			320.02					
Totals			8263296	1565.02	4.89	5	1459		106.02	-214.00			31.12	36.47
													Difference	-14.7%

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Site Name	GINNA								Difference	Subtract 320.02			Subtracting 320.02 hours	
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	DISTANCE (mi)	Time Step	Rounded Up	Highway		(Dist-Highway)	YMT to ToGROATruck			Model Hours	Source Hours
GINT	Painesville 5	58.67	1689696	320.02	1.00	1	258		82.91					
Painesville2 3	Omaha2 3 3	58.67	4493280	851.00	2.66	3	851		0.00					
Omaha 1	St. George1	58.67	6431040	1218.00	3.81	4	1218		0.00					
St. George1	YMT	58.67	0	0.00	0	0	214		-214.00					
YMT	ToGROATruck	58.67	1689696	320.02	1	1			320.02					
Totals			14303712	2709.04	8.47	9	2541		168.04	-151.98			59.72	63.52
													Difference	-6%
Site Name	HANFORD								Difference	Subtract 320.02			Subtracting 320.02 hours	
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	DISTANCE (mi)	Time Step	Rounded Up	Highway		(Dist-Highway)	YMT to ToGROATruck			Model Hours	Source Hours
HANT	St. George1	58.67	5042400	955.00	2.98	3	955		0.00					
St. George1	YMT	58.67	0	0.00	0	0	214		-214.00					
YMT	ToGROATruck	58.67	1689696	320.02	1	1			320.02					
Totals			6732096	1275.02	3.98	4	1169		106.02	-214.00			23.87	29.22
													Difference	-18.3%
Site Name	INDIAN POINT								Difference	Subtract 320.02			Subtracting 320.02 hours	
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	DISTANCE (mi)	Time Step	Rounded Up	Highway		(Dist-Highway)	YMT to ToGROATruck			Model Hours	Source Hours
IPT	Youngstown1 5 5	58.67	2217600	420.00	1.31	2	420		0.00					
Youngstown2 3	Omaha2 3 3	58.67	4598880	871.00	2.72	3	871		0.00					
Omaha 1	St. George1	58.67	6431040	1218.00	3.81	4	1218		0.00					
St. George1	YMT	58.67	0	0.00	0	0	214		-214.00					
YMT	ToGROATruck	58.67	1689696	320.02	1	1			320.02					
Totals			14937216	2829.02	8.84	10	2723		106.02	-214.00			62.72	68.07
													Difference	-7.9%

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Site Name	La Crosse								Difference	Subtract 320.02			Subtracting 320.02 hours	
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	DISTANCE (mi)	Time Step	Rounded Up	Highway		(Dist-Highway)	YMT to ToGROATruck			Model Hours	Source Hours
LACT	Omaha2 3 3	58.67	2328480	441.004	1.38	2	441		0					
Omaha 1	St. George1	58.67	6431040	1218.00	3.81	4	1218		0.00					
St. George1	YMT	58.67	0	0.00	0	0	214		-214.00					
YMT	ToGROATruck	58.67	1689696	320.02	1	1			320.02					
Totals			10449216	1979.02	6.18	7	1873		106.02	-214.00			41.47	46.82
													Difference	-11.4%
Site Name	INEEL								Difference	Subtract 320.02			Subtracting 320.02 hours	
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	DISTANCE (mi)	Time Step	Rounded Up	Highway		(Dist-Highway)	YMT to ToGROATruck			Model Hours	Source Hours
INLT	St. George1	58.67	2808960	532.00	1.66	2	532		0.00					
St. George1	YMT	58.67	0	0.00	0	0	214		-214.00					
YMT	ToGROATruck	58.67	1689696	320.02	1	1			320.02					
Totals			4498656	852.02	2.66	3	746.00		106.02	-214.00			13.30	18.65
													Difference	-28.7%
Site Name	Milstone								Difference	Subtract 320.02			Subtracting 320.02 hours	
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	DISTANCE (mi)	Time Step	Rounded Up	Highway		(Dist-Highway)	YMT to ToGROATruck			Model Hours	Source Hours
MILT	Youngstown1 5 5	58.67	2692800	510.00	1.59	2	510		0.00					
Youngstown2 3	Omaha2 3 3	58.67	4598880	871.00	2.72	3	871		0.00					
Omaha 1	St. George1	58.67	6431040	1218.00	3.81	4	1218		0.00					
St. George1	YMT	58.67	0	0.00	0	0	214		-214.00					
YMT	ToGROATruck	58.67	1689696	320.02	1	1			320.02					
Totals			15412416	2919.02	9.12	10	2813.00		106.02	-214.00			64.97	70.32
													Difference	--7.6%

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Site Name	Monticello								Difference	Subtract 320.02			Subtracting 320.02 hours	
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	DISTANCE (mi)	Time Step	Rounded Up	Highway		(Dist-Highway)	YMT to ToGROATruck			Model Hours	Source Hours
MONT	Bloomington1 1 1	58.67	1689696	320.02	1	1	51		269.02					
Bloomington2 3	Omaha2 3 3	58.67	2022240	383.00	1.20	2	383		0.00					
Omaha 1	St. George1	58.67	6431040	1218.00	3.81	4	1218		0.00					
St. George1	YMT	58.67	0	0.00	0	0	214		-214.00					
YMT	ToGROATruck	58.67	1689696	320.02	1	1			320.02					
Totals			11832672	2241.04	7.00	8	1866.00		375.04	55.02			48.02	46.65
													Difference	2.9%
Site Name	Palisades								Difference	Subtract 320.02			Subtracting 320.02 hours	
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	DISTANCE (mi)	Time Step	Rounded Up	Highway		(Dist-Highway)	YMT to ToGROATruck			Model Hours	Source Hours
PALT	Omaha2 3 3	58.67	3083520	584.00	1.82	2	584		0.00					
Omaha 1	St. George1	58.67	6431040	1218.00	3.81	4	1218		0.00					
St. George1	YMT	58.67	0	0.00	0	0	214		-214.00					
YMT	ToGROATruck	58.67	1689696	320.02	1	1			320.02					
Totals			11204256	2122.02	6.63	7	2016.00		106.02	-214.00			45.05	50.40
													Difference	-10.6%
Site Name	Pilgrim								Difference	Subtract 320.02			Subtracting 320.02 hours	
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	DISTANCE (mi)	Time Step	Rounded Up	Highway		(Dist-Highway)	YMT to ToGROATruck			Model Hours	Source Hours
PILT	Painesville 5	58.67	3437280	651.00	2.03	3	651		0.00					
Painesville2 3	Omaha2 3 3	58.67	4493280	851.00	2.66	3	851		0.00					
Omaha 1	St. George1	58.67	6431040	1218.00	3.81	4	1218		0.00					
St. George1	YMT	58.67	0	0.00	0	0	214		-214.00					
YMT	ToGROATruck	58.67	1689696	320.02	1	1			320.02					
Totals			16051296	3040.02	9.50	11	2934.00		106.02	-214.00			68.00	73.35
													Difference	-7.3%

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Site Name	St Lucie								Difference	Subtract 320.02			Subtracting 320.02 hours	
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	DISTANCE (mi)	Time Step	Rounded Up	Highway		(Dist-Highway)	YMT to ToGROATruck			Model Hours	Source Hours
SLT	Metropolis1 4 4	58.67	5142720	974.00	3.04	4	974		0.00					
Metropolis2 3	St Joseph2 3 3	58.67	2555520	484.00	1.51	2	484		0.00					
St. Joseph1	Omaha 1	58.67	718080	136.00	0.42	1	182		-46.00					
Omaha 1	St. George1	58.67	6431040	1218.00	3.81	4	1218		0.00					
St. George1	YMT	58.67	0	0.00	0	0	214		-214.00					
YMT	ToGROATruck	58.67	1689696	320.02	1	1			320.02					
Totals			16537056	3132.02	9.79	12	3072.00		60.02	-260.00			70.30	76.80
													Difference	-8.5%
Site Name	Turkey Point								Difference	Subtract 320.02			Subtracting 320.02 hours	
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	DISTANCE (mi)	Time Step	Rounded Up	Highway		(Dist-Highway)	YMT to ToGROATruck			Model Hours	Source Hours
TPT	Metropolis1 4 4	58.67	5976960	1132.00	3.54	4	1132		0					
Metropolis2 3	St Joseph2 3 3	58.67	2555520	484.00	1.51	2	484		0.00					
St. Joseph1	Omaha 1	58.67	718080	136.00	0.42	1	182		-46.00					
Omaha 1	St. George1	58.67	6431040	1218.00	3.81	4	1218		0.00					
St. George1	YMT	58.67	0	0.00	0	0	214		-214.00					
YMT	ToGROATruck	58.67	1689696	320.02	1	1			320.02					
Totals			17371296	3290.02	10.28	12	3230.00		60.02	-260.00			74.25	80.75
													Difference	-8.0%

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Site Name	Clinton								Difference	Subtract 320.02			Subtracting 320.02 hours	
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	DISTANCE (mi)	Time Step	Rounded Up	Highway		(Dist-Highway)	YMT to ToGROATruck			Model Hours	Source Hours
CLIT	Omaha2 3 3	58.67	2624160	497.00	1.55	2	497		0.00					
Omaha 1	St. George1	58.67	6431040	1218.00	3.81	4	1218		0.00					
St. George1	YMT	58.67	0	0.00	0	0	214		-214.00					
YMT	ToGROATruck	58.67	1689696	320.02	1	1			320.02					
Totals			10744896	2035.02	6.36	7	1929.00		106.02	-214.00			42.87	48.22
													Difference	-11.1%
Site Name	DC Cook								Difference	Subtract 320.02			Subtracting 320.02 hours	
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	DISTANCE (mi)	Time Step	Rounded Up	Highway		(Dist-Highway)	YMT to ToGROATruck			Model Hours	Source Hours
DCCT	Omaha2 3 3	58.67	2925120	554.00	1.73	2	554		0.00					
Omaha 1	St. George1	58.67	6431040	1218.00	3.81	4	1218		0.00					
St. George1	YMT	58.67	0	0.00	0	0	214		-214.00					
YMT	ToGROATruck	58.67	1689696	320.02	1	1			320.02					
Totals			11045856	2092.02	6.54	7	1986.00		106.02	-214.00			44.30	49.65
													Difference	-10.8%
Site Name	Fort St. Vrain								Difference	Subtract 320.02			Subtracting 320.02 hours	
FROM	TO	SPEED (ft/sec)	DISTANCE (FT)	DISTANCE (mi)	Time Step	Rounded Up	Highway		(Dist-Highway)	YMT to ToGROATruck			Model Hours	Source Hours
Fort St Vrain	St. George1	58.67	4239840	803.00	2.51	3	803		0.00					
St. George1	YMT	58.67	0	0.00	0	0	214		-214.00	FSV				
YMT	ToGROATruck	58.67	1689696	320.02	1	1			320.02					
Totals			5929536	1123.02	3.51	4	1017.00		106.02	-214.00			20.07	25.42
													Difference	-21.0%
													Average diff.	-10.6%
									Excludes FSV				Absolute Avg diff	10.9%

APPENDIX D
BARGE AND HEAVY HAUL DISTANCES

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APPENDIX D BARGE AND HEAVY HAUL DISTANCES

This appendix contains the output of EXCEL Workbook Barge and HH_Appendix Dd_6_21_06_revD_8_31_07.xls, with a manual adjustment of Humboldt Bay for TSM Version 6 highlighted.

Column A: This column lists the Site ID as used in the TSM.

Column B: This column lists the sites which used barges and heavy haul trucks for transportation.

Column C: This column lists the barge distances in miles as listed in BargeHH_Distance table in MIS-WAT-SE-000001 (BSC 2003a).

Column D: As part of the cost calculations, the distance in Column C is multiplied by 2 to determine the round trip distance in miles.

Column E: For costs, the distance from Column D is divided by 7 miles per hour to determine the hours of travel then divided by 8 for the time steps.

Column F: This column lists the time steps determined from the distance in Column C divided by 7 miles per hour (the speed listed on page 34 of MIS-WAT-SE-000001 [BSC 2003a] and identified in Cell A40 on the worksheet) then divided by 8 hours. The result is rounded up to give time steps.

Column G: This column list the number of time steps to load and unload. For the load/unload time, page 34 of MIS-WAT-SE-000001 (BSC 2003a) uses 48 hours meaning 24 hours for the load (3 time steps) and 24 hours for the unload.

Column H: This column list the time steps used in the TSM on the connector from the rail site to the barge sites. The total time steps for the rail site to the barge site is 3 time steps plus travel time.

Column I: This column list the time steps used in the TSM on the connector from the barge site to the rail sites. The total time steps for the barge site to the rail site is 3 time steps plus travel time.

Column J: This column lists the HH distances as listed in BargeHH_Distance table in MIS-WAT-SE-000001 (BSC 2003a).

Column K: This column divides the distance in Column J by 7 mph which is used as the HH speed based on page 34 of MIS-WAT-SE-000001 (BSC 2003a) to give the hours of travel.

Column L: For cost calculations, the hours of travel from Column K is divided by 8 hours to determine the number of time steps.

Column M: This column uses the hours of travel determined in Column K and divides that time by 8 hours to give time steps. This number is rounded up to the nearest whole number.

