

Freight and Fuel Transportation Optimization Tool Quick Start Tutorial

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13. ABSTRACT (Maximum 200 words) Volpe created the Freight and Fuel Transportation Optimization Tool (FTOT) to support the FAA, DOE, and the U.S. Navy's Office of Naval Research to assess optimal transport options for freight and fuel supply chains. FTOT is a flexible scenario-testing tool that optimizes the transportation of materials for future energy and freight scenarios. FTOT models and tracks commodity-specific information and can take into account conversion of raw materials to products (e.g., crude oil to jet fuel/diesel) and fulfillment of downstream demand. This report documents the Quick Start Scenarios developed to help the user explore the functionality of the FTOT public release 2022.2. This documentation is updated quarterly and available on the Public FTOT GitHub repository: https://github.com/VolpeUSDOT/FTOT-public			
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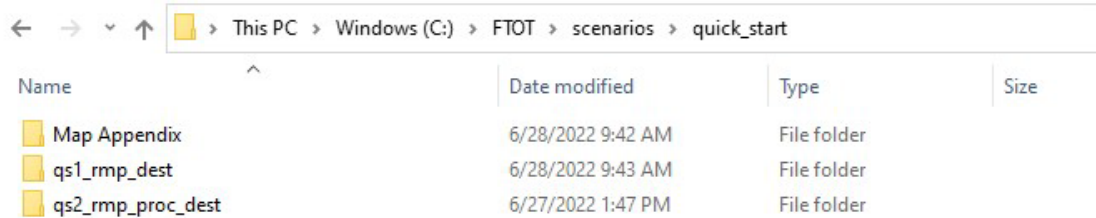
Installation Guide

To complete installation of FTOT, refer to Section 2 of the FTOT User Guide. FTOT should be installed before running the Quick Start scenarios below.

Quick Start Tutorial

Overview

Assuming you have installed FTOT, this is the place to learn how to run FTOT scenarios and view the results. After downloading the Quick Start scenarios, the directory and file path should look like this:



Name	Date modified	Type	Size
Map Appendix	6/28/2022 9:42 AM	File folder	
qs1_rmp_dest	6/28/2022 9:43 AM	File folder	
qs2_rmp_proc_dest	6/27/2022 1:47 PM	File folder	

Figure 1: FTOT Quick Start Folder Structure

The Quick Start series is a set of simple scenarios designed to introduce supply chain modeling in FTOT. The first scenario (Quick Start 1) is the simplest; the second scenario (Quick Start 2) adds more complexity with intermediate processing. In addition to demonstrating the FTOT functionality, the Quick Start scenarios can also serve as a template for creating user-specified scenarios.

Getting Started

- FTOT scenarios are stored in the C:\FTOT\scenarios\quick_start folder. Within this directory, each scenario includes its own dedicated subfolder for storing the scenario configuration and outputs.
- Each scenario (e.g., qs1_rmp_dest) contains a batch script file called **run_vX_X.bat**, where the Xs denotes the version number of the batch file.
- You can run the batch script by double clicking it or manually executing it in the Command Prompt. NOTE: If you have stored your FTOT installation anywhere other than “C:\FTOT” or your FTOT Python environment anywhere other than “C:\FTOT\python3_env” (these are the defaults as defined in the FTOT installation instructions), then you will need to modify these paths for each batch script that you run to appropriately reflect the actual paths on your machine.

Results

- Informational logging is available in the command shell during the run. Detailed logging is available in the **.\logs** folder.
- The user is encouraged to read the logs to familiarize themselves with the FTOT operations occurring during each step.
- FTOT generates results in the **.\Reports** and **.\Maps** folders of the scenario. The reports and maps are timestamped.

- The report is found in a timestamped **reports** folder within the **.\Reports** directory of the scenario. The FTOT report shows a summary of the results for each step in the analysis. The report is broken into the following sections: run time summary of each step, intermediate calculations and optimal results, configurations, warnings, and errors.
- A Tableau Dashboard (**tableau_dashboard.twbx**) can also be found in the timestamped **reports** folder within the **.\Reports** directory of the scenario. This can be opened in Tableau Reader.
- The map files can be found in the **.\Maps** directory of the scenario. FTOT generates a series of maps for each FTOT step to help the user see what happens during the scenario.
- Maps generated by the Quick Start scenarios can be found in the C:\FTOT\scenarios\quick_start\Map Appendix folder. The user can compare the map files generated from their own scenario run against these to confirm the scenarios ran correctly.

