USE OF CONTAINER MODEL SUITE OF TOOLS WITH HARBORSYM DEEPENING

Prepared for the U.S. Army Corps of Engineers Institute for Water Resources

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1.0 Introduction

HarborSym was originally developed by the Institute for Water Resources (IWR) to assess channel widening improvements at coastal ports and harbors. HarborSym is a planning-level, Monte-Carlo simulation model designed to assist in economic analyses of coastal harbors. With user provided input data, such as the port layout, vessel calls, and transit rules, the model calculates vessel interactions within the harbor. Unproductive wait times result when vessels are forced to delay movements due to transit restrictions within the channel. HarborSym was developed to estimate these delays. Using the model, analysts can calculate the cost of these delays and any changes in overall transportation costs resulting from proposed modifications to the channel's physical dimensions or sailing restrictions. This in turn will drive the calculation of NED benefits. Developed as a data driven model, HarborSym allows the users to analyze changes without modifying complex computer code. This approach also enables analysts to apply the model to many different ports by defining the network representation of the harbor. The release of HarborSym Version 1.4.7, geared towards widening, was recently certified.

HarborSym has been improved upon to include channel deepening and containership analysis. The expanded model, Version 1.5.1 referred to as HarborSym Deepening with Loading Tools (HSD), is currently undergoing the model certification process. To aid planners in the extensive data required for a HSD project, IWR developed the HarborSym Model Suite of Tools (HMST). At the time of this writing, the HMST has not yet been used in concert with HSD by Corps analysts in the field. This document describes the work flow process used to develop a HSD project using the HMST and includes details on the data requirements, data available from the tools, flow of information from tool-to-tool, required external processing, and considerations for the HMST modules.

When possible, real data from the Port of Savannah were used to populate a "Test Project". The Test Project was developed solely to assist in documenting the information flow process for a HSD project using the HMST and is not intended to assess the economic feasibility of channel deepening at the Port of Savannah. In some instances, where data were not provided by the HMST or were not readily accessible or easily obtained, general assumptions were made. Field economists engaged in containership analysis should contact the Deep Draft Navigation Planning Center of Expertise (DDNPCX) for up-to-date methodologies and to get specialized planning expertise.

Additionally, the focus of this document is using the HMST in conjunction with HSD. It is assumed that the reader is familiar with HarborSym. This document does not explicitly address elements of HarborSym original to the widening version, including: developing the port network of structures, defining port transit rules, critical commodities, commodity safety zones, vessel docking/undocking times, commodity transfer rates, vessel size unit capacity, vessel turning times, vessel speed in reach, cloning projects, generating a scenario, and HarborSym simulation outputs and results.

1.1 Container Model Suite of Tools Overview

The HMST consists of six tools that work together to access and pre-process data needed to complete channel deepening in concert with HSD. Three of the tools, the A-DAPP, W-DAPP, and Tide Tool, are stand-alone modules launched separately from HSD. These tools are used to access data and preprocess it for use by HSD. The other three tools, the BLT, CLT, and Combiner, are included in the HSD install and are launched from the HSD Tools menu. These modules are used to create a synthetic future vessel call database for use by HSD.

The Tide Tool provides access to information on astronomical tides at tidal stations around the world utilizing the tide prediction engine WTides developed by Philip Thornton (http://www.wtides.com/) to estimate astronomical tide height and current levels. The Tide Tool allows the user to drill into specific geographic regions and select an existing tide and/or current station to review and to create a customer station at as many points in the system as deemed sufficient to fully evaluate the tide impact at a given location.

The Automatic Identification System Data Analysis and Pre-Processor (A-DAPP) provides the capability to visualize, analyze, and synthesize historical Automatic Identification System (AIS) data for use in container port channel improvement studies and associated simulation modeling. The user is provided a graphical interface for selecting a port or ports for a specified timeframe for review and export. The A-DAPP allows for the analysis of container vessels at shore-based stations. During the analysis, the A-DAPP breaks down a vessel's ping data (giving the vessel location, destination, and draft at regular time intervals) as well as the vessel characteristics and port information. The A-DAPP functions include the ability to identify routes and services by containership vessel class, development of statistical information on arrival and departure draft, calculation of statistics on the amount of time spent by vessels at docks, determination of vessel speeds at various points along the route, and calculation of trip shares and other statistics by vessel class and route. Vessel call information for a specific port on dock arrival times/dates, drafts, and route group may be exported and combined with Waterborne Commerce Statistics Center (WCSC) data using the IWR's W-DAPP tool.

The Waterborne Commerce Statistics Center (WCSC) Data Analysis and Pre-Processor (W-DAPP) is a general-use model that extracts data collected by the Corp's WCSC on domestic and foreign vessels, processes that information, and exports it in the form of a port call list that can be used by HSD. The WCSC data are extracted and presented to the user for evaluation and review within the tool for the timeframe and the port selected. The user is also given the opportunity to combine AIS data exported from the A-DAPP for containerized vessels, when available, to the WCSC data to add arrival dates/times, arrival draft, and the vessel call route group and service to the port call list. The W-DAPP facilitates further processing and review of the data to develop a historic port call list that can be exported from the W-DAPP, reviewed, and adapted for import into the HSD application. The port call list is used in HSD to review how traffic currently moves within a port and provides the user with statistics such as the average amount of time a vessel spends in a port, average time a vessel spends at a dock, and average time waiting under the current conditions. These statistics can be then be used as a base for comparing project alternatives.

Two modules, collectively referred to as the HarborSym Loading Modules, were developed to assist the user in generating a synthetic vessel call list that satisfies a given commodity forecast for non-containerized and containerized ships respecting the depth constraints of the docks. Given the distinct nature of non-containerized and containerized ships, separate tools were developed to address their specific vessel loading behavior. The Bulk Loading Tool (BLT) module generates a synthetic future vessel call list based on user provided information on the fleet and commodity demands for all non-containership vessels, such as breakbulk, bulk carriers, barges, cruise ships, and tanker vessels. The Container Loading Tool (CLT) module produces a containership-only synthetic future vessel call list based on user inputs describing commodity forecasts at docks and the available fleet. Given the nature of the HSD database structure, the BLT and CLT-generated vessel call lists must be combined into a single vessel call list for cases where both types of traffic are to be modeled. The Combiner module was developed to address this need.

1.2 Work Flow Process

The general work flow for a HSD project will utilize the Tide Tool, A-DAPP, and W-DAPP to satisfy the data requirements of HSD, the CLT, and the BLT. The Tide Tool assists the users in creating secondary tide and current stations and estimating tidal availability for use by HSD. The A-DAPP and W-DAPP collect and process historical data for a specified period of analysis that describes the vessels calling at the port of study and the commodities transferred at each dock. After the user reviews and scrubs the outputs from these tools, HSD utilizes this data, as well as additional data, to simulate vessel traffic at the port of study during the historical period. The CLT and BLT also utilize this historical data, as well as other data inputs, to generate a future picture of vessels calling at the port of study that captures an externally generated commodity forecast, future fleet forecast, and the depth constraints of the channel. The diagram provided in Figure 1 provides a schematic of the information flow for a HSD project.

The following sections guide the user through the start-to-end process of generating a future condition simulation of port traffic under existing and modified channel conditions using HSD and the HMST. The flow described herein is but one way in which the end goal could be achieved. Project specific work flow variations are likely.

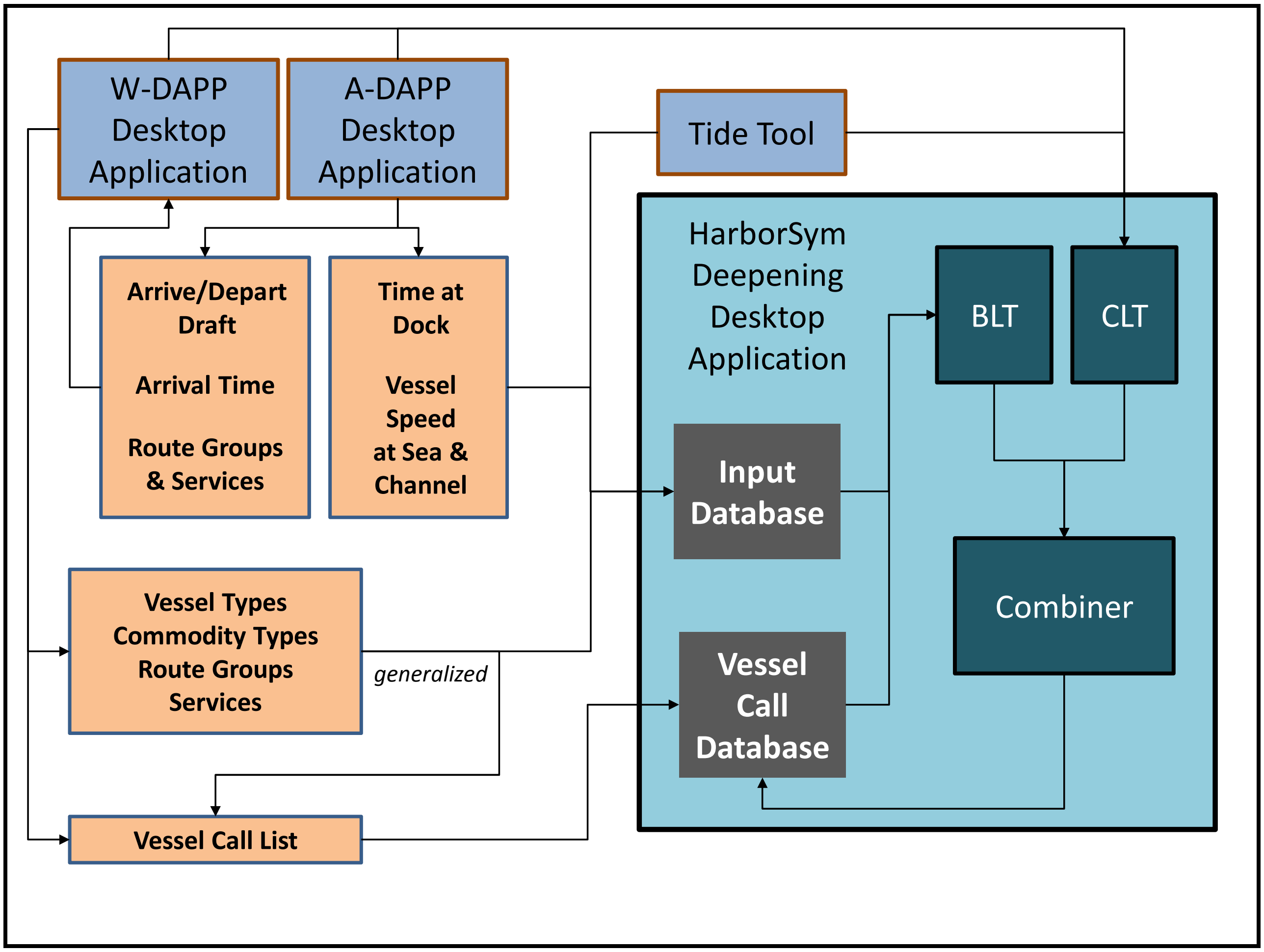


Figure 1 - HSD Project Information Flow

2.0 Create HarborSym Project

As with any HarborSym project, the process begins by identifying the study area and creating a new project in HSD. The user is required to provide the latitude/longitude for the port. If this information is not otherwise known, the Tide Tool can be launched to identify these parameters. After launching the Tide Tool, use the Navigation Pane to select the port of study or a port close-by. For the Test Project, the Savannah River Entrance was selected, as shown in Figure 2. Select the tab in the Data Pane for Station Information. The Latitude/Longitude for the station is provided in the lower right section of the Data Pane.