Column N: This column list the number of time steps to load and unload. For the load/unload time, page 34 of MIS-WAT-SE-000001 (BSC 2003a) uses 48 hours meaning 24 hours for the load (3 time steps) and 24 hours for the unload.

Column O: This column list the time steps used in the TSM on the connector from the rail site to the HH sites. The total time steps for the rail site to the barge site is 3 time steps plus travel time.

Column P: This column list the time steps used in the TSM on the connector from the HH site to the rail sites. The total time steps for the barge site to the rail site is 3 time steps plus travel time.

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A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
SITE ID	SITE_NAME	A_BARGE DISTANCE	Round trip distance	Round trip timesteps @ 7 mph (for costs)	Travel time in time steps rounded up (one way)	Load and Unload Time in Timesteps	Calc for R-B Connector	Calc for B-R Connector	A_HH DISTANCE	Travel time @ 7 mph (Hours)	Travel time for costs (steps)	Travel time in time steps rounded up	Load and Unload Time in Timesteps	Calc for R-HH Connector	Calc for HH-R Connector
<p>NOTE 1: TSM Version 2 listed DC, IP, KEW, PAL, and POI as barge sites, these have been changed to heavy haul sites for TSM Version 4 and later.</p> <p>NOTE 2: Barge and Heavy Haul distances in columns C and J respectively were obtained from User Manual for the CRWMS Analysis and Logistics Visually Interactive Model – Version 4.0, MIS-WAT-SE-000001 Rev 00. BSC 2003a. Distances for Beaver Valley and Humboldt obtained from electronic attachment FW Humboldt Bay and Beaver Valley Intermodal.txt.</p> <p>NOTE 3: Load and Unload Time in Time steps is based on 3 time steps based on assumption of 24 hours to load and 24 hours to unload. The load and unload times are assumed to be the setup times. 48 hours is the minimum setup time on page A-26 of the reference listed in BSC 2003a.</p>															
BARGE SITES															
BF	BROWNS FERRY	35.20	70.40	1.3	1	3	4	4							
CC	CALVERT CLF	61.60	123.20	2.2	2	3	5	5							
CPR	COOPER STN	72.60	145.20	2.6	2	3	5	5							
GG	GRAND GULF	31.80	63.60	1.1	1	3	4	4							
HAD	HADDAM NECK	61.60	123.20	2.2	2	3	5	5							
HC	HOPE CREEK	18.80	37.60	0.7	1	3	4	4							
OC	OYSTER CRK	80.70	161.40	2.9	2	3	5	5							
PIL	PILGRIM	46.00	92.00	1.6	1	3	4	4							
SAL	SALEM	21.40	42.80	0.8	1	3	4	4							
SL	ST LUCIE	86.90	173.80	3.1	2	3	5	5							
SUR	SURRY	43.90	87.80	1.6	1	3	4	4							
TP	TURKEY PT	33.50	67.00	1.2	1	3	4	4							
HUM	HUMBOLT	207.00	414.00	7.4	4	3	8	8							
HEAVY HAUL SITES															
BRP	BIG ROCK								12.40	1.77	0.22	1	3	4	4
CAL	CALLAWAY								11.50	1.64	0.21	1	3	4	4
FC	FORT CALHOUN								3.70	0.53	0.07	1	3	4	4
GIN	GINNA								21.80	3.11	0.39	1	3	4	4
OCO	OCONEE								10.90	1.56	0.19	1	3	4	4

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
SITE ID	SITE_NAME	A_BARGE DISTANCE	Round trip distance	Round trip timesteps @ 7 mph (for costs)	Travel time in time steps rounded up (one way)	Load and Unload Time in Timesteps	Calc for R-B Connector	Calc for B-R Connector	A_HH DISTANCE	Travel time @ 7 mph (Hours)	Travel time for costs (steps)	Travel time in time steps rounded up	Load and Unload Time in Timesteps	Calc for R-HH Connector	Calc for HH-R Connector
PEA	PEACHBOTTOM								36.60	5.23	0.65	1	3	4	4
YR	YANKEE-ROWE								6.30	0.90	0.11	1	3	4	4
BV	BEAVER VALLEY								10.50	1.50	0.19	1	3	4	4
DC	DIABLO CANYON								27.00	3.86	0.48	1	3	4	4
IP	INDIAN POINT								8.80	1.26	0.16	1	3	4	4
KEW	KEWAUNEE								6.00	0.86	0.11	1	3	4	4
PAL	PALISADES								26.00	3.71	0.46	1	3	4	4
POI	POINT BEACH								22.60	3.23	0.40	1	3	4	4
		Time Units													
		8.00													
	Barge speed														
	7.00mph														

APPENDIX E
CONNECTOR TIMING PARAMETERS

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APPENDIX E CONNECTOR TIMING PARAMETERS

This appendix lists the connectors in the transportation maps in TSM and the associated timing parameter, either the input transit time or the speed/distance TSM uses to calculate the transit time. As discussed in the text, most connector timings are set by the distance divided by the conveyance speed. This appendix contains the output of connection timing for EXCEL workbook "Appendix E_V6 Connector Timing.xls" listed in Section 8. The Alpha Order worksheet is used for this appendix. This workbook does not have any calculations; EXCEL is used because it is the simplest way to format and manipulate connector information downloaded from the TSM analysis menu.

The values in this appendix can be used with the maps in Appendix A to understand the connector parameters. Use the site names from Appendix A to find the connectors in this appendix. However, the easiest way to understand the TSM settings is by using the TSM GUI and double clicking on the connector of interest. This appendix includes all truck sites including truck sites that have not been used and are not active and checked. The active sites are in Appendix C. These connectors will be checked if the truck site is activated.

Column A: Process Name. Truck sites end with "T", rail sites end with "R", barge sites end with "B", and Heavy haul sites end with "HH". Some processes are transportation nodes for major cities where several connectors may merge or for major cities for example "Atlanta". Where possible, nodes are named to match key nodes in the FEIS.

Column B: Connector Name or "From to". This column indicates the connector name for named connectors or the points the connectors links C: "from to". Connectors are not typically named but are assigned names in some case such as when the connector includes program extensions.

Column C: Connector Time or Distance. This column indicates the input transit time in time steps formatted as D-Days: Hours: Min: Seconds for more than one day and Hours: Min: Seconds for less than 1 day format. This column will have the distance (Dist.) in feet for connectors where the distance and speed is used for the transit time. For connections less than 8 hours (1 time step) 8 hours is used. Barge and HH route connectors have 4 time steps (D 1-8: 0: 0).

Column D: Conveyance Speed. This column indicates the speed used for that connector. Note that 58.67 ft/s (40 mph) is the speed for a truck and 35.20 ft/s (24 mph) is the speed for a dedicated rail shipment.

Changes for TSM Version 6.0 are highlighted.

	A	B	C	D
	Process Name	Connector Name or "From To"	Connector Time or Distance	Conveyance Speed
3	ANOR	-		
4		C: ANOR to Kansas City	Dist:2143680	35.20 ft/s
5	ANOT	-		
6		C: ANOT to LV2 2 2	Dist:8838720	58.67 ft/s
7	Atlanta	-		
8		C: Atlanta to Lawrenceville1 10 9	Dist:2629440	35.20 ft/s
9		C: Atlanta to Lawrenceburg1 10 9	Dist:2180640	35.20 ft/s
10	Barstow	-		
11		C: Barstow to NVR	8:00:00	
12	BFB	-		
n13		C: BFB to BFR	D 1-8: 0: 0	
14		C: BFB to Cairo	Dist:1161600	35.20 ft/s
15		-		
16		C: BFR to BFB	D 1-8: 0: 0	
17	BFT	-		
18		C: BFT to Metropolis1 4 4	8:00:00	
19	Blair6 6	-		
20		C: Blair6 6 to Uvada1 6 6	D 1-8: 0: 0	
21	Bloomington2 3	-		
22		C: Bloomington2 3 to Omaha2 3 3	Dist:2022240	58.67 ft/s
23	BRAR	-		
24		C: BRAR to Blair2 7 8	Dist:2793120	35.20 ft/s
25	BRAT	-		
26		C: BRAT to Omaha2 3 3	Dist:3505920	58.67 ft/s
27	BRPHH	-		
28		C: BRPHH to BRPR	D 1-8: 0: 0	
29		C: BRPHH to Blair2 7 8	Dist:4994880	35.20 ft/s
30	BRPR	-		
31		C: BRPR to BRPHH	D 1-8: 0: 0	
32	BRPT	-		
33		C: BRPT to Omaha2 3 3	Dist:6684480	58.67 ft/s
34	BRUR	-		
35		C: BRUR to Atlanta	Dist:2439360	35.20 ft/s
36	BRUT	-		
37		C: BRUT to Roanoke 4 4	Dist:6272640	58.67 ft/s
38	BVHH	-		
39		C: BVHH to ColumbianaNE	8:00:00	
40		C: BVHH to BVR	D 1-8: 0: 0	
41	BVR	-		
42		C: BVR to BVHH	D 1-8: 0: 0	
43	BVT	-		
44		C: BVT to Youngstown1 5 5	8:00:00	
45	BYRR	-		
46		C: BYRR to Blair2 7 8	Dist:2191200	35.20 ft/s
47	BYRT	-		

	A	B	C	D
	Process Name	Connector Name or "From To"	Connector	Conveyance
			Time or Distance	Speed
48		C: BYRT to Omaha2 3 3	Dist:3453120	58.67 ft/s
49	Cairo8	-		
50		C: Cairo8 to KansasCity2 7 8	Dist:2381280	35.20 ft/s
51	CALHH	-		
52		C: CALHH to CALR	D 1-8: 0: 0	
53		C: CALHH to KansasCity2 7 8	8:00:00	
54	CALR	-		
55		C: CALR to CALHH	D 1-8: 0: 0	
56	CALT	-		
57		C: CALT to St. Joseph2 3 3	8:00:00	
58	CATR	-		
59		C: CATR to Lawrenceburg1 10 9	Dist:2877600	35.20 ft/s
60	CATT	-		
61		C: CATT to Metropolis1 4 4	Dist:3331680	58.67 ft/s
62	CCB	-		
63		C: CCB to CCR	D 1-16: 0: 0	
64		C: CCB to Youngstown-NA	Dist:1980000	35.20 ft/s
65	CCR	-		
66		C: CCR to CCB	D 1-16: 0: 0	
67	CCT	-		
68		C: CCT to Youngstown1 5 5	Dist:2576640	58.67 ft/s
69	CGSR	-		
70		C: CGSR to Uvada1 6 6	D 1-8: 0: 0	
71	CGST	-		
72		C: CGST to St. George1	Dist:5137440	58.67 ft/s
73	Cincinnati2 3	-		
74		C: Cincinnati2 3 to St. Joseph2 3 3	Dist:3300000	58.67 ft/s
75	CLIR	-		
76		C: CLIR to Blair2 7 8	Dist:2819520	35.20 ft/s
77	CLIT	-		
78		C: CLIT to Omaha2 3 3	Dist:2624160	58.67 ft/s
79	Columbiana	-		
80		C: Columbiana to KansasCity2 7 8	Dist:4461600	35.20 ft/s
81	CPR	-		
82		C: CPR to Denver2 8 7	D 1-0: 0: 0	
83	CPRB	-		
84		C: CPRB to CPRR	D 1-16: 0: 0	
85		C: CPRB to Omaha	8:00:00	
86	CPRR	-		
87		C: CPRR to CPRB	D 1-16: 0: 0	
88	CPRT	-		
89		C: CPRT to Omaha 1	8:00:00	
90	CPT	-		
91		C: CPT to LV2 2 2	Dist:8991840	58.67 ft/s
92	CRYR	-		
93		C: CRYR to Atlanta	Dist:2539680	35.20 ft/s

	A	B	C	D
	Process Name	Connector Name or "From To"	Connector Time or Distance	Conveyance Speed
94	CRYT	-		
95		C: CRYT to Metropolis1 4 4	Dist:4260960	58.67 ft/s
96	DBR	-		
97		C: DBR to Blair2 7 8	Dist:3875520	35.20 ft/s
98	DBT	-		
99		C: DBT to Omaha2 3 3	Dist:6082560	58.67 ft/s
100	DCCR	-		
101		C: DCCR to Blair2 7 8	Dist:2940960	35.20 ft/s
102	DCCT	-		
103		C: DCCT to Omaha2 3 3	Dist:2925120	58.67 ft/s
104	DCHH	-		
105		C: DCHH to Barstow	Dist:1906080	35.20 ft/s
106		C: DCHH to DCR	D 1-8: 0: 0	
107	DCR	-		
108		C: DCR to DCHH	D 1-8: 0: 0	
109	DCT	-		
110		C: DCT to Fresno2 2	8:00:00	
111	Denver1 6 6	-		
112		C: Denver1 6 6 to Uvada1 6 6	16:00:00	
113	DeramusSW	-		
114		C: DeramusSW to Kansas City	Dist:2904000	35.20 ft/s
115	DRER	-		
116		C: DRER to Blair2 7 8	Dist:2539680	35.20 ft/s
117	DRET	-		
118		C: DRET to Omaha2 3 3	Dist:3453120	58.67 ft/s
119	DUAR	-		
120		C: DUAR to Blair2 7 8	Dist:1420320	35.20 ft/s
121	DUAT	-		
122		C: DUAT to Omaha2 3 3	Dist:1694880	58.67 ft/s
123	EastPalestine2 7 8	-		
124		C: EastPalestine2 7 8 to Blair2 7 8	Dist:4783680	35.20 ft/s
125	FARR	-		
126		C: FARR to Atlanta	Dist:1367520	35.20 ft/s
127	FART	-		
128		C: FART to Shreveport2 4 4	Dist:4044480	58.67 ft/s
129	FCHH	-		
130		C: FCHH to Blair6 6	8:00:00	
131		C: FCHH to FCR	D 1-8: 0: 0	
132	FCR	-		
133		C: FCR to FCHH	D 1-8: 0: 0	
134	FCT	-		
135		C: FCT to St. George1	Dist:6573600	58.67 ft/s
136	FERR	-		
137		C: FERR to Blair2 7 8	Dist:4387680	35.20 ft/s
138	FERT	-		
139		C: FERT to Omaha2 3 3	Dist:6357120	58.67 ft/s