For more information on interpreting results, see the complete FTOT Documentation, specifically the User Guide.

More Information

The Quick Start documentation details the nuances of each run and provides brief overviews of the main results. **It is highly recommended that the user run both Quick Start scenarios after installation, as they will confirm that FTOT has been installed correctly and is producing the correct outputs.**

Troubleshooting

See the troubleshooting guide in the FTOT User Guide for tips on how to resolve common issues like runtime dependency errors (missing software), missing input data, and missing base maps.

Quick Start 1 (QS1) – Simple Supply Chain with No Intermediate Processing (RMP to Destination)

Instructions: to run the QS1 scenario, execute run_v6_1.bat in quick_start\qs1_rmp_dest. The run should take about 5-10 minutes. A description of this scenario is below, including the expected results.

Purpose

Quick Start 1 is the simplest supply chain model. The purpose of this scenario is to demonstrate the movement of one commodity from a single origin (known as a raw material producer, or RMP) to a single destination.

Input Data

FTOT requires two sets of input data to model the supply chain: (i) geospatial facility location data and (ii) facility-commodity data. Quick Start 1 sends 100 tons of blueberries from facility rmp_25003 in western Massachusetts to facility dest_25025 near Boston, with no intermediate processors.

Running a Scenario

The scenario XML configuration file (e.g., scenario.xml) is used to define the locations of the files and parameter values used in the QS1 run. The QS1 scenario file defines the scenario name and descriptions, points to the base transportation network, as well as geospatial input data and facility-commodity data.

Execute the batch script (run_v6_1.bat) to initiate the FTOT run and execute the sequence of FTOT steps described in the User Guide.

Viewing Results

FTOT generates four main outputs from a scenario: a text report, a CSV-formatted report that can be analyzed using Excel or Tableau, a packaged Tableau workbook, and a sequence of maps showing each of the steps in the FTOT run.

The text report, CSV-formatted report, and the Tableau dashboard (tableau_dashboard.twbx) can be found in a timestamped reports folder in the .\Reports directory of the scenario.

Optimal routing results are shown in the By Commodity & Mode story point of the Tableau dashboard, as well as the map outputs. The map files can be found in a timestamped reports folder in the .\Maps directory of the scenario.

To check that the QS1 results are accurate, the user can compare their output maps to those in the Map Appendix folder within the quick_start directory. Figure 2 shows the optimal routing solution. The optimal solution shows that the material travels over the road network from the RMP to the destination. In this case, the Massachusetts Turnpike (Interstate 90) is used for the majority of the trip.