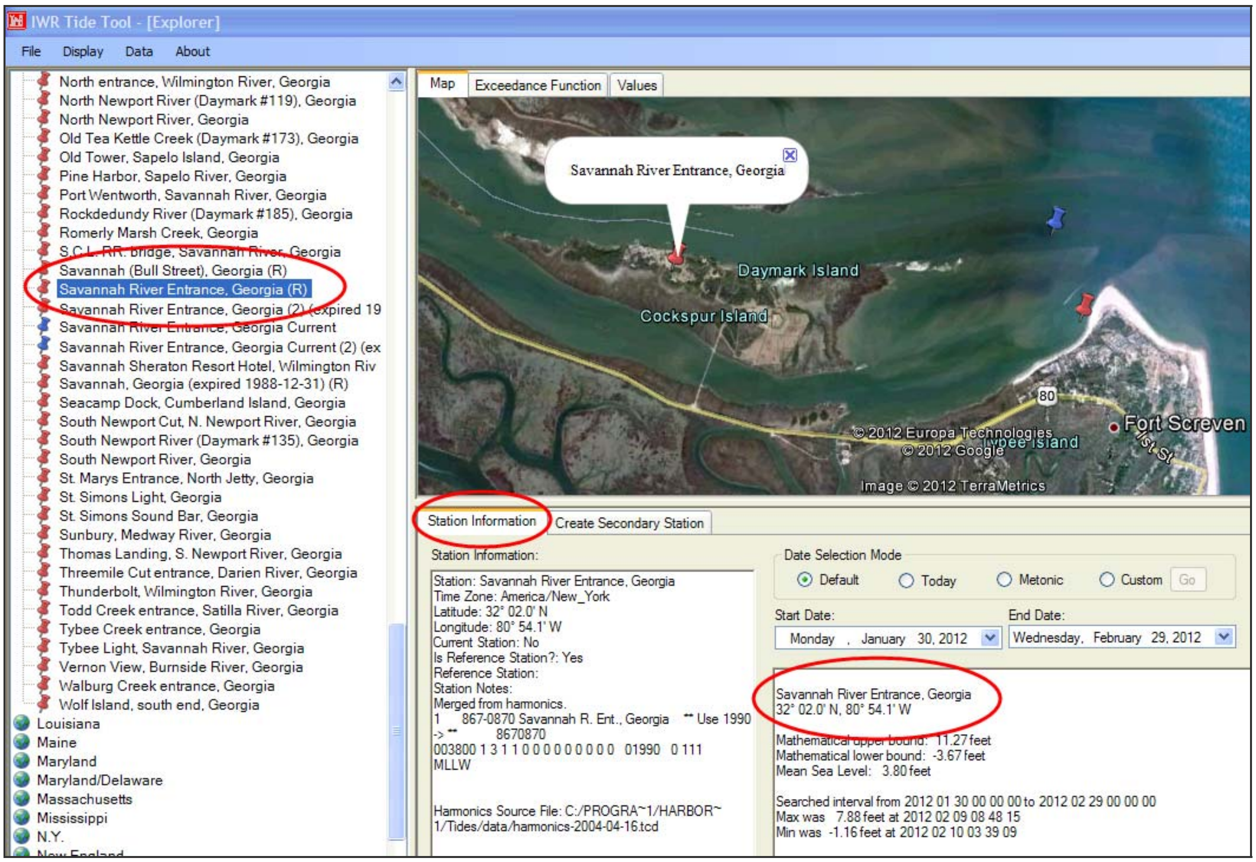


Figure 2 - Select Near-by Station in Tide Tool to Determine Port Coordinates

After the initial study parameters have been set up, the user will continue by specifying the data structures for HSD. The user will need to specify Vessel Info, Commodity Info, Port Structures, Port Traffic, and Tide. In some studies, the types and characteristics of vessel calling the port and the types of commodities transferred at the docks will be known. If, however, these data characteristics are unknown or incomplete, the A-DAPP and W-DAPP can be utilized to assess the historical patterns and inform the development of the appropriate categorizations for the HSD study.

3.0 Populate Tide Stations

Whenever there is a predictable water depth greater than the channel controlling depth, the additional depth is likely to be used in the operations of the deepest drafting vessels calling the port. The additional water depth can allow vessels to enter the system that would otherwise be prevented due to insufficient controlling depth. Use of tides may involve vessel delay costs that can be impacted by physical modifications to the navigation channels. In order to simulate these conditions, HSD requires information on the applicable tide levels at the study port.

Tide prediction is needed for HSD because of tide-related rules. Typical tidal rules relate to single vessel movements, limited by depth or current. A typical current rule would restrict sailing if vessel draft is greater than a certain amount while current exceeds a specified amount. A depth rule limits sailing based on "maximum draft plus tide", i.e., a vessel cannot move in a channel unless the draft plus the current tidal depth is greater than some value. Thus, tide prediction is required for both current and tide height.

HSD utilizes the tide prediction engine WTides developed by Philip Thornton (http://www.mdr.co.nz/) to estimate astronomical tide height and current levels. These are the same values commonly published in tide tables, but are not the meteorological tide or current values that may be influenced by storms. Tide and current are predicted and stored for user selected tidal stations for the study area in one-hour increments for the duration of the simulation. Tide reference stations are identified separately from current reference stations. Up to two tide stations are specified for each reach, with a user defined weighting value (between 0 and 1) assigned to determine the contribution of each tidal station to the reach. The interpolation provides an estimate of the water depth and current velocity throughout the reach during the simulation; within HSD, tide or current values do not vary along the length of a reach. Note that tide/current values are predicted only for reaches, not for nodes – values for nodes are derived from the value calculated for the reach. Note also that unless reference stations and interpolation values are properly selected for reaches, it is possible to get different tidal prediction at a node, depending upon which reach is used for the tide calculation

Currently, HSD does not include the capability for users to identify secondary tidal stations not included in the WTides database. If only one reference point is identified within the study and an interpolation value of 1 is entered for all reaches, all nodes and reaches will have uniform water depth and current velocity. The IWR-developed Tide Tool is capable of generating secondary tide stations for import into HSD.

Note: When creating custom stations it is important to consult with someone knowledgeable about tide for the area. If the offsets are incorrect, tidal values will not be valid. A coastal engineer or someone from the Port would be excellent resources.

For the Test Project, a secondary tide station data was generated for the Port of Savannah. To begin, close the HSD application and launch the Tide Tool from the Windows Start Menu. Use the Navigation Pane on the left to drill into the tide or current station desired as the reference station. Click to select the station, as shown in Figure 3.

Note: If HSD is left open during the Tide Tool secondary station creation, it will need to be closed and re-launched in order for the secondary stations to appear in the Tide Stations List.

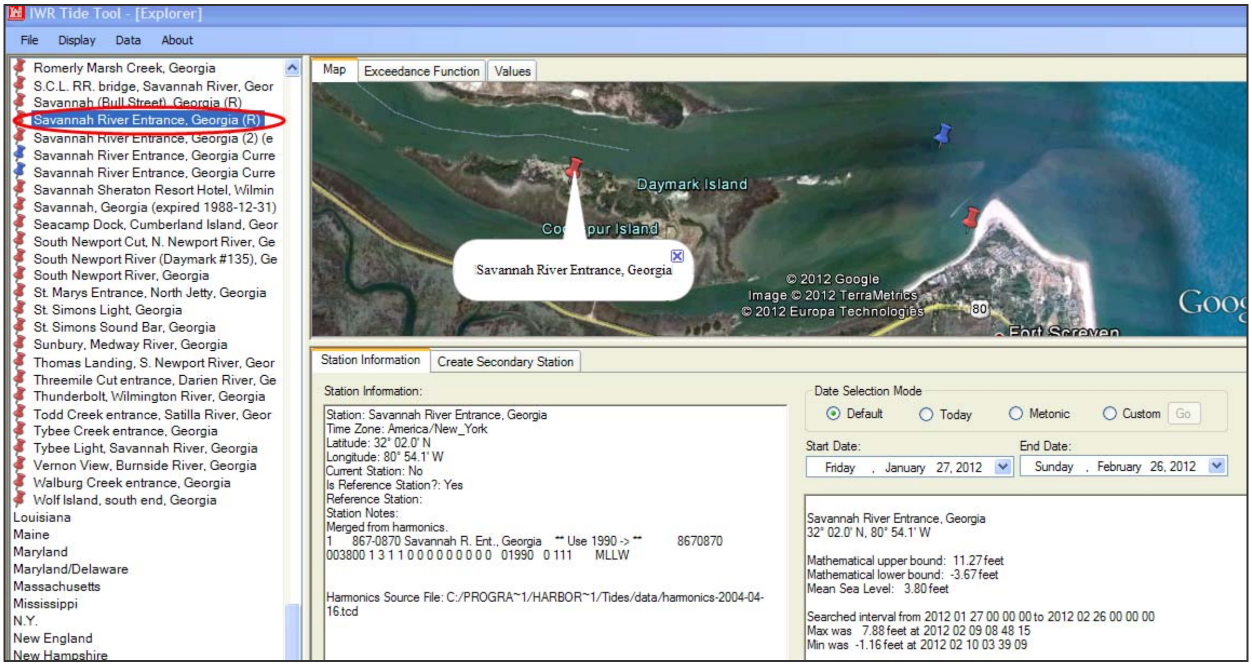


Figure 3 - Select Reference Station in Tide Tool

Once the reference station is selected, click on the "Create Secondary Station" tab. Position the cursor over the location on the map where the custom station is desired and left click. Notice how the Latitude and Longitude points in the data pane change as you click on the map. These steps are highlighted in Figure 4. For the Test Project, the secondary station was named Kings Island, corresponding to the King Island Reach where the station is located.

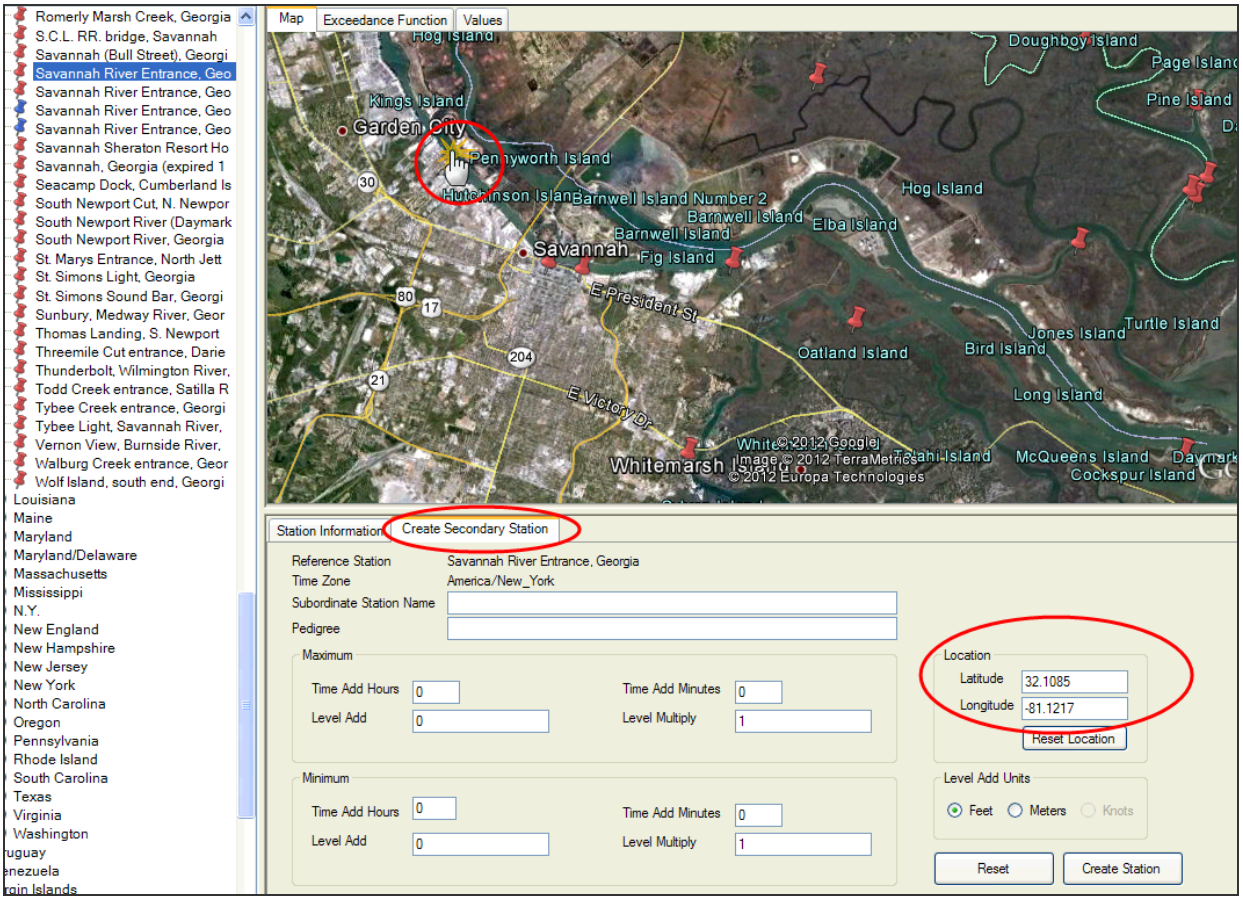


Figure 4 - Select Location for Secondary Station in Tide Tool

Create a name in the "Subordinate Station Name" box. For maximum and minimum tides, adjustments are made to the elevation and time components of the reference station tide. Time is adjusted by hours and minutes. Elevation is adjusted by adding/subtracting the unit specified and using a multiplier. Once these values are input click create station.