	A	B	C	D
	Process Name	Connector Name or "From To"	Connector Time or Distance	Conveyance Speed
140	FITR	-		
141		C: FITR to Painesville 10	Dist:1779360	35.20 ft/s
142	FITT	-		
143		C: FITT to Painesville 5	Dist:2322600	58.67 ft/s
144	Fresno2 2	-		
145		C: Fresno2 2 to LV2 2 2	Dist:2608320	58.67 ft/s
146	FSVR	-		
147		C: FSVR to Denver1 6 6	8:00:00	
148	FSVT	-		
149		C: FSVT to St. George1	Dist:4239840	58.67 ft/s
150	GGB	-		
151		GGR	8:00:00	
152		C: GGB to Deramus	8:00:00	
153		C: GGB to GGR	D 1-8: 0: 0	
154	GGR	-		
155		C: GGR to GGB	D 1-8: 0: 0	
156	GGT	-		
157		C: GGT to Shreveport2 4 4	8:00:00	
158	GINHH	-		
159		C: GINHH to GINR	D 1-8: 0: 0	
160		C: GINHH to Painesville 10	Dist:1473120	35.20 ft/s
161	GINR	-		
162		C: GINR to GINHH	D 1-8: 0: 0	
163	GINT	-		
164		C: GINT to Painesville 5	8:00:00	
165	HADB	-		
166		C: HADB to HADR	D 1-16: 0: 0	
167		C: HADB to Schenectady	Dist:966240	35.20 ft/s
168	HADR	-		
169		C: HADR to HADB	D 1-16: 0: 0	
170	HADT	-		
171		C: HADT to Youngstown1 5 5	Dist:3268320	58.67 ft/s
172	HANR	-		
173		C: HANR to Uvada1 6 6	D 1-8: 0: 0	
174	HANT	-		
175		C: HANT to St. George1	Dist:5042400	58.67 ft/s
176	Harlan 6	-		
177		C: Harlan 6 to Blair6 6	8:00:00	
178	HARR	-		
179		C: HARR to Atlanta	Dist:2112000	35.20 ft/s
180	HART	-		
181		C: HART to Roanoke 4 4	Dist:5723520	58.67 ft/s
182	HATR	-		
183		C: HATR to Atlanta	Dist:1061280	35.20 ft/s
184	HATT	-		
185		C: HATT to Metropolis1 4 4	Dist:3564000	58.67 ft/s

	A	B	C	D
	Process Name	Connector Name or "From To"	Connector Time or Distance	Conveyance Speed
186	HCB	-		
187		C: HCB to HCR	D 1-8: 0: 0	
188		C: HCB to ColumbianaNE	Dist:2196480	35.20 ft/s
189	HCR	-		
190		C: HCR to HCB	D 1-8: 0: 0	
191	HCT	-		
192		C: HCT to Youngstown1 5 5	Dist:3289440	58.67 ft/s
193	HUMB	-		
194		C: HUMB to HUMR	D 2-16: 0: 0	
195		C: HUMB to Modesto1 6 6	8:00:00	
196	HUMR	-		
197		C: HUMR to HUMB	D 2-16: 0: 0	
198	HUMT	-		
199		C: HUMT to Fresno1 1 1	Dist:2518560	58.67 ft/s
200	INLR	-		
201		C: INLR to Uvada1 6 6	8:00:00	
202	INLT	-		
203		C: INLT to St. George1	Dist:2808960	58.67 ft/s
204	IPHH	-		
205		C: IPHH to IPR	D 1-8: 0: 0	
206		C: IPHH to Schenectady	8:00:00	
207	IPR	-		
208		C: IPR to IPHH	D 1-8: 0: 0	
209	IPT	-		
210		C: IPT to Youngstown1 5 5	Dist:2217600	58.67 ft/s
211	JCT New Portage	-		
212		C: JCT New Portage to EastPalestine1 9 10	8:00:00	
213	KansasCity1 6 6	-		
214		C: KansasCity1 6 6 to Uvada1 6 6	D 1-8: 0: 0	
215	KEWHH	-		
216		C: KEWHH to KEWR	D 1-8: 0: 0	
217		C: KEWHH to Blair2 7 8	Dist:3711840	35.20 ft/s
218	KEWR	-		
219		C: KEWR to KEWHH	D 1-8: 0: 0	
220	KEWT	-		
221		C: KEWT to Omaha2 3 3	Dist:4546080	58.67 ft/s
222	LACR	-		
223		C: LACR to Plattsmouth	Dist:2893440	35.20 ft/s
224	LACT	-		
225		C: LACT to Omaha2 3 3	Dist:2328480	58.67 ft/s
226	Lake Charles 8 7	-		
227		C: Lake Charles 8 7 to Barstow	Dist:9720480	35.20 ft/s
228	Lawrenceburg2 7 8	-		
229		C: Lawrenceburg2 7 8 to KansasCity2 7 8	Dist:3289440	35.20 ft/s
230	Lawrenceville	-		
231		C: Lawrenceville to KansasCity2 7 8	Dist:2170080	35.20 ft/s

	A	B	C	D
	Process Name	Connector Name or "From To"	Connector	Conveyance
			Time or Distance	Speed
232	LIMR	-		
233		C: LIMR to ColumbianaNE	Dist:2085600	35.20 ft/s
234	LIMT	-		
235		C: LIMT to Youngstown1 5 5	Dist:2534400	58.67 ft/s
236	LSR	-		
237		C: LSR to Plattsmouth	Dist:2244000	35.20 ft/s
238	LST	-		
239		C: LST to Omaha2 3 3	Dist:3505920	58.67 ft/s
240	Lunita1 8 7	-		
241		C: Lunita1 8 7 to Denver2 8 7	D 1-16: 0: 0	
242	MCGR	-		
243		C: MCGR to Atlanta	Dist:1689600	35.20 ft/s
244	MCGT	-		
245		C: MCGT to Roanoke 4 4	Dist:5654880	58.67 ft/s
246	Metropolis2 3	-		
247		C: Metropolis2 3 to St. Joseph2 3 3	Dist:2555520	58.67 ft/s
248	MILR	-		
249		C: MILR to Schenectady	Dist:1188000	35.20 ft/s
250	MILT	-		
251		C: MILT to Youngstown1 5 5	Dist:2692800	58.67 ft/s
252	Minneapolis	-		
253		C: Minneapolis to Denver1 6 6	Dist:4973760	35.20 ft/s
254	Modesto2 8 7	-		
255		C: Modesto2 8 7 to Barstow	Dist:1784640	35.20 ft/s
256	MONR	-		
257		C: MONR to Minneapolis	8:00:00	
258	MONT	-		
259		C: MONT to Bloomington1 1 1	8:00:00	
260	MOR	-		
261		C: MOR to Blair2 7 8	Dist:2529120	35.20 ft/s
262	MOT	-		
263		C: MOT to Omaha2 3 3	Dist:3453120	58.67 ft/s
264	MYR	-		
265		C: MYR to Schenectady	Dist:1779360	35.20 ft/s
266	MYT	-		
267		C: MYT to Painesville 5	Dist:4667520	58.67 ft/s
268	NAR	-		
269		C: NAR to Youngstown-NA	Dist:2560800	35.20 ft/s
270	NAT	-		
271		C: NAT to Cincinnati 5 5	Dist:3067680	58.67 ft/s
272	NMPR	-		
273		C: NMPR to Painesville 10	Dist:1779360	35.20 ft/s
274	NMPT	-		
275		C: NMPT to Painesville 5	Dist:2322600	58.67 ft/s
276	NVR	-		
277		C: NVR to ToNevIMF	8:00:00	

	A	B	C	D
	Process Name	Connector Name or "From To"	Connector	Conveyance
			Time or Distance	Speed
278	Oakley1 1	-		
279		C: Oakley1 1 to St. George1	Dist:5728800	58.67 ft/s
280	OCB	-		
281		OCR	8:00:00	
282		C: OCB to OCR	D 1-16: 0: 0	
283		C: OCB to ColumbianaNE	Dist:2555520	35.20 ft/s
284	OCOHH	-		
285		OCOR	8:00:00	
286		C: OCOHH to OCOR	D 1-8: 0: 0	
287		C: OCOHH to Lawrenceburg1 10 9	Dist:2613600	35.20 ft/s
288	OCOR	-		
289		C: OCOR to OCOHH	D 1-8: 0: 0	
290	OCOT	-		
291		C: OCOT to Metropolis1 4 4	Dist:3315840	58.67 ft/s
292	OCR	-		
293		C: OCR to OCB	D 1-16: 0: 0	
294	OCT	-		
295		C: OCT to Youngstown1 5 5	Dist:3025440	58.67 ft/s
296	Omaha	-		
297		C: Omaha to Uvada1 6 6	D 1-8: 0: 0	
298	Omaha 1	-		
299		C: Omaha 1 to St. George1	Dist:6431040	58.67 ft/s
300	Painesville 8	-		
301		C: Painesville 8 to Blair2 7 8	Dist:4445760	35.20 ft/s
302	Painesville2 3	-		
303		C: Painesville2 3 to Omaha2 3 3	Dist:4493280	58.67 ft/s
304	PALHH	-		
305		C: PALHH to PALR	D 1-8: 0: 0	
306		C: PALHH to Blair2 7 8	Dist:3490080	35.20 ft/s
307	PALR	-		
308		C: PALR to PALHH	D 1-8: 0: 0	
309	PALT	-		
310		C: PALT to Omaha2 3 3	Dist:3083520	58.67 ft/s
311	PEAHH	-		
312		C: PEAHH to PEAR	D 1-8: 0: 0	
313		C: PEAHH to ColumbianaNE	Dist:1805760	35.20 ft/s
314	PEAR	-		
315		C: PEAR to PEAHH	D 1-8: 0: 0	
316	PEAT	-		
317		C: PEAT to Youngstown1 5 5	Dist:2006400	58.67 ft/s
318	PERR	-		
319		C: PERR to KansasCity2 7 8	Dist:4208160	35.20 ft/s
320	PERT	-		
321		C: PERT to Painesville2 3	0:00:00	
322	PILB	-		
323		C: PILB to Schenectady	Dist:1140480	35.20 ft/s

	A	B	C	D
	Process Name	Connector Name or "From To"	Connector	Conveyance
			Time or Distance	Speed
324		C: PILB to PILR	D 1-8: 0: 0	
325	PILR	-		
326		C: PILR to PILB	D 1-8: 0: 0	
327	PILT	-		
328		C: PILT to Painesville 5	Dist:3437280	58.67 ft/s
329	PIR	-		
330		C: PIR to StPaul2 7 8	8:00:00	
331	PIT	-		
332		C: PIT to Bloomington2 3	8:00:00	
333	Plattsmouth6	-		
334		C: Plattsmouth6 to Denver1 6 6	Dist:2951520	35.20 ft/s
335	POIHH	-		
336		C: POIHH to POIR	D 1-8: 0: 0	
337		C: POIHH to Blair2 7 8	Dist:2845920	35.20 ft/s
338	POIR	-		
339		C: POIR to POIHH	D 1-8: 0: 0	
340	POIT	-		
341		C: POIT to Omaha2 3 3	Dist:4546080	58.67 ft/s
342	Portsmouth2 7 8	-		
343		C: Portsmouth2 7 8 to KansasCity2 7 8	Dist:4451040	35.20 ft/s
344	PVR	-		
345		C: PVR to Barstow	Dist:2175360	35.20 ft/s
346	PVT	-		
347		C: PVT to LV2 2 2	Dist:3796320	58.67 ft/s
348	QCR	-		
349		C: QCR to Plattsmouth	Dist:2053920	35.20 ft/s
350	QCT	-		
351		C: QCT to Omaha2 3 3	Dist:2624160	58.67 ft/s
352	RBR	-		
353		C: RBR to Shreveport2 10 9	Dist:1436160	35.20 ft/s
354	RBT	-		
355		C: RBT to Shreveport2 4 4	8:00:00	
356	Red Oak 6	-		
357		C: Red Oak 6 to Blair6 6	8:00:00	
358	Roanoke2 5	-		
359		C: Roanoke2 5 to Cincinnati 5 5	Dist:2270400	58.67 ft/s
360	ROBR	-		
361		C: ROBR to Atlanta	Dist:1599840	35.20 ft/s
362	ROBT	-		
363		C: ROBT to Metropolis1 4 4	Dist:4183040	58.67 ft/s
364	RSR	-		
365		C: RSR to Modesto1 6 6	8:00:00	
366	RST	-		
367		C: RST to Fresno1 1 1	8:00:00	
368	SALB	-		
369		C: SALB to SALR	D 1-8: 0: 0	