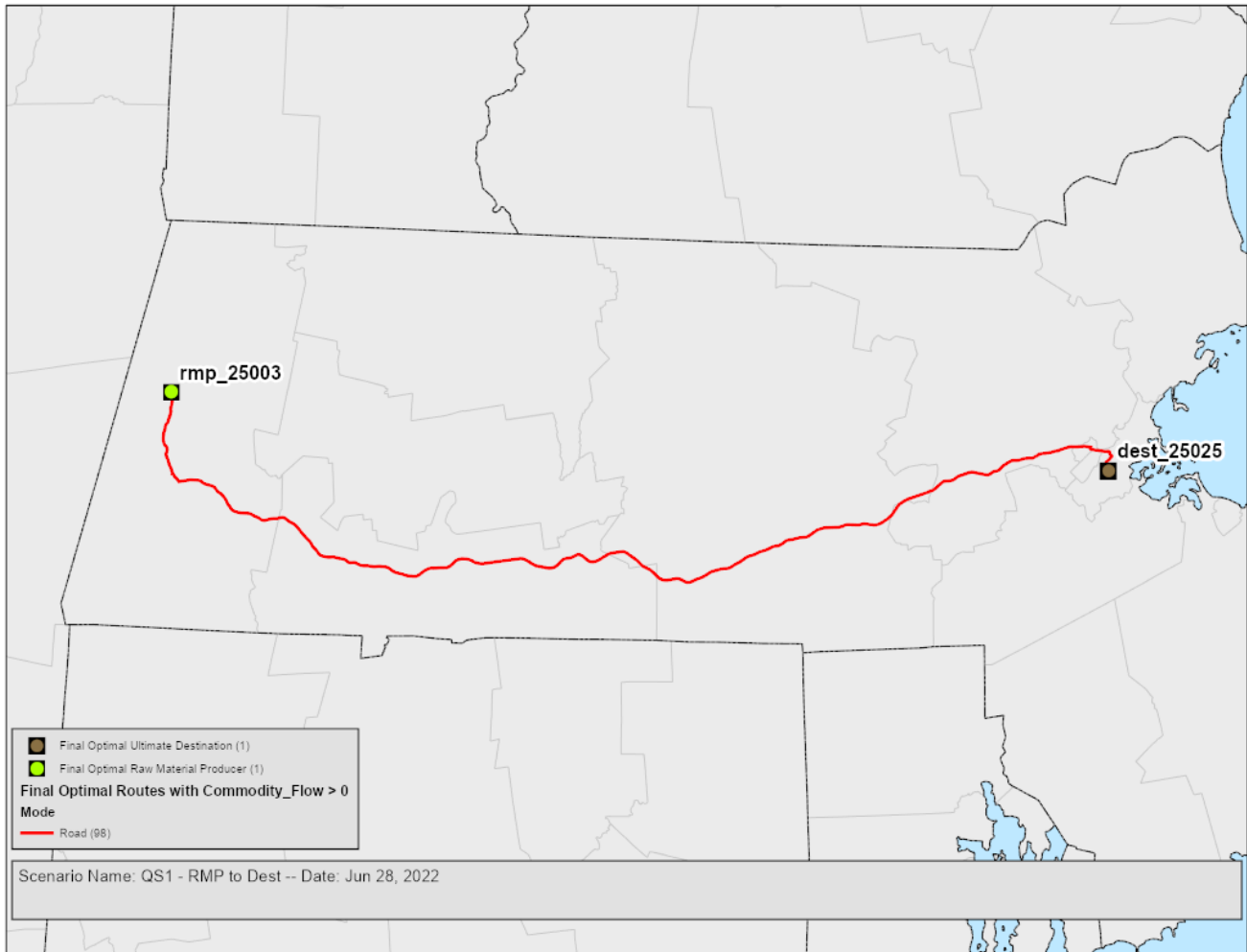


Figure 2: QS1 Optimal Solution

Quick Start 2 (QS2) – Supply Chain with Intermediate Processing Facility (RMP to Processor to Destination, No Road)

Instructions: to run the QS2 scenario, execute run_v6_1.bat in quick_start\qs2_rmp_proc_dest. The run should take about 5-10 minutes. A description of this scenario is below, including the expected results.

Purpose

Quick Start 2 increases the complexity of the supply chain by including an intermediate processing facility. The purpose of this scenario is to demonstrate the movement of one commodity from a single RMP to an intermediate processor facility where the commodity is converted to a new material, and then from the processor to a single destination. In this case, the RMP supplies blueberries and the destination demands jam. An intermediate processor will take blueberries as an input and convert it to jam using the facility-commodity input data specified by the user.

This scenario also demonstrates the functionality to exclude elements of the multimodal network (e.g., allow flows on a subset of modes). In this case, commodities are not permitted to route via the road network. Further commodity-mode specifications are detailed in the User Guide and Reference Scenarios.

Input Data

The input geospatial and facility-commodity data are similar to Quick Start 1. The data are set up to send 100 tons of blueberries from facility rmp_25003 in western Massachusetts to processor facility proc_25015 further east, where blueberries are converted to jam at a 1:1 ratio, which is sent to destination dest_25025 near Boston. The processor feature class and facility-commodity file proc.csv are used to specify the location and characteristics of the processor used.

To exclude the road network mode, the Route_Optimization_Script section of the scenario XML file has been set to False. FTOT will exclude the road network from the optimization and look for alternative flows.

Running a Scenario

The QS2 scenario configuration file is similar to the QS1 scenario configuration file, with the following changes:

- Scenario Name and Scenario Description were changed to note processors are included.
- The base processor GIS layer and processor commodity data input CSV file are now specified (Base_Processors_Layer and Processors_Commodity_Data, respectively). Previously, these fields were labeled “None.”
- The Road field was set to False under the Permitted_Modes section of the Route_Optimization_Script settings.

Execute the batch script (run_v6_1.bat) to initiate the FTOT run and execute the sequence of FTOT steps described in the User Guide.

Viewing Results

Optimal routing results are shown in the By Commodity & Mode story point of the Tableau dashboard, as well as the map outputs. To check that the QS2 results are accurate, the user can compare their output maps to those in the Map Appendix folder within the quick_start directory. Figure 3 shows the optimal routing solution. The optimal solution shows that the material travels over the rail network from the RMP to processor, and then from the processor to the destination. Note the route change compared to QS1. In this case, FTOT used the rail network for the entirety of the route since flows over the road network were not permitted.