Tide Tool will need to be closed and then re-launched in order for the custom station to appear under Custom Stations in the Navigation Pane. If custom stations are being created to be used in HSD, these will automatically populate when populate stations is selected for the project alternative.

Statistics may now be run for any period of time and output analysis completed. It is important to compare the output obtained from the created secondary station to output from the reference station to ensure that the values make sense and there was not an input error. Custom stations can be deleted by right clicking on "Custom Stations" under "All Tide Stations" and selecting "Delete All Custom Stations" or by right clicking on a specific custom station and selecting "Delete Station."

Launch HSD and begin the steps to populate the tide stations for the study. Right-click on the project name and select Populate Tide Stations, as shown in Figure 5. The Populate Tide Stations window will appear, as shown in Figure 6. The latitude and longitude of the harbor and a search radius must be entered to obtain a list of the relevant tidal stations. Once this data has been entered click the Retrieve button. The appropriate tidal stations need to be enabled by checking the enable box. Select "Tide" from the menu for station type. Click the Save button to save these changes and close the window. If the secondary stations created with the Tide Tool are not available in the list of tide stations, close HSD and re-launch the application. Also, be sure to specify an adequate search radius.

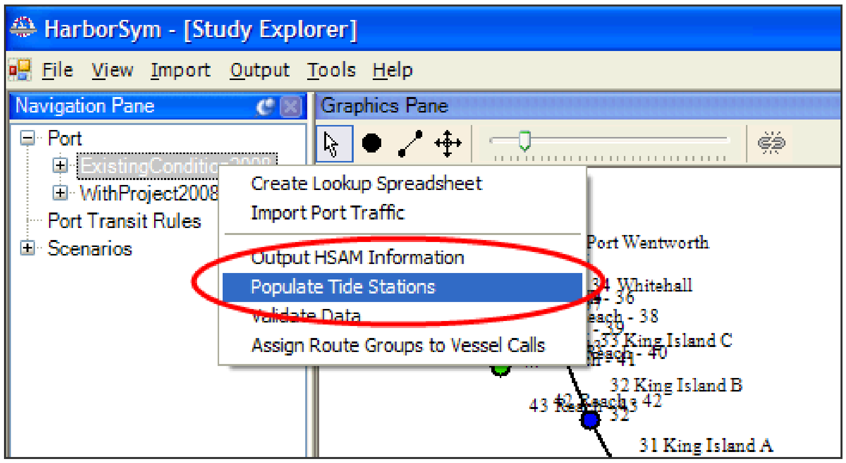


Figure 5 - Populate Tide Stations in HSD

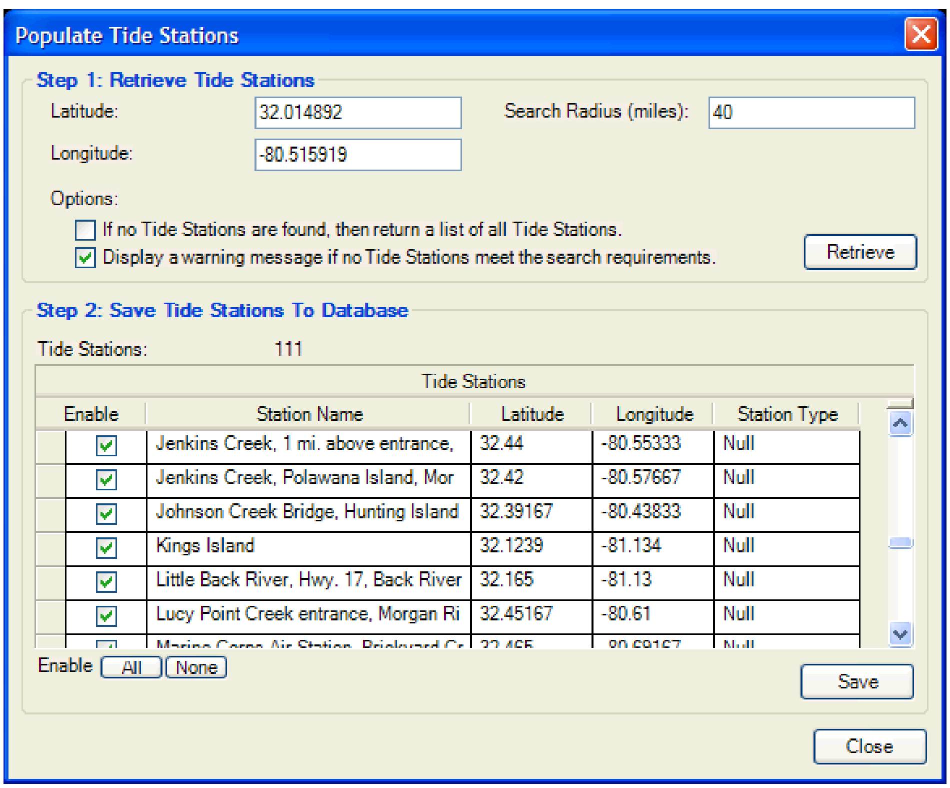


Figure 6 - Select Tide Stations for Project

Once tide stations in the study area have been identified, the user should assign the appropriate tide stations to each reach through the "Tidal Stations" branch under "Tide" in the Navigation Pane. The data entry grid will automatically populate with the available reach name. For each reach the user can select two nearby tide stations from which HSD will pull necessary tidal information. The tide stations identified in the "Populate Tide Stations" step will appear as options in the pull down menus, as shown in Figure 7 . The interpolation field should be a value between 0 and 1, where an entry of 0 pulls tide value entirely from Tide Station 1 and an entry of 1 pulls tide value entirely from Tide Station 2. For example, if a reach is closer to Tide Station 1 than Tide Station 2, a value of 0.25 might be entered.

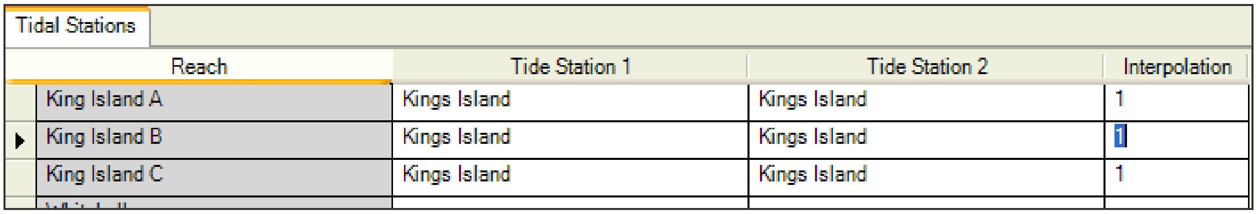


Figure 7 - Assign Tide Stations to Reaches

4.0 Retrieve Historical Port Traffic Using DAPPs

For a HSD study, the user will need to make assumptions regarding the proper categorization and grouping of vessel types, commodities, and route groups that will serve as the general categories for building the HSD input database (IDB). Information on the historical patterns of these data is useful as a starting point for making the proper generalizations. Additionally, analysis of historical vessel movement data serves as the starting point for developing a HSD vessel call database (VCDB). The A-DAPP and W-DAPP are used to access and preprocess historical AIS and WCSC data, respectively, that can be used for analyzing patterns, making generalizations, and creating historical vessel call lists.

To begin, launch the A-DAPP module, select Port View from the Navigation Pane, and select the port of study from the Single Port or Custom Selection tab in the Data Pane. Specify the time frame desired for the base analysis and select Save Changes and Create Services. For the Test Project, Savannah was selected as the port of study through the Single Port tab and 2008 was selected for the period of analysis. Figure 8 highlights these steps.

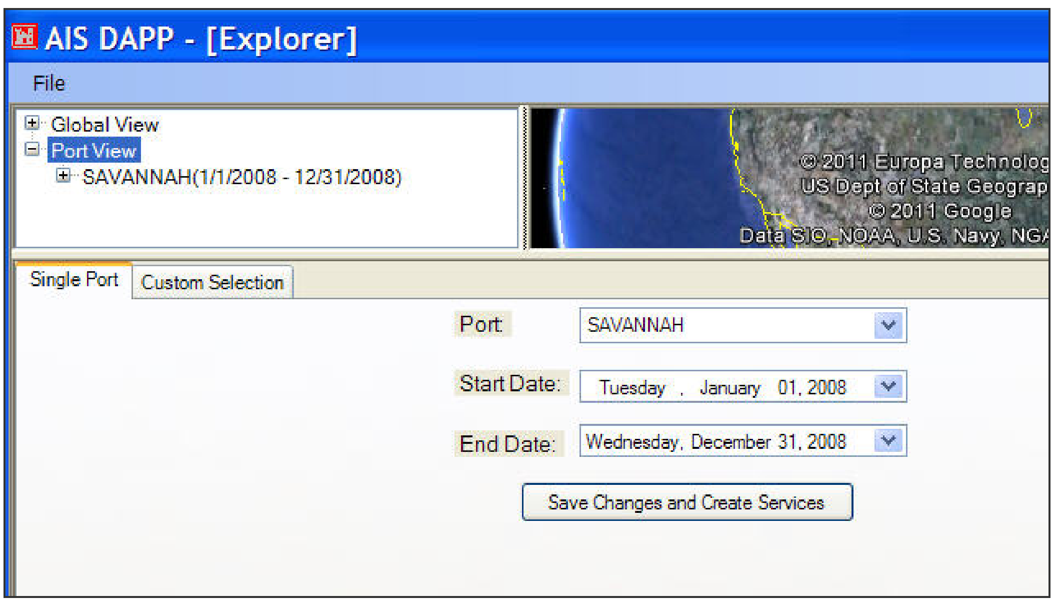


Figure 8 - Select Port of Study in A-DAPP

Notes on the A-DAPP: In some instances, it may be useful to analyze a number of years to extract vessel calling patterns. The user should note that to get a full picture of vessel routes and services, the data frame should be extended by two to three months prior and after the desired analysis period. Note the end date of the AIS data (2008 at the time of this writing) and consider its implications for vessel calls in the last month of the requested data. Manual adjustments may be required to the route group and service fields for calls in the last month of data. Also, A-DAPP ports are defined according to the World Port Index, thus be cautious that the appropriate combination of A-DAPP ports are selected, if applicable, that represent the port of study.

AIS data for containerized vessels processed by the A-DAPP that is available for an associated vessel call list includes: Vessel Name, IMO Number, Vessel Class, Vessel Subclass, Arrival Date/Time, Arrival Draft, Time at Destination, and Route Group. These data must be exported from the A-DAPP, imported into the W-DAPP to combine it with WCSC data, and put into a format compatible with HSD. These steps enhance the WCSC data with AIS arrival times and arrival drafts and will add the vessel route group to the WCSC data. Additionally, A-DAPP developed Service data are exported to the W-DAPP even though it is not a field in a vessel call list used by HSD. Including this field, which is deleted prior to import into HSD, allows the user to create statistics on Services needed by the CLT. It is anticipated that future versions of HarborSym will incorporate service-related information directly.

To export the W-DAPP compatible data, right click on Calls from the A-DAPP Navigation Pane as shown in Figure 9 and select W-DAPP Export. Save the file to the directory specified for project files. For now, the A-DAPP module can be closed, but will be referenced again in later steps.