	A	B	C	D
	Process Name	Connector Name or "From To"	Connector Time or Distance	Conveyance Speed
370		C: SALB to ColumbianaNE	Dist:2196480	35.20 ft/s
371	SALR	-		
372		C: SALR to SALB	D 1-8: 0: 0	
373	SALT	-		
374		C: SALT to Youngstown1 5 5	Dist:3236640	58.67 ft/s
375	Schenectady	-		
376		C: Schenectady to Painesville 10	Dist:2629440	35.20 ft/s
377	SEAR	-		
378		C: SEAR to Schenectady	Dist:1277760	35.20 ft/s
379	SEAT	-		
380		C: SEAT to Painesville 5	Dist:4139520	58.67 ft/s
381	SEQR	-		
382		C: SEQR to Lawrenceburg1 10 9	Dist:1393920	35.20 ft/s
383	SEQT	-		
384		C: SEQT to Metropolis1 4 4	Dist:1721280	58.67 ft/s
385	Shreveport1 2	-		
386		C: Shreveport1 2 to LV2 2 2	Dist:9403680	58.67 ft/s
387	ShreveportSW	-		
388		C: ShreveportSW to Denver2 8 7	D 1-8: 0: 0	
389	SLB	-		
390		C: SLB to SLR	D 1-16: 0: 0	
391		C: SLB to Atlanta	Dist:3864960	35.20 ft/s
392	SLR	-		
393		C: SLR to SLB	D 1-16: 0: 0	
394	SLT	-		
395		C: SLT to Metropolis1 4 4	Dist:5142720	58.67 ft/s
396	SOR	-		
397		C: SOR to Barstow	8:00:00	
398	SOT	-		
399		C: SOT to LV2 2 2	Dist:1768800	58.67 ft/s
400	SRSR	-		
401		C: SRSR to Atlanta	Dist:1145760	35.20 ft/s
402	SRST	-		
403		C: SRST to Metropolis1 4 4	Dist:3136320	58.67 ft/s
404	St. George1	-		
405		C: St. George1 to YMT	0:00:00	
406	St. Joseph1	-		
407		C: St. Joseph1 to Omaha 1	8:00:00	
408	StartBarge1 9	-		
409		C: StartBarge1 9 to GGR	0:00:00	
410	StartBarge16 6	-		
411		C: StartBarge16 6 to CPRR	0:00:00	
412	StartBarge16 7	-		
413		C: StartBarge16 7 to DCR	0:00:00	
414	StartBarge17	-		
415		C: StartBarge17 to HUMR	0:00:00	

	A	B	C	D
	Process Name	Connector Name or "From To"	Connector	Conveyance
			Time or Distance	Speed
416	StartBarge2 9	-		
417		C: StartBarge2 9 to BFR	0:00:00	
418	StartBarge3 9	-		
419		C: StartBarge3 9 to SLR	0:00:00	
420	StartBarge4 9	-		
421		C: StartBarge4 9 to TPR	0:00:00	
422	StartHH1 9	-		
423		C: StartHH1 9 to OCOR	0:00:00	
424	StartHH13 8	-		
425		C: StartHH13 8 to PALR	0:00:00	
426	StartHH14 8	-		
427		C: StartHH14 8 to KEWR	0:00:00	
428	StartHH15 8	-		
429		C: StartHH15 8 to POIR	0:00:00	
430	StartHH5 8	-		
431		C: StartHH5 8 to BRPR	0:00:00	
432	StartHH6 8	-		
433		C: StartHH6 8 to CALR	0:00:00	
434	StartHH7 6	-		
435		C: StartHH7 6 to FCR	0:00:00	
436	StPaul1 6 6	-		
437		C: StPaul1 6 6 to Blair6 6	Dist:1816320	35.20 ft/s
438	STPR	-		
439		C: STPR to Barstow	Dist:9313920	35.20 ft/s
440	STPT	-		
441		C: STPT to LV2 2 2	Dist:9794400	58.67 ft/s
442	SUMR	-		
443		C: SUMR to Lawrenceburg1 10 9	Dist:2666400	35.20 ft/s
444	SUMT	-		
445		C: SUMT to Metropolis1 4 4	Dist:3315840	58.67 ft/s
446	SURB	-		
447		C: SURB to Portsmouth9 10	Dist:2777280	35.20 ft/s
448		C: SURB to SURR	D 1-8: 0: 0	
449	SURR	-		
450		C: SURR to SURB	D 1-8: 0: 0	
451	SURT	-		
452		C: SURT to Cincinnati 5 5	Dist:3595680	58.67 ft/s
453	SUSR	-		
454		C: SUSR to JCT New Portage	Dist:1267200	35.20 ft/s
455	SUST	-		
456		C: SUST to Youngstown1 5 5	Dist:1816320	58.67 ft/s
457	TMIR	-		
458		C: TMIR to ColumbianaNE	Dist:1737120	35.20 ft/s
459	TMIT	-		
460		C: TMIT to Youngstown1 5 5	Dist:1742400	58.67 ft/s
461	TPB	-		

	A	B	C	D
	Process Name	Connector Name or "From To"	Connector Time or Distance	Conveyance Speed
462		C: TPB to TPR	D 1-8: 0: 0	
463		C: TPB to Atlanta	Dist:4002240	35.20 ft/s
464	TPR	-		
465		C: TPR to TPB	D 1-8: 0: 0	
466	TPT	-		
467		C: TPT to Metropolis1 4 4	Dist:5976960	58.67 ft/s
468	TROR	-		
469		C: TROR to Uvada1 6 6	D 1-8: 0: 0	
470	TROT	-		
471		C: TROT to St. George1	Dist:5728800	58.67 ft/s
472	Uvada2 8 7	-		
473		C: Uvada2 8 7 to NVR	8:00:00	
474	VOGR	-		
475		C: VOGR to Atlanta	Dist:1246080	35.20 ft/s
476	VOGT	-		
477		C: VOGT to Metropolis1 4 4	Dist:3109920	58.67 ft/s
478	VYR	-		
479		C: VYR to Schenectady	8:00:00	
480	VYT	-		
481		C: VYT to Painesville 5	Dist:3263040	58.67 ft/s
482	WATR	-		
483		C: WATR to Lunita1 9	Dist:1135200	35.20 ft/s
484	WATT	-		
485		C: WATT to Shreveport2 4 4	8:00:00	
486	WBR	-		
487		C: WBR to Lawrenceburg1 10 9	Dist:1209120	35.20 ft/s
488	WBT	-		
489		C: WBT to Metropolis1 4 4	Dist:2402400	58.67 ft/s
490	WCR	-		
491		C: WCR to Kansas City	8:00:00	
492	WCT	-		
493		C: WCT to Oakley2 2 2	Dist:1821600	58.67 ft/s
494	WVR	-		
495		C: WVR to Painesville 10	Dist:1198560	35.20 ft/s
496	WVT	-		
497		C: WVT to Painesville 5	8:00:00	
498	YMR	-		
499	YMT	-		
500		C: YMT to ToGROATruck 9	8:00:00	
501	Youngstown 7	-		
502		C: Youngstown 7 to Blair2 7 8	Dist:4683360	35.20 ft/s
503	Youngstown2 3	-		
504		C: Youngstown2 3 to Omaha2 3 3	Dist:4598880	58.67 ft/s
505	YRHH	-		
506		C: YRHH to YRR	D 1-8: 0: 0	
507		C: YRHH to Painesville 10	Dist:2977920	35.20 ft/s

	A	B	C	D
	Process Name	Connector Name or "From To"	Connector	Conveyance
			Time or Distance	Speed
508	YRR	-		
509		C: YRR to YRHH	D 1-8: 0: 0	
510	YRT	-		
511		C: YRT to Painesville 5	Dist:3263040	58.67 ft/s
512	ZIOR	-		
513		C: ZIOR to Blair2 7 8	Dist:2645280	35.20 ft/s
514	ZIOT	-		
515		C: ZIOT to Omaha2 3 3	Dist:3875520	58.67 ft/s
516	z-StartBarge11 10	-		
517		C: z-StartBarge11 10 to SALR	0:00:00	
518	z-StartBarge12 10	-		
519		C: z-StartBarge12 10 to HCR	0:00:00	
520	z-StartBarge5 10	-		
521		C: z-StartBarge5 10 to OCR	0:00:00	
522	z-StartBarge6 10	-		
523		C: z-StartBarge6 10 to CCR	0:00:00	
524	z-StartBarge7 10	-		
525		C: z-StartBarge7 10 to HADR	0:00:00	
526	z-StartBarge8 10	-		
527		C: z-StartBarge8 10 to PILR	0:00:00	
528	z-StartBarge9 10	-		
529		C: z-StartBarge9 10 to SURR	0:00:00	
530	z-StartHH	-		
531		C: z-StartHH to BVR	0:00:00	
532	z-StartHH10 10	-		
533		C: z-StartHH10 10 to IPR	0:00:00	
534	z-StartHH2 10	-		
535		C: z-StartHH2 10 to GINR	0:00:00	
536	z-StartHH3 10	-		
537		C: z-StartHH3 10 to PEAR	0:00:00	
538	z-StartHH4 10	-		
539		C: z-StartHH4 10 to YRR	0:00:00	

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APPENDIX F
STATE LINE CROSSINGS

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APPENDIX F STATE LINE CROSSINGS

This appendix contains the output of the EXCEL workbook “Appendix F_statelines_7_20_07.xls” listed in Section 8. The spreadsheet shown document the state line crossings used in the TSM and compares it to the state line crossings in the 2003 TSLCC. State line crossings values are used to assign resources to the connectors to calculate the total state line crossings for cost estimating purposes.

Column A: Site ID as used in the TSM

Column B: Site Name

Column C: State lines (SLT) crossed along projected truck routes according to Calvin_2K.mdb

Column D: State lines (SLR) crossed along projected rail routes according to Calvin_2K.mdb

Column E: Map in the TSM where the site is found.

Column F: Blank

Column G: SLT crossed along the TSM routes by manual inspection of belt_1.prn in Section 8.

Column H: SLR crossed along the TSM routes by manual inspection of ec_n15.prn and ec_n15b.prn in Section 8

Column I: Blank .

Columns J-P: Not used (Hidden)

Column Q: Difference in the rail state lines crossed (Column C- Column G).

Column R: Difference in the truck state lines crossed (Column D-Column H)

Column S: Blank

Column T: Current state lines in TSM for truck routes from the hard-coded SLT in the extension for each connector in each route.

Column U: Current state lines in TSM for rail routes from the hard-coded SLR in the extension for each connector in each route

Column V: TSM difference from Calvin (Column U-Column D)

Column W: TSM difference from Calvin (Column T-Column C)