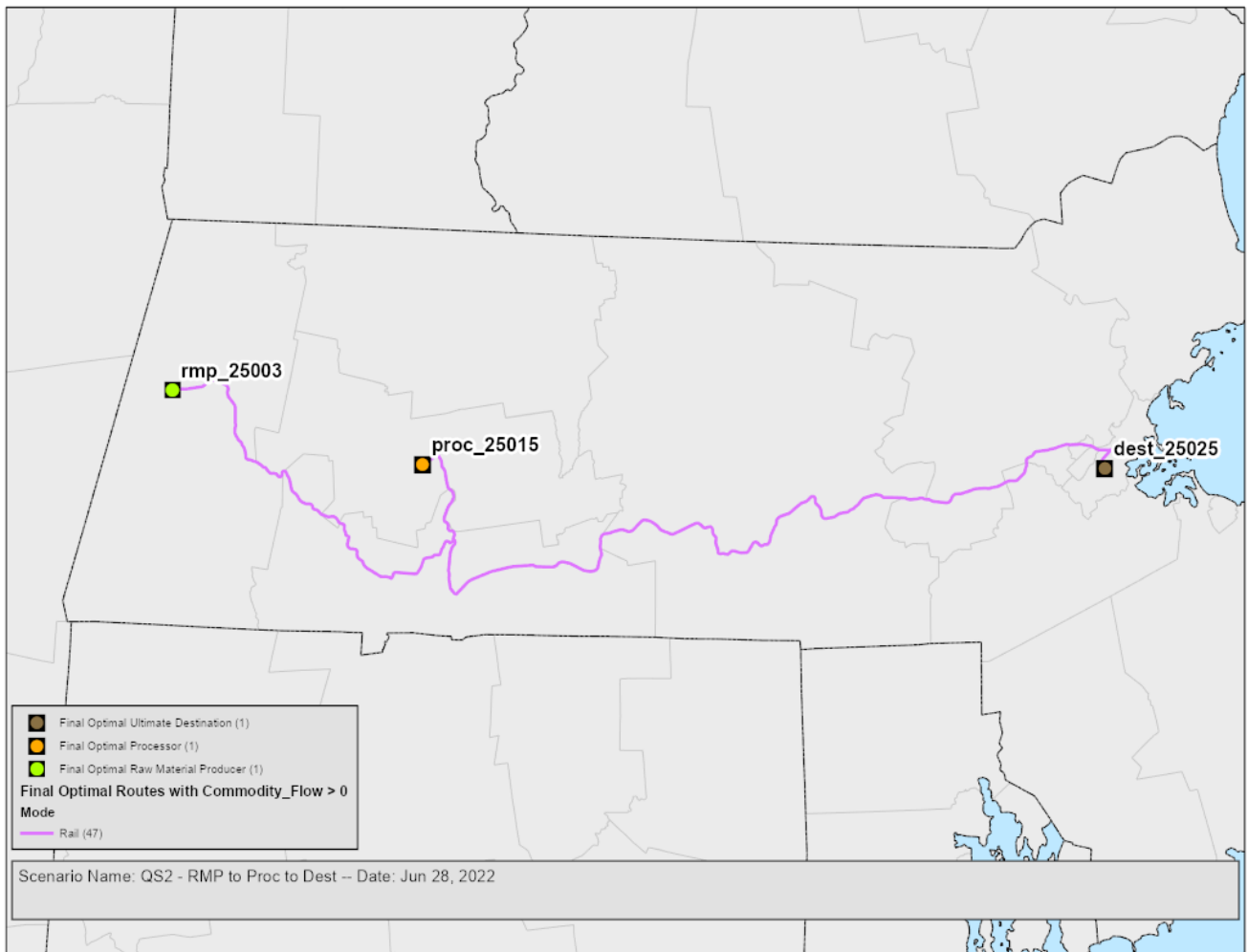


Figure 3: QS2 Optimal Solution

Scenario Run Checklist

After the user has run the Quick Start scenarios and familiarized themselves with FTOT's basic functionalities, they can begin to create their own FTOT scenario. Refer to Section 3 of the FTOT User Guide for more detailed information. The FTOT Reference Scenarios Documentation provides concrete examples of several FTOT features, including candidate generation, disruption scenarios, and commodity-mode specifications, and should be used as a guide and template for setting up FTOT scenarios.

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