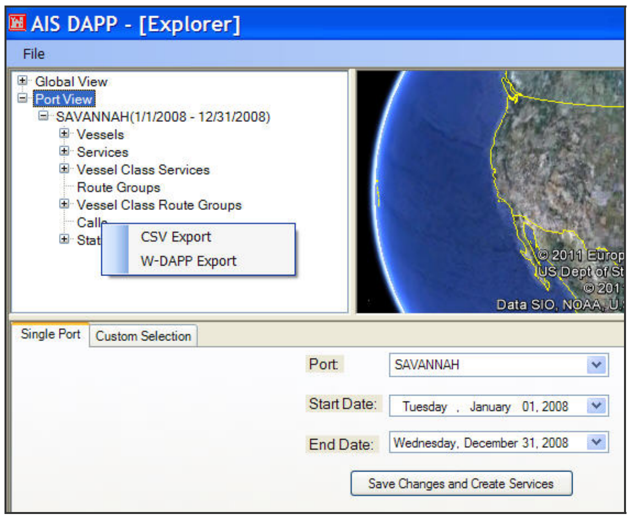


Figure 9 - Export Calls Data from A-DAPP

Next, launch the W-DAPP and begin the process to load data for the port of study from the Corps Oracle server to the local W-DAPP postgres database. Begin by selecting Import/WCSC Data Import/New Selection from the W-DAPP main menu. A Google Earth-based user interface will open that will allow the user to select the desired ports, docks, and time frame for which the WCSC data are desired. Select the appropriate port(s) for the study from the Navigation Pane on the left of the application. If the port of study is found in the Navigation Pane under Ports, you may right click on the port name to select the docks in the port for further analysis, as shown in Figure 10. Click the Execute button once selected to view the docks in the Data Pane. Also, the user can select the port from the Google Earth map by (1) clicking the radio button next to the Select button, (2) dragging the mouse to create a box around the port(s) desired, and (3) clicking the Execute button. These steps are highlighted in Figure 11.

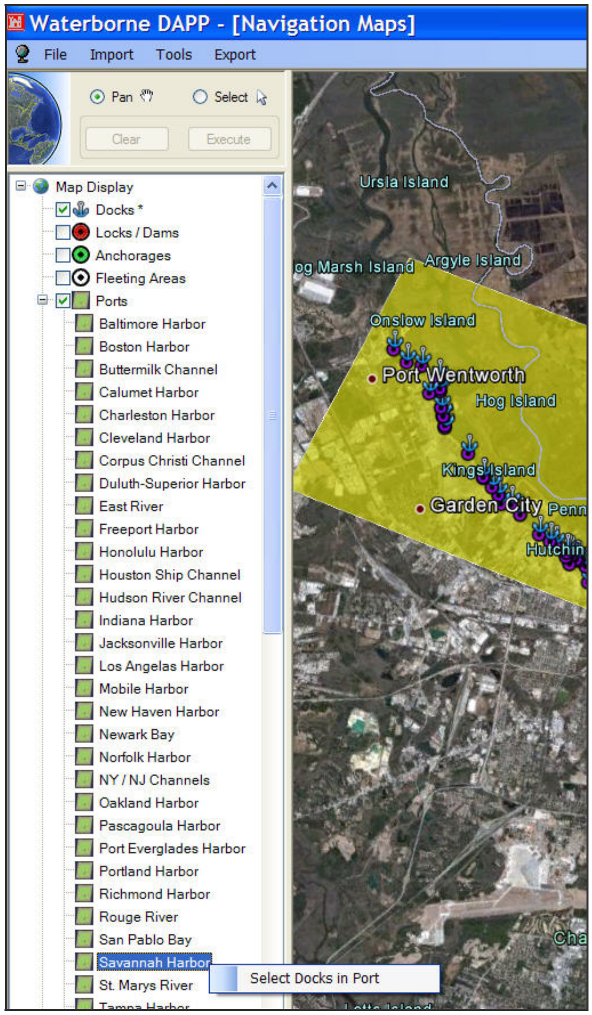


Figure 10 - Select Docks at Port of Study Using Navigation Pane in W-DAPP

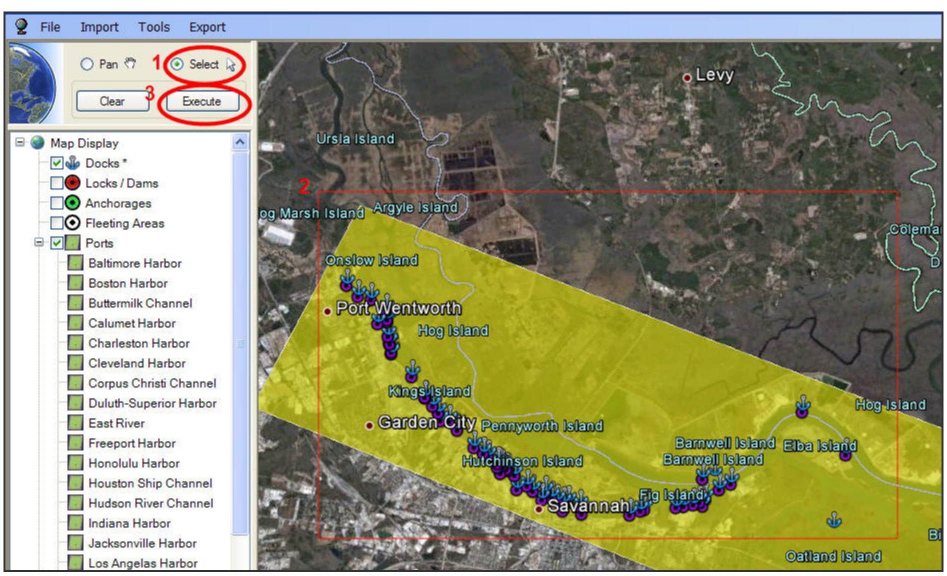
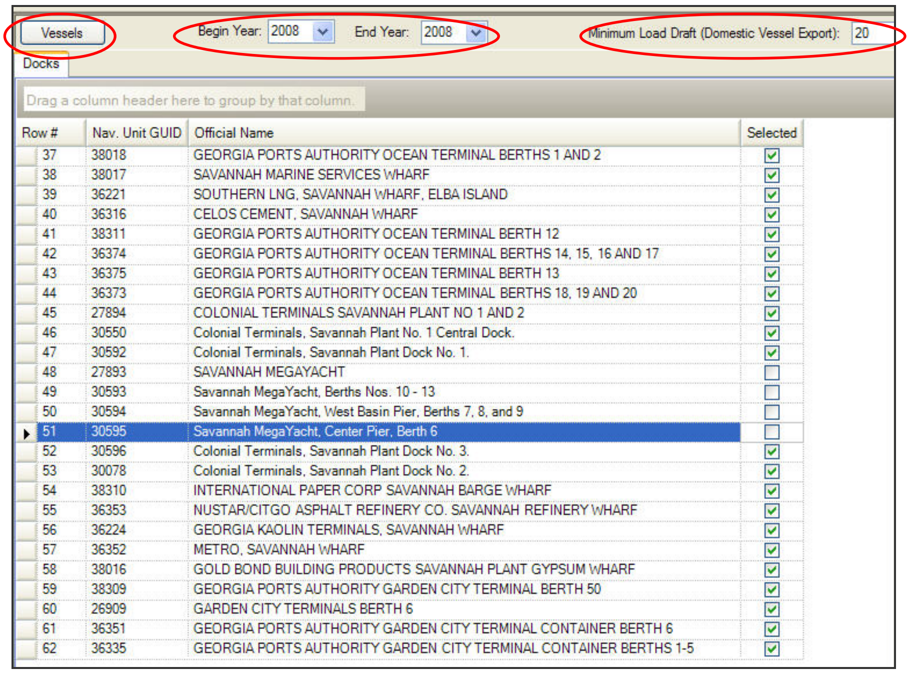


Figure 11 - Select Docks at Port of Study Using Map Data Pane in W-DAPP

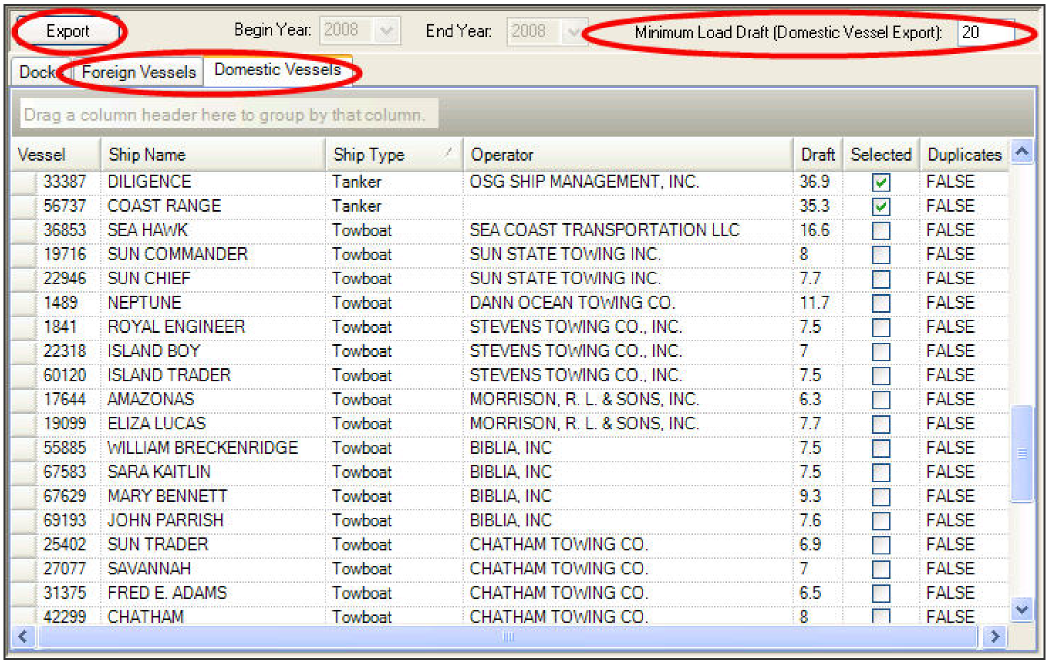
Once the desired port data is selected, the docks available for data extraction will appear in the Data Pane, as shown in Figure 12. The user should review the docks and eliminate any that are not needed for the study. For the Test Project, the Mega Yacht berths were removed from the list. Specify the beginning and ending year for the data. The user can also specify a minimum draft for selecting vessels for the data extraction. This is useful in a number of circumstances, such as when only deep drafting vessels are desired for the analysis. Once these parameters are specified, click the Vessels button to load the W-DAPP Data Pane with a list of all vessels that visited the docks specified during the time frame specified with a minimum draft greater than that specified. The user will be provided with an informational prompt warning that data retrieval could take a few minutes. Upon completion, the number of foreign and domestic vessels queried from the WCSC data will be noted.