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A	B	C	D	E	F	G	H	I	Q	R	S	T	U	V	W		
Make from Calvin_2K.mdb .					Manual count				Current in TSM								
		Calvin			3/3/2006				Difference from Calvin to Manual			Updated	Updated	Diff from TSM to Calvin			
		Truck SL Cross	Rail SL Cross		Truck lines by counting	Rail lines by counting		Truck	Rail			Truck Cross TSM V3.0x	SL per TSM V3.0x	Rail Cross TSM V3.0x	SL per TSM V3.0x	Rail differences	Truck differences
SITE ID	SITE_NAME	MGR_W_T K	MGR_W_R AIL	MAP								T Model	R Model-				
BRAR	BRAIDWOOD	7	6	MW		7	7	0	-1			7	7	1	0		
BRPR	BIG ROCK	9	9	MW		9	9	0	0			9	9	0	0		
BYRR	BYRON	7	7	MW		7	7	0	0			7	7	0	0		
CALR	CALLAWAY	6	8	MW		7	7	-1	1			7	7	-1	1		
CLIR	CLINTON	7	8	MW		7	7	0	1			7	7	-1	0		
DBR	DAVIS-BESSE	9	10	MW		9	9	0	1			9	9	-1	0		
DCCR	COOK	9	9	MW		9	9	0	0			9	9	0	0		
DRER	DRESDEN	7	7	MW		7	7	0	0			7	7	0	0		
DUAR	DUANE ARNOLD	6	6	MW		6	6	0	0			6	6	0	0		
FERR	ENRICO FERMI	9	9	MW		9	9	0	0			9	9	0	0		
KEWR	KEWAUNEE	8	8	MW		8	8	0	0			8	8	0	0		
LACR	LACROSSE	8	8	MW		8	7	0	1			7	8	0	-1		
LSR	LASALLE	7	10	MW		7	6	0	4			7	7	-3	0		
MORR	MORRIS	7	7	MW		7	7	0	0			7	7	0	0		
PALR	PALISADES	9	9	MW		9	9	0	0			9	9	0	0		
PERR	PERRY	9	10	MW		9	10	0	0			9	9	-1	0		
PIR	PRAIRIE ISL	7	7	MW		7	7	0	0			8	7	0	1		
POIR	POINT BEACH	8	8	MW		8	8	0	0			8	8	0	0		
OCR	QUAD CITIES	7	7	MW		7	6	0	1			7	7	0	0		
ZIOR	ZION	7	7	MW		7	7	0	0			7	7	0	0		
BVR	BEAVER VALLEY	10	10	NE		10	11	0	0			10	11	0	0		
CCR	CALVERT CLF	11	11	NE		11	13	0	-2			11	12	1	0		
FITR	FITZPATRICK	11	11	NE		11	11	0	0			10	11	0	-1		
GINR	GINNA	11	11	NE		11	11	0	0			10	11	0	-1		
HADR	HADDAM NECK	12	13	NE		12	13	0	0			13	13	0	1		
HCR	HOPE CREEK	13	11	NE		13	11	0	0			11	13	2	-2		
IPR	INDIAN PT 1&2	11	11	NE		12	11	-1	0			11	11	1	0		
LIMR	LIMERICK	10	10	NE		10	11	0	-1			10	11	1	0		
MILR	MILLSTONE	13	13	NE		13	13	0	0			12	13	0	-1		
MYR	MAINE YANKEE	14	15	NE		14	15	0	0			14	14	-1	0		
NAR	NORTH ANNA	11	14	NE		12	14	-1	0			14	12	-2	3		
NMPR	NINE MILE PT	11	11	NE		11	11	0	0			10	11	0	-1		
OCR	OYSTER CRK	11	11	NE		11	11	0	0			11	12	1	0		
PEAR	PEACHBOTTOM	10	10	NE		10	11	0	-1			10	11	1	0		
PILR	PILGRIM	12	12	NE		12	12	0	0			12	12	0	0		
SALR	SALEM	13	11	NE		13	11	0	0			11	12	1	-2		
SEAR	SEABROOK	13	14	NE		13	14	0	0			13	13	-1	0		
SURR	SURRY	11	12	NE		12	12	-1	0			14	12	0	3		
SUSR	SUSQUEHANNA	10	10	NE		10	10	0	0			10	11	1	0		
TMIR	THREE MILE ISL	10	10	NE		10	11	0	-1			10	11	1	0		

A	B	C	D	E	F	G	H	I	Q	R	S	T	U	V	W
VYR	VT YANKEE	13	13	NE		13	13		0	0		11	13	0	-2
WVR	WVDP	11	11	NE		11	11		0	0		10	11	0	-1
YRR	YANKEE-ROWE	13	13	NE		12	13		1	0		11	13	0	-2
CGSR	WASH NUCLEAR	6	5	NW		6	5		0	0		6	5	0	0
CPRR	COOPER STN	7	5	NW		6	5		1	0		5	5	0	-2
FCR	FORT CALHOUN	5	5	NW		5	5		0	0		5	5	0	0
HANR	HANFORD	6	5	NW		6	5		0	0		6	5	0	0
HUMR	HUMBOLDT BAY	3	2	NW		2	2		1	0		2	2	0	-1
INLR	INEEL-DOE	4	3	NW		4	3		0	0		4	3	0	0
MONR	MONTICELLO	7	8	NW		7	7		0	1		7	8	0	0
RSR	RANCHO SECO	2	2	NW		2	2		0	0		2	2	0	0
TROR	TROJAN	6	4	NW		6	5		0	-1		6	5	1	0
BFR	BROWNS FERRY	10	12	SE		11	12		-1	0		11	13	1	1
BRUR	BRUNSWICK	11	15	SE		13	15		-2	0		14	14	-1	3
CATR	CATAWBA	11	13	SE		12	13		-1	0		12	13	0	1
CYRR	CRYSTAL RVR	11	14	SE		12	14		-1	0		12	13	-1	1
FARR	FARLEY	9	13	SE		10	13		-1	0		9	13	0	0
GGR	GRAND GULF	8	11	SE		8	12		0	-1		8	12	1	0
HARR	HARRIS	12	15	SE		13	15		-1	0		14	14	-1	2
HATR	HATCH	10	13	SE		11	12		-1	1		11	12	-1	1
MCGR	MCGUIRE	12	13	SE		13	15		-1	-2		14	12	-1	2
OCOR	OCONEE	11	14	SE		12	13		-1	1		12	13	-1	1
RBR	RVR BEND	6	10	SE		7	6		-1	4		7	7	-3	1
ROBR	ROBINSON	11	14	SE		12	14		-1	0		12	13	-1	1
SEQR	SEQUOYAH	10	13	SE		10	11		0	2		10	11	-2	0
SLR	ST LUCIE	11	14	SE		12	14		-1	0		12	13	-1	1
SRSR	SAV RIVER-DOE	11	12	SE		12	14		-1	-2		12	13	1	1
SUMR	SUMMER	11	13	SE		12	13		-1	0		12	13	0	1
TPR	TURKEY PT	11	14	SE		12	14		-1	0		12	13	-1	1
VOGR	VOGTLE	10	13	SE		11	12		-1	1		12	12	-1	2
WATR	WATERFORD	6	10	SE		7	6		-1	4		7	7	-3	1
WBR	WATTS BAR	9	11	SE		10	11		-1	0		10	11	0	1
ANOR	ARK NUCLEAR	7	9	SW		7	9		0	0		7	7	-2	0
CPR	COMANCHE PK	5	5	SW		6	5		-1	0		6	6	1	1
DCR	DIABLO CANYON	2	2	SW		2	2		0	0		2	2	0	0
PVR	PALO VERDE	3	3	SW		3	3		0	0		3	3	0	0
SOR	SAN ONOFRE	2	2	SW		2	2		0	0		2	2	0	0
STPR	SOUTH TEXAS	5	9	SW		5	5		0	4		5	5	-4	0
WCR	WOLF CREEK	5	7	SW		6	7		-1	0		6	7	0	1
	Total State Lines	694	761			716	747					710	742		
	Total Difference to TSLCC								-22	14				-19	16
	% Difference to TSLCC											2.31	-2.50		

APPENDIX G
TIMING TESTS

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APPENDIX G TIMING TESTS

This appendix contains the key results from EXCEL workbook “App. G TimeTesting_comparison_7_26_07_slt.xls” that is attached in Section 8. The timing tests are described in Section 2.6.1 of the main text. The timing test results include the time at the waste sites to receive cask loads from the “Distribute” process and form the consist. The time to transport the consist from the waste site to Yucca Mountain is also shown. The results also show a comparison of results for the progression of TSM development from Version 4.0 in SimCAD™ 7.0 to Version 6.0 in SimCAD™ 7.1. Notice that the Version 6.0 tests were conducted using an interim version of Version 6.0. As discussed in Section 1.2, there will be some additional refinements to this interim version but these should not impact the conclusions from these tests.

Results

Table G-1 The first table shows results for TSM Version 4.0 in SimCAD™ 7.0 followed by Tables G-2 through G-5 for the other tests.

The columns are arranged to show the 3 timing tests that were run. Each test is followed by the Travel Time Steps which is the run time from completion of the consist to arrival at NVR/YMT. The time step are then converted to hours. Following the 3 timing tests, the average for the tests are calculated and the standard deviation is also provided. During the tests substantial test-to-test variations were observed so standard deviations were added to assess the variations. The Average Steps to make a consist at the site is followed by the Average Total Steps or step to reach NVR/YMT. The difference in the time to make the consist and the time to reach NVR/YMT is the travel time from the site to NVR/YMT. Results for rail sites are shown at the top of the tables and truck sites are shown at the bottom of the tables.

All test and evaluation times are shown as TSM simulation 8-hour time steps and in hours. The sites include:

<i>Rail Sites</i>	Typically commercial waste sites using rail form a 3-cask consist for shipments (DOE sites use 5-cask consists). The simulation time in this case represents loading the casks and forming the consist. Sites ending in “R” in the SiteID column.
<i>Barge Sites</i>	Barge sites are a special type of rail site and the waste site time includes the time for the barge to make cyclical trips with loaded and empty transportation cask between the TSM “R sites” and the “B sites” until the consist is completed. Sites ending in “B” in the SiteID column.
<i>HH sites</i>	HH sites are a special type of rail site and the waste site time includes the time for the HH trailer to make cyclical trips with loaded and empty transportation cask between the TSM “R sites” and the “HH sites” until the consist is completed. Sites ending in “HH” in the SiteID column.
<i>Truck sites</i>	Truck waste sites load and ship a single LWT transportation cask in a typical shipment. The simulation time for waste site time is

therefore shorter than a rail site time. Sites ending in “T” in the SiteID column.

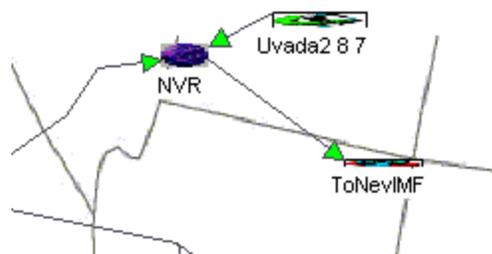
The columns in the table include:

<i>Test Column: Site</i>	Three columns with values for the times manually recorded as the tests are performed. Sub-columns are: Site: The time from when the first cask load enters the TSM until the consist is formed and departs the waste site. NVR or YMT: The time from when the first cask load enters the TSM until the consist is arrives at NVR/YMT. Travel Time steps: The difference in the above site and NVR/YMT that represents the travel time. Travel Hours: Travel time steps converted to hours for general interest.
<i>Analysis Columns</i>	Averages and standard deviations for the three tests for Site, NVR/YMT total, and Travel Time.
<i>Difference Columns</i>	Differences between Site and Travel Time results between various versions of TSM and SimCAD™ as numerical value and as a percent. Numerical differences in Travel Time in hours is also presented for interest.

All of the active rail and truck sites in TSM were not included in the timing tests and are not presented in this appendix. The sites selected were chosen to provide representative results that covered all of the main routes in all of the TSM map departments. The tested sites are adequate to draw insights on the differences version of TSM and SimCAD™.

Inputs for Cycle Time Tests

Some of the results of these timing tests are used for the cycle time tests. Notice that the BFB, PEAHH, and SUMR sites that are used in the cycle time analysis discussed in Section 2.6.2 and presented in Section 5.6.2 are circled in the tables. As shown in the detail below from Figure A-8 in Appendix A, the timing tests and the TSM programming include a one-step connector prior to “ToNevIMF” is not included in the timing tests in this appendix. Therefore 1 step needs to be added to the test time to arrive at the cycle time that will be in the simulation to reach Yucca Mountain. There is a similar situation for the YMT site, see Figure A-2. This correction is made in the results tables in Section 5.6.2.



Analysis

The timing tests assess the consistency of TSM through changes in TSM and SimCAD™. However, the comparisons must take into account the considerable variation in the tests and that exact matches of timings run to run and model-to-model are not expected. Considerations of the standard deviations of the averaged test data are used to assist in the evaluation and variations. Standard deviations greater than 10% are highlighted to give a general idea of the variation and to indicate large differences in the comparisons. Differences in case-to-case results greater than 10% are also highlighted.

Results for two identical tests shown in “Timing Test 2 for TSM Version 5.0 in SimCAD™ 7.1” show considerable variation and provide insight on the amount of variation below which two results may be considered as the numerically equivalent. The maximum difference is 22%, indicating that differences of 22% may be viewed as numerically equivalent. This large percentage indicates that this type of timing test alone may not be sufficient to judge consistency between two versions. Therefore, cycle time testing must also be performed to validate TSM V6.0.

The evaluation also included a review of results with large standard deviations. The test data are reviewed for outliers and the standard deviation for individual test cases to justify comparisons showing large differences.

Based on the variations inherent in these tests, consideration of outliers in the tests, and observations of the model behavior during tests, the results between the variations show no model-to-model inconsistencies. However, this result must be qualified as being only a general indication of consistency given the large variation in identical tests.

The timing tests can be improved by running more than 3 test runs to narrow the differences between the test averages. However, a more comprehensive and conclusive test is available using the cycle time testing as described in Section 2.6.2 and 5.6.2. Cycle time tests effectively run thousands of objects through the processes providing more statistically meaningful results. However, the cycle time are limited in that they provide no data specifically on the times for cask allocation and consist formation because these results are influence by system effects such as the competition by the various cask loads. Also, the cycle time test cannot provide specific data on the travel times from the sites to the GROA since these are not recorded during full run simulations.