Row #	Nav. Unit GUID	Official Name	Selected
37	38018	GEORGIA PORTS AUTHORITY OCEAN TERMINAL BERTHS 1 AND 2	☑
38	38017	SAVANNAH MARINE SERVICES WHARF	☑
39	36221	SOUTHERN LNG, SAVANNAH WHARF, ELBA ISLAND	☑
40	36316	CELOS CEMENT, SAVANNAH WHARF	☑
41	38311	GEORGIA PORTS AUTHORITY OCEAN TERMINAL BERTH 12	☑
42	36374	GEORGIA PORTS AUTHORITY OCEAN TERMINAL BERTHS 14, 15, 16 AND 17	☑
43	36375	GEORGIA PORTS AUTHORITY OCEAN TERMINAL BERTH 13	☑
44	36373	GEORGIA PORTS AUTHORITY OCEAN TERMINAL BERTHS 18, 19 AND 20	☑
45	27894	COLONIAL TERMINALS SAVANNAH PLANT NO 1 AND 2	☑
46	30550	Colonial Terminals, Savannah Plant No. 1 Central Dock.	☑
47	30592	Colonial Terminals, Savannah Plant Dock No. 1.	☑
48	27893	SAVANNAH MEGAYACHT	☐
49	30593	Savannah MegaYacht, Berths Nos. 10 - 13	☐
50	30594	Savannah MegaYacht, West Basin Pier, Berths 7, 8, and 9	☐
51	30595	Savannah MegaYacht, Center Pier, Berth 6	☐
52	30596	Colonial Terminals, Savannah Plant Dock No. 3.	☑
53	30078	Colonial Terminals, Savannah Plant Dock No. 2.	☑
54	38310	INTERNATIONAL PAPER CORP SAVANNAH BARGE WHARF	☑
55	36353	NUSTAR/CITGO ASPHALT REFINERY CO. SAVANNAH REFINERY WHARF	☑
56	36224	GEORGIA KAOLIN TERMINALS, SAVANNAH WHARF	☑
57	36352	METRO, SAVANNAH WHARF	☑
58	38016	GOLD BOND BUILDING PRODUCTS SAVANNAH PLANT GYPSUM WHARF	☑
59	38309	GEORGIA PORTS AUTHORITY GARDEN CITY TERMINAL BERTH 50	☑
60	26909	GARDEN CITY TERMINALS BERTH 6	☑
61	36351	GEORGIA PORTS AUTHORITY GARDEN CITY TERMINAL CONTAINER BERTH 6	☑
62	36335	GEORGIA PORTS AUTHORITY GARDEN CITY TERMINAL CONTAINER BERTHS 1-5	☑

Figure 12 - Review Data Prior to Importing WCSC Data to Local Machine

The final step in selecting the vessel data to import from the WCSC Oracle warehouse is to review the foreign and domestic vessels and deselect any that are not desired for the study and any that are duplicates in the database, as shown in Figure 13. For example, because HSD does not explicitly model tows, these ship types were removed from the Test Project selection. The user may sort by the 'Ship Type' or 'Duplicates' fields to analyze the vessels for selection. Once the vessels have been reviewed, select the Export button in the Data Pane, also shown in Figure 13. Clicking the Export button will create a local database for the data with a list of the vessels, docks, and other parameters selected. Specify the location for the database and click OK. The user will be provided with an informational prompt warning that data retrieval could take a few minutes, select OK. When asked if you would like to import the data into the current project, select Yes.



Vessel	Ship Name	Ship Type	Operator	Draft	Selected	Duplicates
33387	DILIGENCE	Tanker	OSG SHIP MANAGEMENT, INC.	36.9	☑	FALSE
56737	COAST RANGE	Tanker		35.3	☑	FALSE
36853	SEA HAWK	Towboat	SEA COAST TRANSPORTATION LLC	16.6	☐	FALSE
19716	SUN COMMANDER	Towboat	SUN STATE TOWING INC.	8	☐	FALSE
22946	SUN CHIEF	Towboat	SUN STATE TOWING INC.	7.7	☐	FALSE
1489	NEPTUNE	Towboat	DANN OCEAN TOWING CO.	11.7	☐	FALSE
1841	ROYAL ENGINEER	Towboat	STEVENS TOWING CO., INC.	7.5	☐	FALSE
22318	ISLAND BOY	Towboat	STEVENS TOWING CO., INC.	7	☐	FALSE
60120	ISLAND TRADER	Towboat	STEVENS TOWING CO., INC.	7.5	☐	FALSE
17644	AMAZONAS	Towboat	MORRISON, R. L. & SONS, INC.	6.3	☐	FALSE
19099	ELIZA LUCAS	Towboat	MORRISON, R. L. & SONS, INC.	7.7	☐	FALSE
55885	WILLIAM BRECKENRIDGE	Towboat	BIBLIA, INC	7.5	☐	FALSE
67583	SARA KAITLIN	Towboat	BIBLIA, INC	7.5	☐	FALSE
67629	MARY BENNETT	Towboat	BIBLIA, INC	9.3	☐	FALSE
69193	JOHN PARRISH	Towboat	BIBLIA, INC	7.6	☐	FALSE
25402	SUN TRADER	Towboat	CHATHAM TOWING CO.	6.9	☐	FALSE
27077	SAVANNAH	Towboat	CHATHAM TOWING CO.	7	☐	FALSE
31375	FRED E. ADAMS	Towboat	CHATHAM TOWING CO.	6.5	☐	FALSE
42299	CHATHAM	Towboat	CHATHAM TOWING CO.	8	☐	FALSE

Figure 13 - Review Vessels for Data Retrieval in A-DAPP

The user will next need to run through a series of steps to first import the foreign and domestic commerce data and then generate the vessel itineraries and port call list. This is done through the Import and Tools menu options available through the W-DAPP's user interface. The W-DAPP's User's Guide clearly outlines these steps. The general order of viewing and loading data should be executed as provided in the list below and as described in the User's Guide. The user should review the data at each stage so that no unneeded data are added to the final vessel call list, as this will reduce the amount of data cleansing required by the user in later steps.

1. Import/View/Import Foreign Commerce
2. Import/View/Import Domestic Commerce
3. Tools/Foreign Movements/Vessel Itinerary Generation
4. Tools/Foreign Movements/Port Call List Generation
5. Tools/Deep Draft Domestic Movements/Vessel Itinerary Generation
6. Tools/Deep Draft Domestic Movements/Port Call List Generation

When generating the foreign movements port call list (Number 4), be certain to navigate to the tab titled 'Port Call List (Current)' and select the button to 'Import AIS VCL'. At this step, navigate to the file exported from the A-DAPP. After reviewing the matches, click the button to 'Update PCL with AIS Data'. This will add the arrival and departure drafts, arrival times, route group, and service to each vessel movement where the WCSC and AIS data match. Once all steps are complete, select Export/HarborSym Template Data from the menu to export a CSV file that is compatible with the data format required by HSD. In the directory specified will be a file named 'PCL.csv'.

5.0 Review W-DAPP Export for HSD Generalizations

HSD data structure requires generalizations for Vessel Types and Vessel Classes, Route Groups, and Commodities. The data exported in the previous step is useful for making these generalizations. To begin, open the PCL.csv file using Microsoft Excel. Resave the file under a new name with the XLS (or XLXS) extension.

Review the data found in the PCL tab. Place the cursor anywhere in the data grid and select Insert/Pivot Table from the menu options. Use the Pivot Table option in Excel to inform the generalized categories for Commodities, Vessel Types, Vessel Class, and Route Groups.

5.1 Commodities

In the Pivot Table created with the PCL data, drag the field 'commodity_name' to the Row Labels box, as shown in Figure 14. This will provide a listing of all commodities imported and exported at the port of study. The user will need to make some generalizations about the most appropriate categorizations for these commodities in the HSD study. To view which of these commodities are carried on containerized vessels, drag the field 'containerized' to the Report Filter box and select 'Y'.

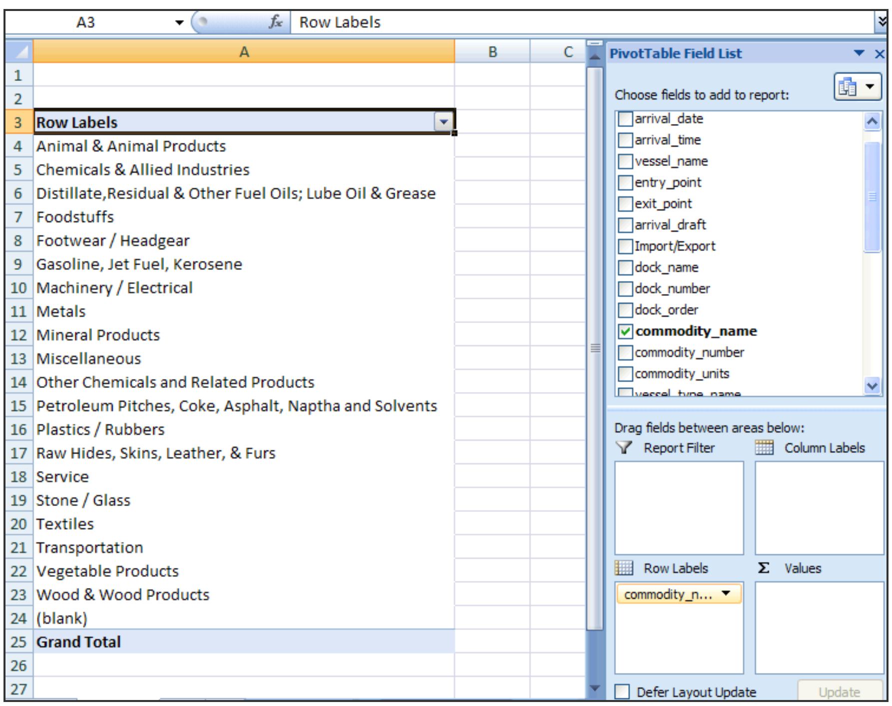


Figure 14 - Create Pivot Table in Excel to Review WCSC Commodity Types

For the Test Project, the following commodity categories were created: General Cargo, Chemical Products, Machinery/Electrical, Mineral Products, and Petroleum Chemical Productions.

Note: more than likely a commodity category named Containers will be used in a deep draft navigation study, although, it is not strictly necessary. The Test Project highlights how to conduct a deep draft navigation study without the use of a Containers commodity category.

A lookup table in a new blank worksheet within the Excel file can then be created noting which WCSC commodity coordinates with which HSD Commodity category. The commodity lookup table for the Test Project is shown in Table 1. The lookup table will be referenced in later steps. In the HSD application, add the commodity categories to the project.

Table 1- Commodity Look-up Table

WCSC Commodity	**HSD Commodity**
Animal & Animal Products	General Cargo
Chemicals & Allied Industries	Chemical Products
Distillate, Residual & Other Fuel Oils; Lube Oil & Grease	Petroleum Chemical Products
Foodstuffs	General Cargo
Footwear / Headgear	General Cargo
Gasoline, Jet Fuel, Kerosene	Petroleum Chemical Products
Machinery / Electrical	Machinery/Electrical
Metals	General Cargo
Mineral Products	Mineral Products
Miscellaneous	General Cargo
Other Chemicals and Related Products	Chemical Products
Petroleum Pitches, Coke, Asphalt, Naptha and Solvents	Petroleum Chemical Products
Plastics / Rubbers	General Cargo
Raw Hides, Skins, Leather, & Furs	General Cargo
Service	General Cargo
Stone / Glass	General Cargo
Textiles	General Cargo
Transportation	General Cargo
Vegetable Products	General Cargo
Wood & Wood Products	General Cargo

5.2 Route Groups

Economic analysis of channel deepening alternatives requires information for each vessel call, specifying the ocean sailing distance to be assigned to the call. HSD uses the concept of “Route Groups” as an alternative to directly specifying this distance for each vessel call. A route group is a named itinerary or portion thereof that a vessel may travel before and after visiting the port under study. Itineraries can be defined generally by larger geographic areas or more specifically when individual ports are known. If exact port-to-port itineraries are known, then the distance can be fixed by specifying the same value for the min, max, and most likely fields, otherwise these fields can be used to specify the triangular distribution representing the sailing distances.

Route Group categories for HSD can be generated from the PCL file. Additional information on Route Groups, such as the additional sea distance, can be accessed through the A-DAPP. Within the context of the A-DAPP, Route Groups are only specified for containerships thus the PCL will only have a Route Group specified for containership movements. For the Test Project, all non containerized vessels are assumed to traverse on local routes, thus detailed Route Group information required for containerized vessels is not required. A 'Default' Route Group should be created and assigned to non containerized Vessel Types.

To begin, clear any fields from the Pivot Table. Add the field 'route_group' to the row labels box. In the Test Project, there are 445 unique Route Groups for vessels calling the Port of Savannah in 2008. Notice the naming convention that the A-DAPP employs for the Route Group. The Route Group Name is in relation to the port of study and is the exact combination of the following:

Prior Port | Next Port | Region_i – Region_n

Port and region codes, where available, are used to abbreviate the text in a Route Group Name. A summary of port and region information including codes is provided in Appendix A of the A-DAPP User's Guide. As an example, the Route Group Name "USNFF | ESALG | SUEZ-SAS-SUEZ-MED" indicates that a vessel traversing this Route Group began in Norfolk, Virginia, and then traveled to the port of study (located on the eastern coast of the U.S. in our example). The vessel then traveled to the Port of Algeciras in Spain, which is located in the Mediterranean region (note that 'MED' is not included in the first position of the Region String). Next, the vessel sailed to a port(s) in South Asia stopping at a port(s) in the Suez Canal region, returning to a port(s) in the Mediterranean, again, stopping in the Suez Canal region. Finally, the vessel returned to the eastern coast of the U.S.

While HSD will allow up to 1,000 Route Groups, the Route Groups should be cleansed and merged to reduce data entry and to simplify the groupings. For the Test Project, Route Groups were analyzed and condensed down to 88 through a number of steps. Condensing Route Groups should consider the prior and next ports, regions visited, and the number of vessels traversing the Route Group. Be sure to review vessel calls that fall at the beginning and end of the time series, as the data may not extend far enough to capture the full trip of the vessel. In these instances, the Route Group of the given vessel in the other months of the year can be referenced to fill in these gaps. Remember to include a Default Route Group for non containerized vessels. Deep Draft Navigation Center of Expertise policies should be consulted for the most proper handling of Route Group generalization.

Once the Route Groups for the HSD project have been reviewed, condensed, and specified, a look-up table should be created in the Excel PCL file so that the final Route Groups can be known for each vessel call. The lookup table should indicate which A-DAPP exported Route Group corresponds to the final listing of Route Groups. In the HSD application, add the Route Groups to the project, as shown in Figure 15.

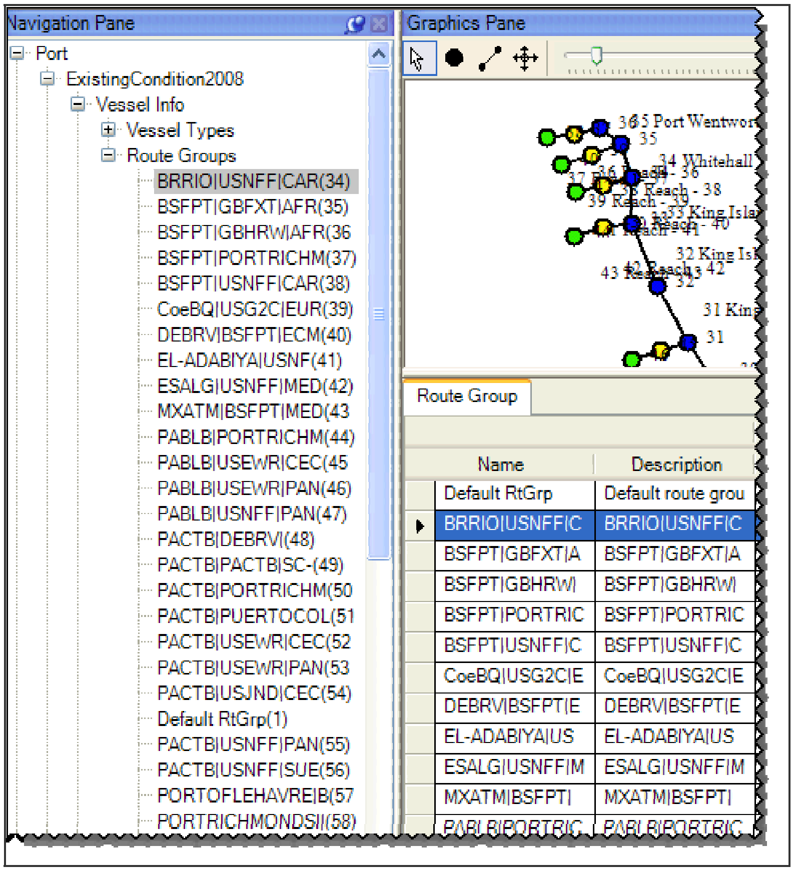


Figure 15 - Add Route Groups to HSD

For each Route Group specified in HSD, triangular distributions for the following variables will need to be specified: Prior Port Distance, Next Port Distance, and Additional Sea Distance. The A-DAPP provides a calculation of Additional Sea Distance for each Route Group and provides a starting point for the data associated with the prior and next port by providing the exact delineation of the port when known. If the exact value is known, the same value can be entered for the min, max, and most likely fields.

Open the A-DAPP application and review the information provided under Port View/Route Groups (be sure that the correct port(s) and timeframe is selected). As shown in Figure 16, export the data by right-clicking anywhere in data grid and selecting Export to CSV File. Specify a directory and name for the Route Group data and click Save. This file will have the exact fields as shown in the Data Pane of the A-DAPP. Notice fields for the Prior and Next Port and the Additional Sea Distance.

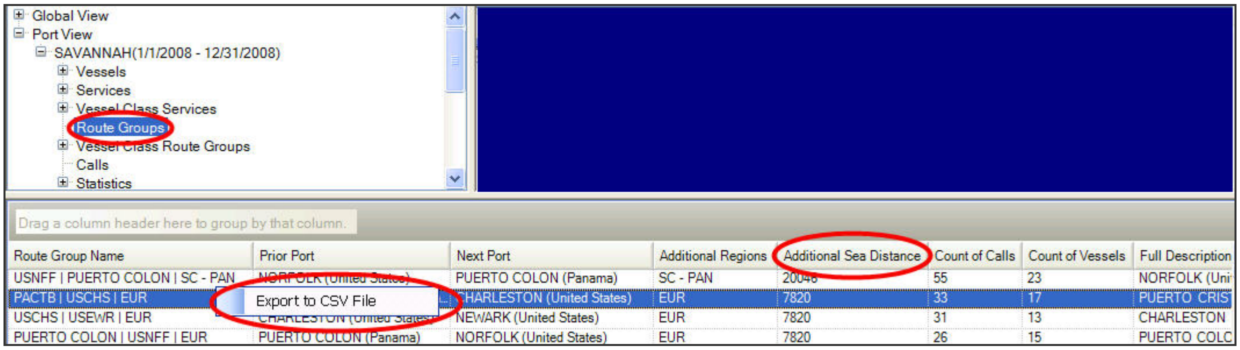


Figure 16 - Route Group Information in A-DAPP

The user will need to gain a clear understanding of what information is provided by the A-DAPP in order to accurately transform the data for use in HSD. The Additional Sea Distance is estimated given a matrix stored in the A-DAPP structure that identifies average sailing distances between centrally located pointes in the A-DAPP regions. Additional Sea Distance is calculated based on the following assumptions:

- The Additional Sea Distance is the sum of the distance from the Next Port's region to the next region listed under "Additional Regions", then from that region to the next listed, and so on.
- If the Prior Port Region is equal to the last region listed, then the distance from the last region to the port of study region is NOT included in the Additional Sea Distance. This distance will be captured in a HSD study through the Prior Port Sailing Distance.
- If the Prior Port Region does NOT equal the last region listed, then the distance from the last region to the port of study region is included in the Additional Sea Distance. Note the example Route Group PACTB | PORT RICHMOND SI | EUR. For this route group the vessel path is Port Puerto Crisobal (Panama) to Port Savannah (U.S. East Coast) to Port Richmond Staten Island (U.S. East Coast) to an unnamed port in Europe returning to Port Savannah (U.S. East Coast). Thus, the distance from last region visited to the region of the port of study is included in the Additional Sea Distance.
- The Additional Sea Distance does not include the sailing distance from the port of study to/from the Prior and Next Port. Also, note that the Additional Sea Distance does not capture port to port movements that are possible between regions.
- In the above example: "USNFF | ESALG | SUEZ-SAS-SUEZ-MED", the Additional Sea Distance would be calculated as:

  (MED to SUEZ) + (SUEZ to SAS) + (SAS to SUEZ) + (SUEZ to MED) + (MED to USEC)

Note that the Additional Regions column may be blank and no region string included in the Route Group Name. This indicates that no additional regions were traveled beyond the port of study's region. If the prior and next ports are in the same region as the port of study, and the Additional Regions field is blank, then the Additional Sea Distance should be zero. The Additional Sea Distance for the Default Route should be set to "1".

For the Route Groups specified for HSD, identify the Additional Sea Distance and input this information into HSD, as shown in Figure 17. The analyst may decide to make assumptions regarding the triangular distributions and should consult the DDNPCX policies for guidance. For the Test Project, no distribution is assumed. Note in Figure 17 the Default RtGrp (default route group) has an Additional Sea Distance of 1.

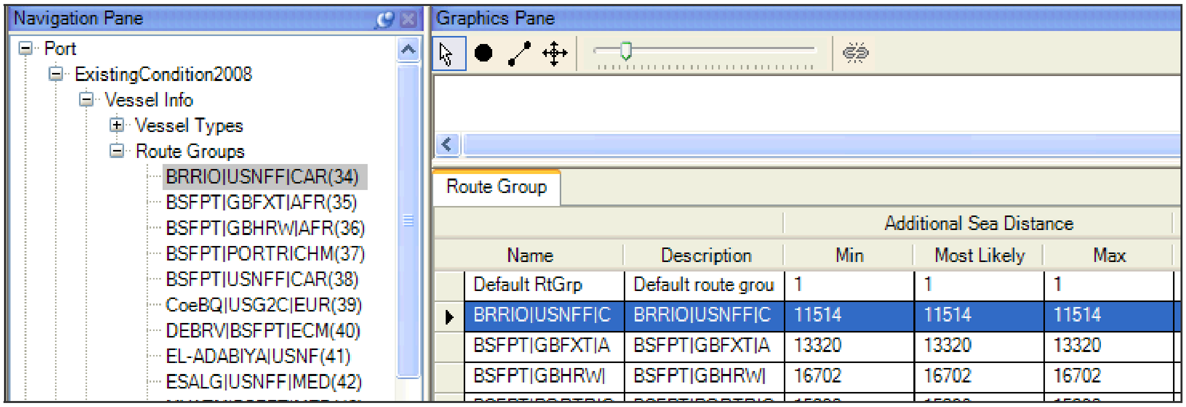


Figure 17 - Input Additional Sea Distance for Route Groups in HSD

As noted, the A-DAPP provides a field that specifies the exact prior and next port visited for a Route Group (this can also be inferred from the Route Group Name in the A-DAPP), when known. These data were exported with the Route Group export from the A-DAPP. Given the exact name of the port, the sailing distance and limiting depths of the prior and next ports can be determined. For the Test Project, two sources were used to determine the distance between the port of study and the prior and next ports: the U.S. Department of Commerce and the National Oceanic and Atmospheric Administration's (NOAA) 2009 publication, *Distance Between United States Ports* and the National Imagery and Mapping Agency's 2001 publication 151, *Distance Between Ports.* For the limiting depths, port websites can be reviewed. The World Port Index also provides generalized information for port depths. The Default Route Group should be assigned limiting depths greater than the port of study so as not to impede the movements of vessels on this route. Once this information for each Route Group is determined, specify the data in HSD.

5.3 Vessel Types

Next, return to the Excel PCL file to review the vessel types that visit the port of study. Move to the worksheet containing the Pivot Table and clear any fields in the Report Filter or Row Labels boxes. Drag the field 'vessel_type_name' to the Row Labels box. Add the 'movement_number' field to the Values box and summarize the data by count, as shown in Figure 18. Adding a column that counts the number of movements for each of the WCSC vessel types will provide the user with an idea of appropriate generalizations for the HSD Vessel Types based on the level of traffic in the vessel call list. Note that 'Count of Movement_Number' is actually a count of unique vessel commodity transfers by dock visits by vessel call. Keep this into consideration when reviewing the data.