Table G-1. Timing Test for TSM Version 4.0 in SimCAD™ 7.0

Test1 Pause Time					Test2 Pause Time i					Test3 Pause Time i					Average Steps to make consist at site			Avg Total Steps			V4 in Version 7.0 Run Averages Travel Steps			Average
SiteID	Map	Site	NVR	Travel Time/Steps	Travel Hrs	Site	NVR	Travel Time/Steps	Travel Hrs	Site	NVR	Travel Time/Steps	Travel Hrs	Site	Std Dev	Std Dev%	NVR	Std Dev	Std Dev%	Travel Time Steps	Std Dev	Std Dev%	Travel Hrs	
BRAR	MWrail	14	24	10	80	14	23	9	72	13	23	10	80	13.67	0.58	4%	23.33	0.58	2%	9.67	0.58	6%	77	
BYRR	MWrail	17	28	11	88	14	24	10	80	14	27	13	104	15.00	1.73	12%	28.33	2.08	8%	11.33	1.53	13%	91	
LIMR	NErail	16	32	16	128	15	33	18	144	15	30	15	120	15.33	1.58	4%	31.67	1.53	5%	16.33	1.53	9%	131	
PEAHH	NErail	35	48	13	104	38	53	15	120	37	52	15	120	36.67	0.58	4%	51.00	2.65	5%	14.33	1.15	8%	115	
CGSR	NWrail	13	20	7	56	13	21	8	64	16	23	7	56	14.00	1.73	12%	21.33	1.53	7%	7.33	0.58	8%	59	
HANR	NWrail	14	21	7	56	14	21	7	56	15	23	8	64	14.33	0.58	4%	21.67	1.15	5%	7.33	0.58	8%	59	
BFB	SErail	34	48	14	112	35	47	12	96	36	48	12	96	35.00	1.00	3%	47.67	0.58	1%	12.67	1.15	9%	101	
SUMR	SErail	14	27	13	104	15	29	14	112	14	30	16	128	14.33	0.58	4%	28.67	1.53	5%	14.33	1.53	11%	115	
ANOR	SWrail	15	26	11	88	14	25	11	88	16	27	11	88	15.00	1.00	7%	26.00	1.00	4%	11.00	0.00	0%	88	
PVR	SWrail	15	20	5	40	15	19	4	32	16	20	4	32	15.33	0.58	4%	19.67	0.58	3%	4.33	0.58	13%	35	

Test1 Pause Time					Test2 Pause Time i					Test3 Pause Time i					Average Steps to make consist at site			Avg Total Steps			Run Averages Avg Steps			Average
SiteID	Map	Site	YMT	Travel Time/Steps	Travel Hrs	Site	YMT	Travel Time/Steps	Travel Hrs	Site	YMT	Travel Time/Steps	Travel Hrs	Site	Std Dev	Std Dev%	YMT	Std Dev	Std Dev%	Travel Time Steps	Std Dev	Std Dev%	Travel Hrs	
CPRT	NWtruck	9	16	7	56	9	16	7	56	9	16	7	56	9.00	0.00	0%	16.00	0.00	0%	7.00	0.00	0%	56	
GINT	NEtruck	9	21	12	96	11	21	10	80	10	20	10	80	10.00	1.00	10%	20.67	0.58	3%	10.67	1.15	11%	85	
HANT	NWtruck	12	15	3	24	11	14	3	24	11	15	4	32	11.33	0.58	5%	14.67	0.58	4%	3.33	0.58	17%	27	
INLT	NWtruck	7	10	3	24	9	12	3	24	7	10	3	24	7.67	1.15	15%	10.67	1.15	11%	3.00	0.00	0%	24	
IPT	NEtruck	12	22	10	80	11	20	9	72	12	21	9	72	11.67	0.58	5%	21.00	1.00	5%	9.33	0.58	6%	75	
LACT	MWtruck	8	15	7	56	8	16	8	64	7	15	8	64	7.67	0.58	8%	15.33	0.58	4%	7.67	0.58	8%	61	
CRYT	SEtruck	10	22	12	96	11	23	12	96	10	22	12	96	10.33	0.58	6%	22.33	0.58	3%	12.00	0.00	0%	96	
DCCT	MWtruck	10	17	7	56	13	20	7	56	10	17	7	56	11.00	1.73	16%	18.00	1.73	10%	7.00	0.00	0%	56	
CLIT	MWtruck	10	17	7	56	8	15	7	56	9	16	7	56	9.00	1.00	11%	16.00	1.00	6%	7.00	0.00	0%	56	
TPT	SEtruck	12	25	13	104	10	23	13	104	12	25	13	104	11.33	1.15	10%	24.33	1.15	5%	13.00	0.00	0%	104	

Table G-2. Timing Test for TSM Version 4.0 in SimCAD™ 7.1

Test1 Pause Time					Test2 Pause Time i					Test3 Pause Time i					Average Steps to make consist at site			Avg Total Steps			Run Averages Travel Steps			Average	Difference (V4 in 7.1)-(V4 in 7.0)					
SiteID	Map	Site	NVR	Travel Time/Steps	Travel Hrs	Site	NVR	Travel Time/Steps	Travel Hrs	Site	NVR	Travel Time/Steps	Travel Hrs	Site	Std Dev	Std Dev%	NVR	Std Dev	Std Dev%	Travel Time Steps	Std Dev	Std Dev%	Travel Hrs	Site	Site %	NVR	NVR %	Travel	Travel %	Travel Hrs
BRAR	MWrail	13	24	11	88	15	26	11	88	14	24	10	80	14.00	1.00	7%	24.67	1.15	5%	10.67	0.58	5%	85.33	0.33	2%	1.33	6%	1.00	10%	8.00
BYRR	MWrail	16	27	11	88	14	24	10	80	15	28	12	96	15.33	1.15	8%	26.33	2.08	8%	11.00	1.00	9%	88.00	0.33	2%	0.00	0%	-0.33	-3%	-2.67
LIMR	NErail	14	31	17	136	15	30	15	120	16	33	17	136	15.00	1.00	7%	31.33	1.53	5%	16.33	1.15	7%	130.67	-0.33	-2%	-0.33	-1%	0.00	0%	0.00
PEAHH	NErail	32	46	14	112	35	49	14	112	36	51	15	120	34.33	2.08	6%	48.67	2.52	5%	14.33	0.58	4%	114.67	-2.33	-6%	-2.33	-5%	0.00	0%	0.00
CGSR	NWrail	16	22	6	48	15	22	7	56	14	22	8	64	15.00	1.00	7%	22.00	0.00	0%	7.00	1.00	14%	56.00	1.00	7%	0.67	3%	-0.33	-5%	-2.67
HANR	NWrail	18	25	7	56	18	25	7	56	17	25	8	64	17.67	0.58	3%	25.00	0.00	0%	7.33	0.58	8%	58.67	3.33	23%	3.33	15%	0.00	0%	0.00
BFB	SErail	35	48	13	104	36	50	14	112	34	46	12	96	35.00	1.00	3%	48.00	2.00	4%	13.00	1.00	8%	104.00	0.00	0%	0.33	1%	0.33	3%	2.67
SUMR	SErail	15	30	15	120	15	30	15	120	14	31	17	136	14.67	0.58	4%	30.33	0.58	2%	15.67	1.15	7%	125.33	0.33	2%	1.67	6%	1.33	9%	10.67
ANOR	SWrail	14	24	10	80	13	24	11	88	16	27	11	88	14.33	1.53	11%	25.00	1.73	7%	10.67	0.58	5%	85.33	-0.67	-4%	-1.00	-4%	-0.33	-3%	-2.67
PVR	SWrail	15	20	5	40	16	21	5	40	15	20	5	40	15.33	0.58	4%	20.33	0.58	3%	5.00	0.00	0%	40.00	0.00	0%	0.67	3%	0.67	15%	5.33

Test1 Pause Time					Test2 Pause Time i					Test3 Pause Time i					Average Steps to make consist at site			Avg Total Steps			Run Averages Avg Steps			Average	Difference (V4 in 7.1)-(V4 in 7.0)					
SiteID	Map	Site	YMT	Travel Time/Steps	Travel Hrs	Site	YMT	Travel Time/Steps	Travel Hrs	Site	YMT	Travel Time/Steps	Travel Hrs	Site	Std Dev	Std Dev%	YMT	Std Dev	Std Dev%	Travel Time Steps	Std Dev	Std Dev%	Travel Hrs	Site	Site %	YMT	YMT%	Travel	Travel %	Travel Hrs
CPRT	NWtruck	6	14	8	64	10	18	8	64	7	13	6	48	7.67	2.08	27%	15.00	2.65	18%	7.33	1.15	16%	58.67	-1.33	-15%	-1.00	-6%	0.33	5%	2.67
GINT	NEtruck	10	20	10	80	10	19	9	72	11	22	11	88	10.33	0.58	6%	20.33	1.53	8%	10.00	1.00	10%	80.00	0.33	3%	-0.33	-2%	-0.67	-6%	-5.33
HANT	NWtruck	11	14	3	24	12	16	4	32	11	15	4	32	11.33	0.58	5%	15.00	1.00	7%	3.67	0.58	16%	29.33	0.00	0%	0.33	2%	0.33	10%	2.67
INLT	NWtruck	9	12	3	24	8	11	3	24	8	11	3	24	8.33	0.58	7%	11.33	0.58	5%	3.00	0.00	0%	24.00	0.67	9%	0.67	6%	0.00	0%	0.00
IPT	NEtruck	11	21	10	80	10	21	11	88	11	22	11	88	10.67	0.58	5%	21.33	0.58	3%	10.67	0.58	5%	85.33	-1.00	-9%	0.33	2%	1.33	14%	10.67
LACT	MWtruck	9	17	8	64	8	14	8	64	8	15	7	56	8.33	0.58	7%	15.33	1.53	10%	7.00	1.00	14%	58.00	0.67	9%	0.00	0%	-0.67	-9%	-5.33
CRYT	SEtruck	11	23	12	96	10	23	13	104	12	24	12	96	11.00	1.00	9%	23.33	0.58	2%	12.33	0.58	5%	98.67	0.67	6%	1.00	4%	0.33	3%	2.67
DCCT	MWtruck	10	17	7	56	13	21	8	64	10	18	8	64	11.00	1.73	16%	18.67	2.08	11%	7.67	0.58	8%	61.33	0.00	0%	0.67	4%	0.67	10%	5.33
CLIT	MWtruck	7	13	6	48	7	13	6	48	7	15	8	64	7.00	0.00	0%	13.67	1.15	8%	6.67	1.15	17%	53.33	-2.00	-22%	-2.33	-15%	-0.33	-5%	-2.67
TPT	SEtruck	12	25	13	104	12	25	13	104	12	26	14	112	12.00	0.00	0%	25.33	0.58	2%	13.33	0.58	4%	106.67	0.67	6%	1.00	4%	0.33	3%	2.67

Table G-3. Timing Test for TSM Version 5.0 in SimCAD™ 7.1

												V5 in Version 7.1						Difference (V5 in 7.1)-(V4 in 7.1)														
Test1 Pause Time in Time Steps				Test2 Pause Time in Time Steps				Test3 Pause Time in Time Steps				Average Steps to make consist at site			Avg Total Steps			Run Averages Travel Steps			Avg			Average Steps to make consist at site			Avg Total Steps			Avg		
SiteID	Map	Site	NVR	Time Steps	Travel Hrs	Site	NVR	Time Steps	Travel Hrs	Site	NVR	Time Steps	Travel Hrs	Site	Std Dev	Std Dev%	NVR	Std Dev	Std Dev%	Steps	Std Dev	Std Dev%	Travel Hrs	Site	Site %	NVR	NVR %	Travel	Travel %	Travel Hrs		
BRAR	MWrail	17	27	10	80	16	26	10	80	14	25	11	88	15.67	1.53	10%	26.00	1.00	4%	10.33	0.58	6%	82.67	1.67	12%	1.33	5%	-0.33	-3%	-2.67		
BYRR	MWrail	16	26	10	80	15	27	12	96	15	26	11	88	15.33	0.58	4%	26.33	0.58	2%	11.00	1.00	9%	86.00	0.00	0%	0.00	0%	0.00	0%	0.00		
LIMR	NErail	14	27	13	104	17	32	15	120	13	31	18	144	14.67	2.08	14%	30.00	2.66	9%	15.33	2.52	16%	122.67	-0.33	-2%	-1.33	-4%	-1.00	-6%	-8.00		
PEAHH	NErail	35	51	16	128	34	48	14	112	34	48	14	112	34.33	0.58	2%	49.00	1.73	4%	14.67	1.15	8%	117.33	0.00	0%	0.33	1%	0.33	2%	2.67		
CGSR	NWrail	15	22	7	56	14	21	7	56	13	22	9	72	14.00	1.00	7%	21.67	0.58	3%	7.67	1.15	15%	61.33	-1.00	-7%	-0.33	-2%	0.67	10%	5.33		
HANR	NWrail	19	27	8	64	18	26	8	64	16	24	8	64	17.67	1.53	9%	25.67	1.53	6%	8.00	0.00	0%	64.00	0.00	0%	0.67	3%	0.67	9%	5.33		
BFB	SErail	32	47	15	120	33	44	11	88	34	47	13	104	33.00	1.00	3%	46.00	1.73	4%	13.00	2.00	15%	104.00	0.00	-6%	-2.00	-4%	0.00	0%	0.00		
SUMR	SErail	15	29	14	112	14	28	14	112	15	30	15	120	14.67	0.58	4%	29.00	1.00	3%	14.33	0.58	4%	114.67	0.00	0%	-1.33	-4%	-1.33	-9%	-10.67		
ANOR	SWrail	15	26	11	88	16	27	11	88	14	25	11	88	15.00	1.00	7%	26.00	1.00	4%	11.00	0.00	0%	88.00	0.67	5%	1.00	4%	0.33	3%	2.67		
PVR	SWrail	17	22	5	40	14	19	5	40	16	19	3	24	15.67	1.53	10%	20.00	1.73	9%	4.33	1.15	27%	34.67	0.33	2%	-0.33	-2%	-0.67	-13%	-5.33		