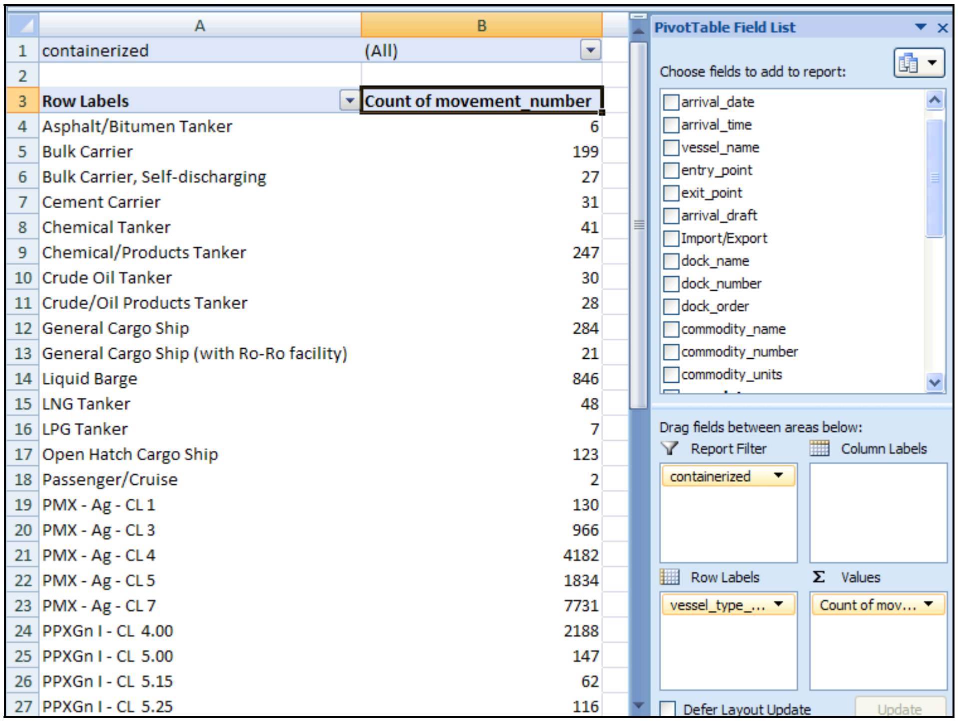


Figure 18 - Create Pivot Table in Excel to Review WCSC and AIS Vessel Types

For the Test Project, vessel types were specified as General Cargo Ship, Lng/Lpg Tanker, Bulker, Tanker, Liquid Barge, and Containerships. In HSD, add the vessel types to the project, as shown in Figure 19. As with the commodities, create a look-up table in a new Excel tab that indicates which WCSC vessel types are associated with the HSD Vessel Types. The lookup table will be referenced in later steps.

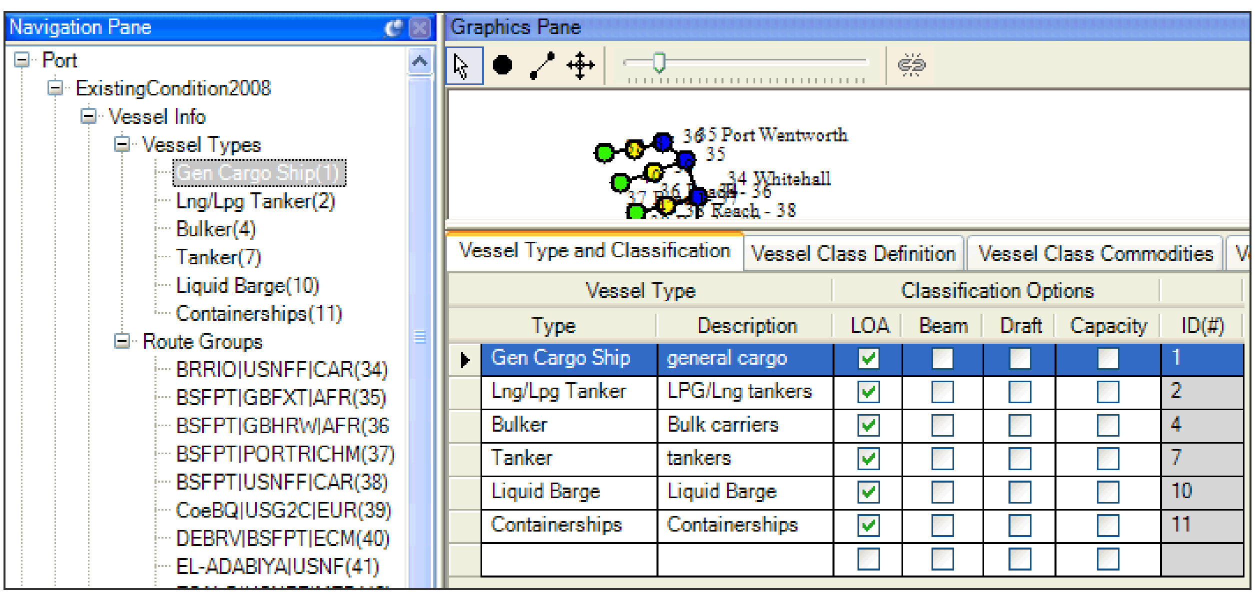


Figure 19 - Add Vessel Types to HSD

6.0 Finalize HSD Project Data

Now that the W-DAPP export has been reviewed to determine the types of vessels visiting the port, commodities exchanged at docks, and the sailing routes of the vessels, the HSD data requirements listed below should be completed (ordered as found in the HSD Navigation Pane). The data exported from the W-DAPP can be reviewed to inform some of these data, as noted.

- *Vessel Info*
  - *Determine characteristic(s) for classifying Vessel Classes within a Vessel Type*
  - *Define Vessel Classes, including ranges for capacity, draft, beam, and length overall (LOA)*
    **Available from PCL*
  - *Indicate what commodities each Vessel Class carries*
    **Available from PCL*
  - *Define Vessel Class Attributes*
- *Complete attributes for Commodities: Note that HSD allows for the specification of the Unit for each commodity category. Choices for Unit are tons, passengers, containers, and automobiles. The Test Project uses Tons for all commodities. If the user wishes to create a commodity category for Containers, then the Unit for this category should be Containers. When scrubbing the PCL file and moving the data into the HSD Port Traffic Template (see Section 7.2 W-DAPP PCL Clean-up), the 'Community_unit' field for any containerized movement should be converted from tons to TEUs.*
- *Under Port Structures, complete all data requirements. This includes: Turning Basin attributes, Vessel Turning Basin Time, Dock attributes, Vessel Docking Time, Commodity Transfer Rates for Docks, Reach attributes, Vessel Speed in Reach, Transit Rules for Reaches, and Dock/Turning Basin Area Matrix.*
- *Port Transit Rules*

Because the next step will involve creating a HSD Port Traffic Template in Excel with tabs for lookups for Vessel Type, Vessel Class, Docks, Commodities, and Route Groups, it is important that these categorical grouping are the final definitions before moving forward. Attributes for these classifications that do not impact the Port Traffic Template can be adjusted as needed prior to running simulations.

7.0 Complete Port Traffic for Existing Condition

Every HSD project has a vessel call database (VCDB) associated with it that contains the vessel traffic and commodity transfers for a given project year. Studies typically have a HSD project that represents the historical existing condition. This project will be linked to a VCDB populated with historical data for some specified year in the past. Data are entered into a VCDB through the Port Traffic node in the Navigation Pane found under the project name, as shown in Figure 20. Data within this node are further organized by Unique Vessels, Vessel Calls, Dock Visits, and Commodity Transfers.

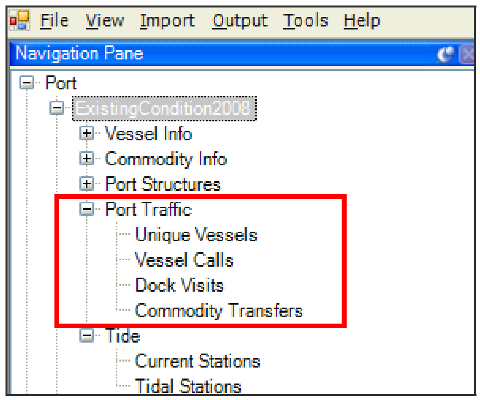


Figure 20 - Port Traffic Node in Navigation Pane

Routines exist within HSD to simplify the steps to populating a VCDB, greatly reducing the amount of date entry required and the occurrence of error. In general, a lookup template spreadsheet (herein referred to as Lookup Spreadsheet) is created that has the information needed to properly create a VCDB, such as the project's vessel classes and types, route groups, docks, and commodity categories. The template also includes an essentially blank worksheet, with only column headings, that can be populated with vessel call information. The template spreadsheet can be imported into a HSD project. Upon import, HSD will break down the spreadsheet to determine the unique vessels calling a port, their vessel calls, the docks visited, and commodities transferred. This routine will populate the VCDB.

7.1 Create Lookup Spreadsheet

To begin, Right-click on the project name in the Navigation Pane and select 'Create Lookup Spreadsheet', as shown in Figure 21. Select the project then specify the directory and file name before clicking Save. The Excel file will contain a number of worksheets:

- Field_Descriptions: table defining each field found in the 'Calls' worksheet
- commodity: HSD Commodity categories, description and number
- dock: HSD Docks with descriptions and dock number
- vessel_types: Vessel Types in HSD, description and number
- vessel_classes: Vessel Classes in HSD with description, number, and associated Vessel Type

- route_group: Route Group names, descriptions, and number in the HSD project
- Calls: blank template worksheet for importing port traffic into a HSD project
- Flags: list of vessel sailing flags available within HSD

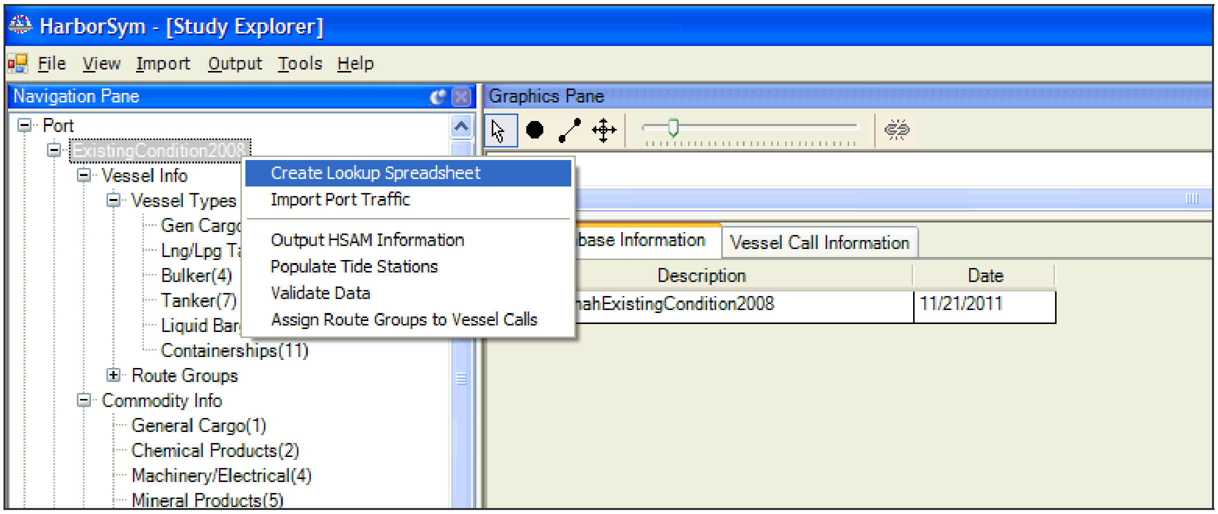


Figure 21 - Create Lookup Spreadsheet in HSD

Users should populate the "Calls" tab of the lookup spreadsheet with the vessel call information. Referencing the data populated by HSD in the other tabs ensures the spreadsheet will be imported correctly into the model. The DockNumber column should be populated based on the dock worksheet. The CommodityNumber column should be populated based on the information on the commodity worksheet and the VesselTypeNumber should be populated based on the information on the vessels worksheet. Similarly, Vessel Class and Route Group information should be populated based on the data provided in the corresponding worksheet. The Flag field can be populated based on the information on the flags worksheet. For a large call list, users can utilize the Microsoft Excel VlookUp function to assist with the entry of these values.

The remaining information should be completed based on port traffic. Users should view the vessel call list as documentation of all vessels arriving at the harbor entrance point(s) during the desired period. All unique vessel arrivals must be assigned a unique Movement Number. This field is used to track vessel calls with multiple row entries in the spreadsheet. For example, a vessel arriving at the entrance point planning to visit two docks within the study system will have two row entries in the import spreadsheet, one for each dock visit, both with the same movement number. The "Dock_Order" field indicates the order in which the vessel will visit each of the docks. Likewise, if a vessel is calling only one dock but exchanging multiple commodities (or importing and exporting commodities), the user must enter multiple rows into the spreadsheet for each commodity exchange (the order of rows is immaterial). These multiple rows must be tagged with the common movement number. Appendix A of the HSD User's Guide contains a table defining the column headings and required data entry values for the Lookup Spreadsheet.

7.2 W-DAPP PCL Clean-up

The W-DAPP exported PCL is conveniently structured to match most of the fields in the HSD Lookup Spreadsheet. The PCL data, however, must be scrubbed and cleansed prior to being pasted into the HSD

Lookup Spreadsheet. Cleansing of the PCL data will require a great deal of effort to ensure accuracy in the data and consistency with HSD input requirements. The following provides some notes on how to prepare the PCL data for pasting into the Lookup Spreadsheet. This list is in no way exhaustive.