												V5 in Version 7.1 test2						Difference (V5 in 7.1 test2)-(V5 in 7.1)														
Test1 Time in Time				Test2 Time in Time				Test3 Time in Time				Average Steps to make consist at site			Avg Total Steps			Run Averages Travel Steps			Avg			Average Steps to make consist at site			Avg Total Steps			Avg		
SiteID	Map	Site	YMT	Total Time	Travel Hrs	Site	YMT	Total Time	Travel Hrs	Site	YMT	Total Time	Travel Hrs	Site	Std Dev	Std Dev%	YMT	Std Dev	Std Dev%	Steps	Std Dev	Std Dev%	Travel Hrs	Site	Site %	YMT	YMT%	Travel	Travel %	Travel Hrs		
CPRT	NWtruck	7	14	7	56	7	15	8	64	7	12	5	40	7.00	0.00	0%	13.67	1.53	11%	6.67	1.53	23%	53.33	-0.67	-9%	-1.33	-9%	-0.67	-9%	-5.33		
GINT	NEtruck	10	20	10	80	11	21	10	80	12	23	11	88	11.00	1.00	9%	21.33	1.53	7%	10.33	0.58	6%	82.67	0.67	6%	1.00	5%	0.33	3%	2.67		
HANT	NWtruck	8	11	3	24	8	12	4	32	8	12	4	32	8.00	0.00	0%	11.67	0.58	5%	3.67	0.58	16%	29.33	-3.33	-29%	-3.33	-22%	0.00	0%	0.00		
INLT	NWtruck	8	11	3	24	9	13	4	32	7	10	3	24	8.00	1.00	13%	11.33	1.53	13%	3.33	0.58	17%	26.67	-0.33	-4%	0.00	0%	0.33	11%	2.67		
IPF	NEtruck	9	19	10	80	11	20	9	72	11	22	11	88	10.33	1.15	11%	20.33	1.53	8%	10.00	1.00	10%	80.00	-0.33	-3%	-1.00	-5%	-0.67	-6%	-5.33		
LACT	MWtruck	8	16	8	64	8	13	7	56	8	15	7	56	7.33	1.15	16%	14.67	1.53	10%	7.33	0.58	8%	58.67	-1.00	-12%	-0.67	-4%	0.33	5%	2.67		
CRYT	SEtruck	11	23	12	96	12	24	12	96	10	22	12	96	11.00	1.00	9%	23.00	1.00	4%	12.00	0.00	0%	96.00	0.00	0%	-0.33	-1%	-0.33	-3%	-2.67		
DCCT	MWtruck	12	18	6	48	10	15	5	40	11	18	7	56	11.00	1.00	9%	17.00	1.73	10%	6.00	1.00	17%	48.00	0.00	0%	-1.67	-9%	-1.67	-22%	-13.33		
CLIT	MWtruck	7	13	6	48	8	15	7	56	8	14	6	48	7.67	0.58	8%	14.00	1.00	7%	6.33	0.58	9%	50.67	0.67	10%	0.33	2%	-0.33	-5%	-2.67		
TPT	SEtruck	11	25	14	112	11	26	15	120	11	24	13	104	11.00	0.00	0%	25.00	1.00	4%	14.00	1.00	7%	112.00	-1.00	-8%	-0.33	-1%	0.67	5%	5.33		

Table G-4. Timing Test 2 for TSM Version 5.0 in SimCAD™ 7.1

												V5 in Version 7.1 test2						Difference (V5 in 7.1 test2)-(V5 in 7.1)														
Test1 Time in Time				Test2 Time in Time				Test3 Time in Time				Average Steps to make consist at site			Avg Total Steps			Run Averages Travel Steps			Avg			Average Steps to make consist at site			Avg Total Steps			Avg		
SiteID	Map	Site	NVR	Time Steps	Travel Hrs	Site	NVR	Time Steps	Travel Hrs	Site	NVR	Time Steps	Travel Hrs	Site	Std Dev	Std Dev%	NVR	Std Dev	Std Dev%	Steps	Std Dev	Std Dev%	Travel Hrs	Site	Site %	NVR	NVR %	Travel	Travel %	Travel Hrs		
BRAR	MWrail	13	23	10	80	14	24	10	80	15	26	11	88	14.00	1.00	7%	24.33	1.53	6%	10.33	0.58	6%	82.67	-1.67	-11%	-1.67	-6%	0.00	0%	0.00		
BYRR	MWrail	16	27	11	88	16	27	11	88	14	27	13	104	15.33	1.15	8%	27.00	0.00	0%	11.67	1.15	10%	93.33	0.00	0%	0.67	3%	0.67	6%	5.33		
LIMR	NErail	16	30	14	112	14	32	18	144	15	30	15	120	15.00	1.00	7%	30.67	1.15	4%	15.67	2.08	13%	125.33	0.33	2%	0.67	2%	0.33	2%	2.67		
PEAHH	NErail	33	49	16	128	33	48	15	120	35	49	14	112	33.67	1.15	3%	48.67	0.58	1%	15.00	1.00	7%	120.00	-0.67	-2%	-0.33	-1%	0.33	2%	2.67		
CGSR	NWrail	12	21	9	72	15	21	6	48	16	23	7	56	14.33	2.08	15%	21.67	1.15	5%	7.33	1.53	21%	58.67	0.33	2%	0.00	0%	-0.33	-4%	-2.67		
HANR	NWrail	17	25	8	64	17	25	8	64	16	23	7	56	16.67	0.58	3%	24.33	1.15	5%	7.67	0.58	8%	61.33	-1.00	-6%	-1.33	-5%	-0.33	-4%	-2.67		
BFB	SErail	35	48	13	104	36	49	13	104	35	48	13	104	35.33	0.58	2%	48.33	0.58	1%	13.00	0.00	0%	104.00	2.33	7%	2.33	5%	0.00	0%	0.00		
SUMR	SErail	13	27	14	112	17	30	13	104	13	28	15	120	14.33	2.31	16%	28.33	1.53	5%	14.00	1.00	7%	112.00	-0.33	-2%	-0.67	-2%	-0.33	-2%	-2.67		
ANOR	SWrail	14	26	12	96	15	24	9	72	16	25	9	72	15.00	1.00	7%	25.00	1.00	4%	10.00	1.73	17%	80.00	0.00	0%	-1.00	-4%	-1.00	-9%	-8.00		
PVR	SWrail	16	20	4	32	15	20	5	40	15	20	5	40	15.33	0.58	4%	20.00	0.00	0%	4.67	0.58	12%	37.33	-0.33	-2%	0.00	0%	0.33	8%	2.67		

												V5 in Version 7.1 test2						Difference (V5 in 7.1 test2)-(V5 in 7.1)														
Test1 Time in Time				Test2 Time in Time				Test3 Time in Time				Average Steps to make consist at site			Avg Total Steps			Run Averages Travel Steps			Avg			Average Steps to make consist at site			Avg Total Steps			Avg		
SiteID	Map	Site	YMT	Total Time	Travel Hrs	Site	YMT	Total Time	Travel Hrs	Site	YMT	Total Time	Travel Hrs	Site	Std Dev	Std Dev%	YMT	Std Dev	Std Dev%	Steps	Std Dev	Std Dev%	Travel Hrs	Site	Site %	YMT	YMT%	Travel	Travel %	Travel Hrs		
CPRT	NWtruck	8	15	7	56	9	17	8	64	8	15	7	56	8.33	0.58	7%	15.67	1.15	7%	7.33	0.58	8%	58.67	1.33	19%	2.00	15%	0.67	10%	5.33		
GINT	NEtruck	11	22	11	88	10	20	10	80	11	22	11	88	10.67	0.58	5%	21.33	1.15	5%	10.67	0.58	5%	85.33	-0.33	-3%	0.00	0%	0.33	3%	2.67		
HANT	NWtruck	8	12	4	32	7	12	5	40	8	12	5	40	7.67	0.58	8%	12.33	0.58	5%	4.67	0.58	12%	37.33	-0.33	-4%	0.67	6%	1.00	27%	8.00		
INLT	NWtruck	9	12	3	24	8	11	3	24	8	11	3	24	8.33	0.58	7%	11.33	0.58	5%	3.00	0.00	0%	24.00	0.33	4%	0.00	0%	-0.33	-10%	-2.67		
IPF	NEtruck	10	21	11	88	11	22	11	88	12	22	10	80	11.00	1.00	9%	21.67	0.58	3%	10.67	0.58	5%	85.33	0.67	6%	1.33	7%	0.67	7%	5.33		
LACT	MWtruck	6	13	7	56	8	17	9	72	8	16	8	64	7.33	1.15	16%	15.33	2.08	14%	8.00	1.00	13%	64.00	0.00	0%	0.67	5%	0.67	9%	5.33		
CRYT	SEtruck	13	23	10	80	11	24	13	104	12	22	10	80	12.00	1.00	8%	23.00	1.00	4%	11.00	1.73	16%	88.00	1.00	9%	0.00	0%	-1.00	-8%	-8.00		
DCCT	MWtruck	9	16	7																												

Table G-5. Timing Test for TSM Version 6.0 in SimCAD™ 7.1

												V6 in Version 7.1										TSM V6.0D7_71_timestesting.SIM										Difference (V6 in 7.1)-(V5 in 7.1)							
Test1 Pause Time in Time Steps				Test2 Pause Time in Time Steps				Test3 Pause Time in Time Steps				Average Steps to make consist at site			Avg Total Steps			Run Averages Travel Steps				Average	Average Steps to make consist at site		Avg Total Steps		Run Averages Travel Steps		Average										
SiteID	Map	Site	NVR	Travel TimeSteps	Travel Hrs	Site	NVR	Travel TimeSteps	Travel Hrs	Site	NVR	Travel TimeSteps	Travel Hrs	Site	Std Dev	Std Dev%	NVR	Std Dev	Std Dev%	Travel Time	Site	Std Dev	Std Dev%	Travel Hrs	Site	Site %	NVR	NVR %	Travel	Travel %	Travel Hrs								
BRAR	MWrail	15	25	10	80	16	28	12	96	15	24	9	72	15.33	0.58	4%	25.67	2.08	8%	10.33	1.53	15%	82.67	-0.33	-2%	-0.33	-1%	0.00	0%	0.00									
BYRR	MWrail	15	24	9	72	16	27	11	88	16	26	10	80	15.67	0.58	4%	25.67	1.53	6%	10.00	1.00	10%	80.00	0.33	2%	-0.67	-3%	-1.00	-9%	-8.00									
LIMR	NErail	16	33	17	136	13	29	16	128	15	31	16	128	14.67	1.53	10%	31.00	2.00	6%	16.33	0.58	4%	130.67	0.00	0%	1.00	3%	1.00	7%	8.00									
PEAHH	NErail	31	46	15	120	35	49	14	112	33	47	14	112	33.00	2.00	6%	47.33	1.53	3%	14.33	0.58	4%	114.67	-1.33	-4%	-1.67	-3%	-0.33	-2%	-2.67									
CGSR	NWrail	15	22	7	56	15	23	8	64	15	22	7	56	15.00	0.00	0%	22.33	0.58	3%	7.33	0.58	8%	58.67	1.00	7%	0.67	3%	-0.33	-4%	-2.67									
HANR	NWrail	18	25	7	56	17	25	8	64	15	22	7	56	16.67	1.53	9%	24.00	1.73	7%	7.33	0.58	8%	58.67	-1.00	-6%	-1.67	-6%	-0.67	-8%	-5.33									
BFB	SErail	33	45	12	96	35	47	12	96	37	50	13	104	35.00	2.00	6%	47.33	2.52	5%	12.33	0.58	5%	98.67	2.00	6%	1.33	3%	-0.67	-5%	-5.33									
SUMR	SErail	14	28	14	112	14	27	13	104	14	29	15	120	14.00	0.00	0%	28.00	1.00	4%	14.00	1.00	7%	112.00	-0.67	-5%	-1.00	-3%	-0.33	-2%	-2.67									
ANOR	Swrail	14	25	11	88	15	27	12	96	16	27	11	88	15.00	1.00	7%	26.33	1.15	4%	11.33	0.58	5%	90.67	0.00	0%	0.33	1%	0.33	3%	2.67									
PVR	SWrail	17	22	5	40	16	21	5	40	14	20	6	48	15.67	1.53	10%	21.00	1.00	5%	5.33	0.58	11%	42.67	0.00	0%	1.00	5%	1.00	23%	8.00									

												Average Steps to make consist at site			Avg Total Steps			Run Averages Travel Steps				Avg Hrs	Average Steps to make consist at site		Avg Total Steps		Run Averages Travel Steps		Avg Hrs		
SiteID	Map	Site	YMT	Travel TimeSteps	Travel Hrs	Site	YMT	Travel TimeSteps	Travel Hrs	Site	YMT	Travel TimeSteps	Travel Hrs	Site	Std Dev	Std Dev%	YMT	Std Dev	Std Dev%	Travel Time	Site	Std Dev	Std Dev%	Travel Hrs	Site	Site %	YMT	YMT%	Travel	Travel %	Travel Hrs
CPRT	NWtruck	8	16	8	64	6	12	6	48	9	16	7	56	7.67	1.53	20%	14.67	2.31	16%	7.00	1.00	14%	56.00	0.67	10%	1.00	7%	0.33	5%	2.67	
GINT	NEtruck	10	21	11	88	11	21	10	80	12	23	11	88	11.00	1.00	9%	21.67	1.15	5%	10.67	0.58	5%	85.33	0.00	0%	0.33	2%	0.33	3%	2.67	
HANT	NWtruck	8	12	4	32	7	11	4	32	8	13	5	40	7.67	0.58	8%	12.00	1.00	8%	4.33	0.58	13%	34.67	-0.33	-4%	0.33	3%	0.67	18%	5.33	
INLT	NWtruck	9	12	3	24	8	11	3	24	9	12	3	24	8.67	0.58	7%	11.67	0.58	5%	3.00	0.00	0%	24.00	0.67	8%	0.33	3%	-0.33	-10%	-2.67	
IPT	NEtruck	11	19	8	64	12	21	9	72	10	20	10	80	11.00	1.00	9%	20.00	1.00	5%	9.00	1.00	11%	72.00	0.67	6%	-0.33	-2%	-1.00	-10%	-8.00	
LACT	MWtruck	7	15	8	64	9	15	6	48	10	17	7	56	8.67	1.53	18%	15.67	1.15	7%	7.00	1.00	14%	56.00	1.33	18%	1.00	7%	-0.33	-5%	-2.67	
CRYT	SEtruck	10	22	12	96	10	22	12	96	11	24	13	104	10.33	0.58	6%	22.67	1.15	5%	12.33	0.58	5%	98.67	-0.67	-6%	-0.33	-1%	0.33	3%	2.67	
DCCT	MWtruck	11	19	8	64	10	17	7	56	11	17	6	48	10.67	0.58	5%	17.67	1.15	7%	7.00	1.00	14%	56.00	-0.33	-3%	0.67	4%	1.00	17%	8.00	
CLIT	MWtruck	9	15	6	48	8	16	8	64	8	15	7	56	8.33	0.58	7%	15.33	0.58	4%	7.00	1.00	14%	56.00	0.67	9%	1.33	10%	0.67	11%	5.33	
TPT	SEtruck	11	23	12	96	12	24	12	96	10	24	14	112	11.00	1.00	9%	23.67	0.58	2%	12.67	1.15	9%	101.33	0.00	0%	-1.33	-5%	-1.33	-10%	-10.67	

APPENDIX H
TRANSPORTATION SHIPMENT REPORT GENERATOR VALIDATION

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APPENDIX H

TRANSPORTATION SHIPMENT REPORT GENERATOR VALIDATION

OBJECTIVE AND BACKGROUND

The TSM report generators are post-processing tools created to facilitate the study and verification of results from TSM model runs. The TSM report generators were designed to automate the analysis of model data and computations through the use of Visual Basis (VB) macros in Microsoft Excel workbooks. This appendix validates the TSM Transportation Shipment Report Generator (TSRG). The TSRG provides information on:

- MTU (Metric Tonnes of Uranium) that traveled by rail and truck through each of the USA states,
- MTU that traveled by rail and truck through designated US cities,
- shipments that traveled by rail and truck through each of the USA states, and
- shipments that traveled by rail and truck through the designated US cities.

The TSRG also includes reference information for the locations traveled through by shipments from the TSM reactor sites to the repository. The reference worksheets list the TSM reactor sites and the corresponding routes that include key locations, US states in the routes and US cities in the routes. This information is also validated as described in this appendix.

VALIDATION METHOD

Results Worksheets

To verify the accuracy of the implementation, the validation process manually applied functions and formulas at the Excel worksheet cell level to compare to the VB results. The workbooks with the manual checks are attached to this report.

The validation was based on the 29B case from the file TSM_V30J2_Scn29B_russ_082605.zip. The input data is from Simdata file TSM_V3.0J2_Scn29B.simdata, mdb file TSM_Scn29B.mdb, and Initial State file IS_Scn29B_LE104_DOE_WO_082205.xls found in TSM_V30J2_Scn29B_russ_082605.zip.

To verify results, validation columns are added next to the columns of the worksheet generated by the VB. The inserted columns contain manually extracted data or the applied computation formula. The applied formula is not just a repeat of the formula contained in the macro or cells; the validation process considers what the desired computation and applies a new formula independently. A visual check is then made to compare results between the columns. This validates that the data was properly extracted from the results database and that the VB is performing the desired analysis.

Original columns of the generator have a white background. Validation columns have a colored background. In each worksheet, comment boxes provide clarification for the calculations. An explanation of colors is as follows:

- | | |
|--------|---|
| Blue | Indicates values extracted from the selected input file or reference worksheet. |
| Green | Represents results of the validation. |
| Yellow | Identifies data converted to 1s and 0s for comparison to reference file or worksheet. |

A description of each step of the result worksheet validation procedure is described in Figure H-1

Reference Worksheets

The Reference Worksheets were generated from Excel files that are based on routing data from the text files ec_n15.prn and ec_n15b.prn. The ec_n15b.prn file contains rail routes that include barge transportation. Truck route files were extracted from the file belt_1.prn. The validation was done by manually checking the Reference Worksheet entries to the original text file information and in the transportation calculation that supports Version 4 of the TSM (BSC 2006a).

USE OF COMPUTER SOFTWARE AND MODELS

In addition to the computer software listed in Section 4.0, the TSRG used these items:

- TSM Interim Version 3.0J2 (included in run files attached to this report). Version 3.0J2 was issued as Version 4.0. The minor revisions to routes and processes and in Version 5.0 and Version 6.0 would not have an impact on the validation.
- SimCAD™ Pro Data Analyzer
- MS EXCEL 2003
- MS Access 2003
- TSM Transportation Shipment Report Generator 1-5

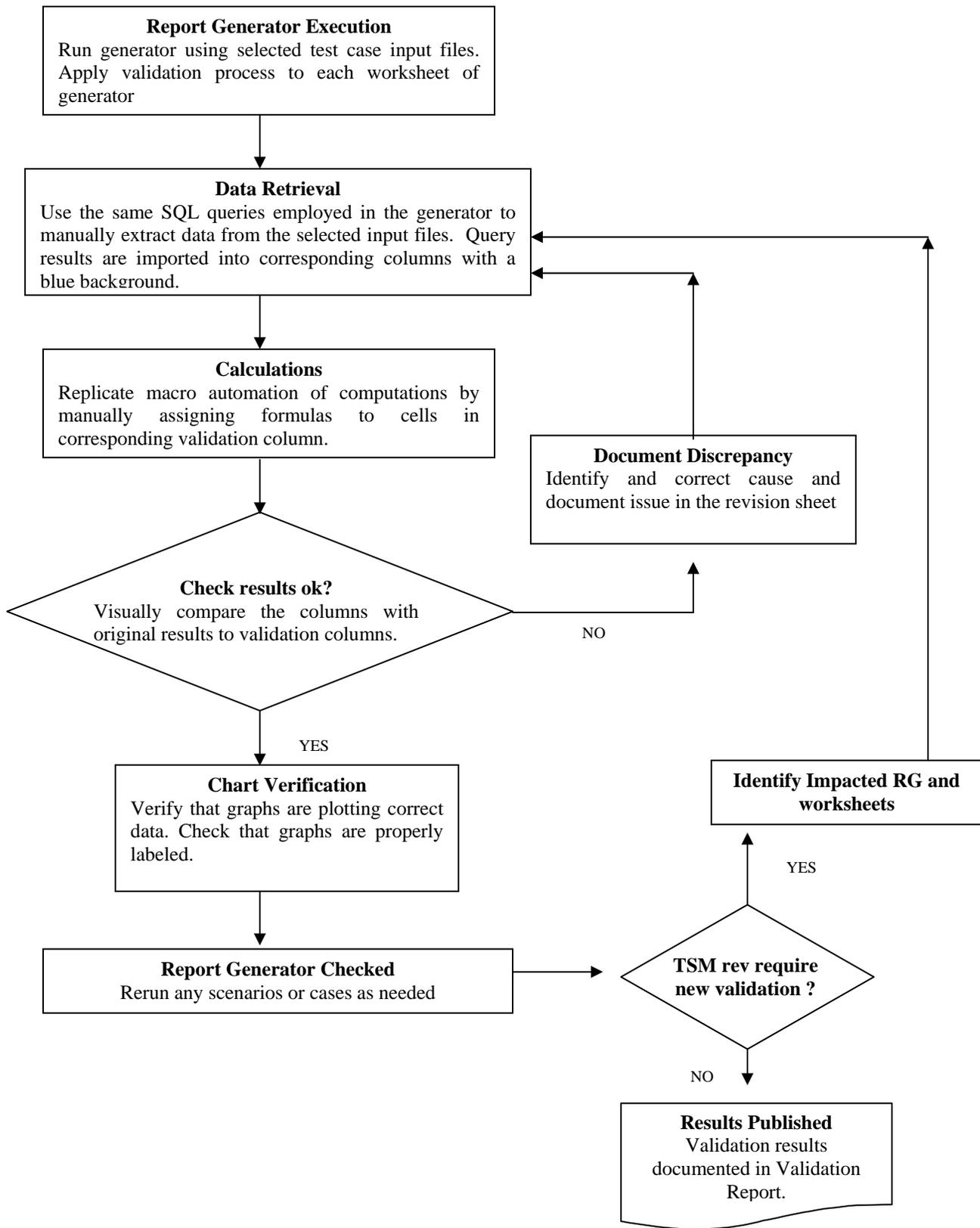


Figure H-1. Results Worksheet Validation Process Flowchart

VALIDATION RESULTS

The validated results are in the file “TSM Transportation Shipment Report Generator_050807_validation.xls”. A generator worksheet “passes” validation when the values in the validation columns match the original values in the corresponding columns. Discrepancies found during the validation process are identified as well as the reason for the discrepancy. Table H-1 lists each of the validation worksheets of the report generator and its validation status. Table H-2 lists manual checks to original input information that were performed on the reference sheets as the TSRG was being developed. Results from these checks were used in the final TSRG reference sheet validation in Table H-2. Table H-1 shows all worksheets are validated and the TSRG is ready for use.

Table H-1. Final TSRG Validation Results

TSRG Worksheet	Passed Validation	Input Files and Comments
1. MTU State-Rail	√	TSM_V3.0J2_Scn29B.simdata analyzed with Simdata Analyzer to do shipments for each site IS_Scn29B_LE104_DOE_WO_082205.xls for checking generator with pivot.xls used to check the MTU sheets
2. MTU State-Truck	√	
3. MTU City-Rail	√	
4. MTU City-Truck	√	
5. Shipment State-Rail	√	TSM_V3.0J2_Scn29B.simdata analyzed with Simdata Analyzer to do shipments for each site
6. Shipment State-Truck	√	
7. Shipment City-Rail	√	TSM Transportation Shipment Report Generator_with ref mods_TSRG 012507_TestingJ2_Scn29b.xls See Table H-1, Item 1.
8. Shipment City-Truck	√	
Ref Rail State	√	TSM Transportation Shipment Report Generator_with ref mods_TSRG 012507_TestingJ2_Scn29b.xls See Table H-1, Item 1.
Ref Rail City	√	
Ref Truck City	√	TSM Transportation Shipment Report Generator_Scn29b_08_22_05_Gen110806.xls See Table H-1, Item 2.
Ref Truck State	√	
Ref Route Files	√	000-00C-G000-00900-000-00A (BSC 2006a), Appendix B and Appendix C.
Ref City	√	Manual check-these are inputs of desired cities.

Table H-2. TSRG Reference Sheet Validation Results

These manually validated hardcopy files have been scanned and are in file App. H TSRG Val notes.pdf. The workbooks in Item 1 and 2 are attachments as listed Table 3. The input files are attachments and are listed in Table 3.

TSRG Worksheet	Passed Validation	Input Files and Comments
<p>-1. TSM Transportation Shipment Report Generator_with ref mods_TSRG 012507_TestingJ2_Scn29b.xls worksheets:</p> <p>5. Shipment State-Rail 6. Shipment State-Truck Sheet Ref Rail State Sheet Ref Rail City</p> <p>Hardcopy manual checks- Scanned in</p>	<p>√</p>	<p>000-00C-G000-00900-000-00A (BSC 2006a)</p> <p>ecn15b.inp (See Section 8.0) edn15.inp (See Section 8.0)</p> <p>TSM Transportation Shipment Report Generator_Scn29b_08_22_05_Gen110806.xls (For "Ref Rail City" only). See next item in this table)</p> <p>The worksheets "5. Shipment State-Rail" and "6. Shipment State-Truck" used to check Items 5-8 in Table H-1.</p> <p>The reference sheets in this workbook were manually checked against the files above then the results were cut and pasted into the workbook for the final check above.</p>
<p>-2. TSM Transportation Shipment Report Generator__Scn29b_08_22_05_Gen110806.xls</p> <p>Sheet Ref Truck State Sheet Ref Truck City</p> <p>Hardcopy manual checks- Scanned in</p>	<p>√</p>	<p>belt_1.prn</p>

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