- Investigate and potentially remove entries without commodity type or units specified. These field cannot be blank in the Lookup Spreadsheet
- Vessel names and numbers should be unique and consistent. Each unique vessel should have only one unique entry for LOA, Beam, Capacity, and Draft.
- More than likely, WCSC dock names will not exactly match the HSD Dock Names. Create a lookup spreadsheet indicating which WCSC docks correspond to which HSD Docks. Using this look-up spreadsheet, specify the HSD Dock Name and Number for each movement.
- Select the desired unit for the Capacity field. Choices are NRT, GRT, and DWT. If the Bulk Loading Tool will be used, then DWT must be selected as Capacity.
- Set the entry/exit node as appropriate from the HSD project.
- Use the lookup table created for Commodities to specify the HSD Commodity Name and Number for each movement. Once this is completed, the number of fields for a movement may need to be combined.
- Use the lookup table created for Vessel Types to specify the HSD Vessel Type for each movement.
- If desired, the PCL field 'vessel_type_name' can be used to specify the Vessel Class for containerships. Using this field, the user can create a lookup table that specifies which vessels are Panamax, Subpanamax, Post Panamax Generation 1, and Post Panamax Generation 2, thus corresponding the Vessel Class Name and Number in HSD. These data for containerships are generated from the A-DAPP.
- Some vessel operators report several trips in a single form and thus several trips can end up in the WCSC data as a single record. In these instances, Trip Count will be greater than 1. These instances should be cleaned-up by creating additional dock visit rows.
- Blank TPI values should be filled.
- Arrival times that are 12:00:00 AM are unknown arrival times. These should be reassigned a random arrival time.
- Change all foreign flags to 'Z_Foreign'.
- Dock order should be assigned. This will be one of the last steps completed.
- HSD allows the user two options for specifying the Route Group for a vessel call. (1) The user can leave the "Route_Group" field blank in the HSD Lookup Spreadsheet. Upon importing the template, HSD will assign the Route Group to a vessel call based on the percentages indicated in the Vessel Class Route Group table. (2) The user can indicate the Route Group, if known, in the Lookup Spreadsheet and direct HSD to only assign a Route Group to the blanks based on the percentages in the Vessel Class Route Groups table. If this option is preferred, the user should be

certain that the percentages and the defined Route Groups for the calls within a Vessel Class are consistent.

7.3 Complete Lookup Spreadsheet and Import into HSD

Once the PCL data are cleansed and appropriately grouped for use in HSD, the user should paste the corresponding fields from the PCL into the Calls worksheet in the Lookup Spreadsheet. Note that three fields in the PCL are informational only and will not have a corresponding field in the Lookup Spreadsheet: trip_count, containerized, and services. Do not include these fields in the Lookup Spreadsheet. However, having these fields associated with the final PCL is useful in future steps. A copy of the final PCL.xls files should be maintained so that statistics can be created on containerized movements and Services (needed for CLT).

Required data in the Lookup Spreadsheet includes: unique movement number, arrival date, arrival time, vessel name, harbor entry point, harbor exit point, vessel arrival draft, dock name, dock number, dock order, commodity, commodity number, units of each commodity transferred, commodity movement direction (import or export), vessel type name, vessel type number, vessel capacity, LOA (length overall), vessel beam, vessel draft, vessel TPI Factor, and Flag (nationality). Optional data in the Lookup Spreadsheet includes the vessel destination (destination port of exiting vessel), NRT (net registered tons), GRT (gross registered tons), DWT (deadweight tons), Route Group Name, Route Group Number, Vessel Class Name, and Vessel Class Number.

Once the Lookup Spreadsheet is complete, it should be imported into HSD. The HSD import routine dissects the Microsoft Excel workbook and populates the extracted data in the correct location within the HSD VCDB. Beneficial features of this capability include the identification of unique vessels within a call list and the assignment of unique vessels to Vessel Classes (if vessel class is blank). Unique vessels are determined based on the external identifier, vessel name, and physical characteristics including LOA, beam, capacity, and draft. The external identifiers, such as Lloyd's numbers, should represent a unique vessel calling the port. During the import process, HSD allows only one combination of external identifier – vessel name – physical characteristics in a call list. Vessel calls showing identical external identifiers and non-identical vessel names and/or physical characteristics will not be imported into HSD. (It is, however, possible to have multiple vessels in the call list with non-unique external identifiers and identical vessel names). All vessel calls unsuccessfully imported into HSD are documented. If necessary, users can modify the call list to reflect unique vessels and re-import the data.

The vessel call list spreadsheet is imported into HSD by either selecting Import Port Traffic from the Import menu in the Task Bar or by Right Clicking on the project name in the Navigation Pane, as shown in Figure 22. Click on the button (...) and browse to find the completed Lookup Spreadsheet and then ensure that the proper worksheet is selected in the Select Worksheet field. Create Import Log is selected by default and it is recommended that this option be selected. The Create Import Log will create a log of the import and notify the user of any rows that were not imported due to erroneous data, such as non-unique vessel information or blanks where data are required.

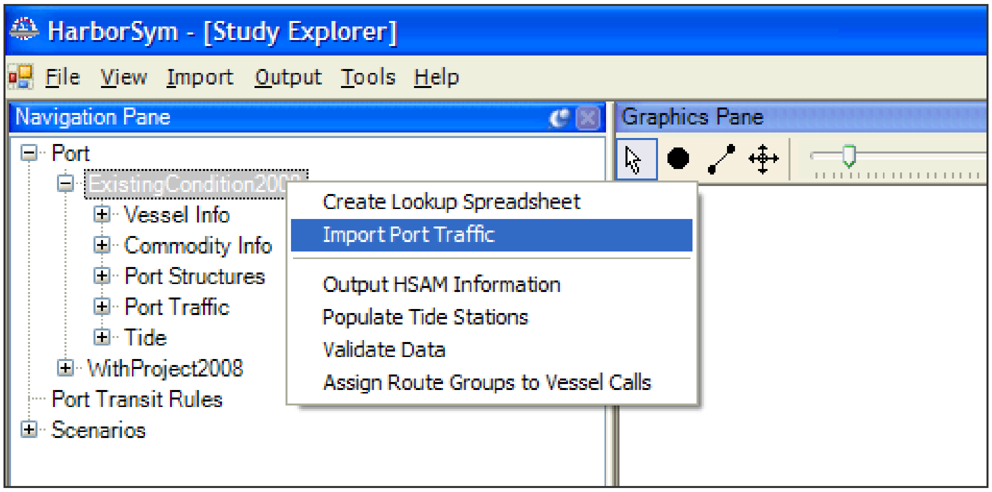


Figure 22 - Import Port Traffic into HSD

Click the Next button to continue with the import. The user must now select a default Vessel Class for each Vessel Type. Ensure that a default class is selected for all Vessel Types. The default for each Vessel Type is signified by a check in the row for the Default Class value, as shown in Figure 23. HSD will use the default class to make Vessel Class assignments when vessels cannot be assigned to a specific class based upon its measurements.

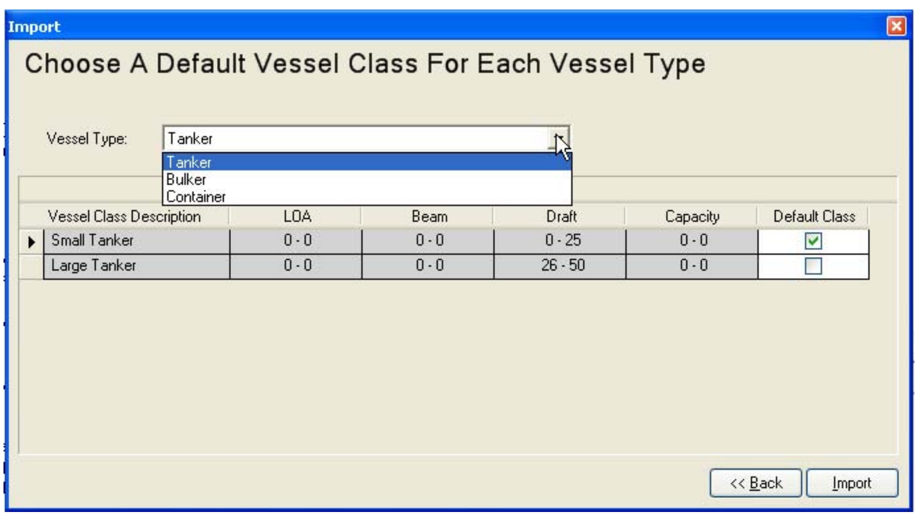


Figure 23 - Select Default Vessel Class

After the default vessel class has been selected for each Vessel Type click the Import button. When the import is complete the user will receive a message asking whether to assign Route Groups to blanks or to all vessel calls. After making the selection, a message will appear to indicate that the import has completed. If vessel class Route Group percentages are inconsistent with the Route Groups in the vessel call spreadsheet, an error message will appear indicating which vessel classes need review. If this occurs, the import will function but Route Groups that were blank upon import will remain blank.

Review the data now available under the Port Traffic node in the Navigation Pane. Review the output files generated when the Lookup Spreadsheet was imported.

8.0 Check and Validate Data

At this point in the work flow, HSD should now be populated with all the data needed to run a simulation. As HSD requires a great deal of consistent user defined information to function properly, a data validation tool has been developed to aid the user in determining the completeness and reasonableness of the information entered. Users can access the data validation tool by right clicking on the project name and selecting Validate Data, as shown in Figure 24. This will launch the Data Validation Form, within which the user can determine which data fields should be verified. Options include: Port Information, Vessel Information, Port Structures, Port Traffic, and Tide Information. After checking the desired data elements for validation, the user should select "Check Data". HSD then generates a report outlining the status of the user-provided data. The report will state Error or Warning and list the problem in any categories for which data needs attention. This report can be printed or saved. A sample data validation report is included in Appendix A of the HSD User's Guide.

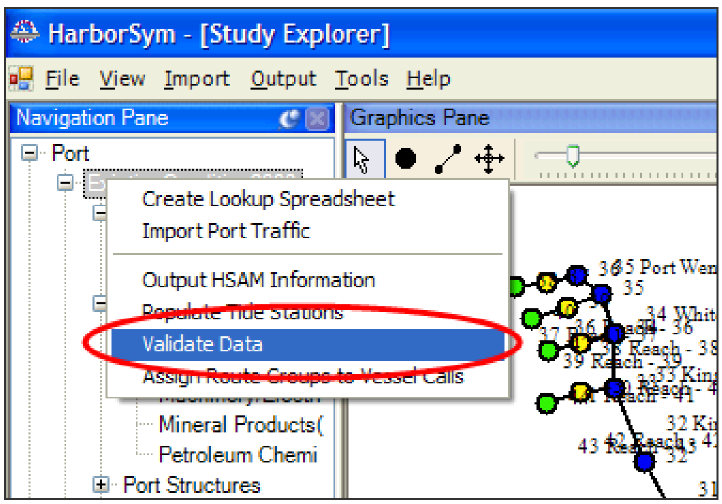


Figure 24 - Validate HSD Data

The Validate Data tool compares the user provided data against established ranges of values that is acceptable for input, as set by the user. Input values outside of the defined range generate an error message during data validation. The configuration settings can be set up selecting "Configuration Settings" under the "File" menu option.

Before moving forward it is pertinent to double check all assumptions, refine, and finalize data. The next steps in the work flow involve cloning the Existing Condition project databases. Also, the BLT and CLT modules will be used to generate a synthetic VCDB for use by HSD. These modules build from the Existing Condition HSD project databases. Thus, changes to the data assumptions in the Existing Condition database after this point may necessitate duplicate data corrections at best, and possibility a redo of steps.

9.0 Clone Existing Condition HSD Project

The HSD Study manager contains a cloning feature that allows the user to create a new project within a study that contains all of the data entered for the original project. The user can then modify the values that would change if the harbor improvement was implemented as the alternative project. Analyst will choose to create cloned projects based on the improvements being analyzed and the planning horizon for which an analysis is desired. To clone a project, launch the Study Manager by selecting File/Study Manager from the main menu. Select the project you wish to clone and select the 'Clone Project' button. The Study Manager is shown in Figure 25.

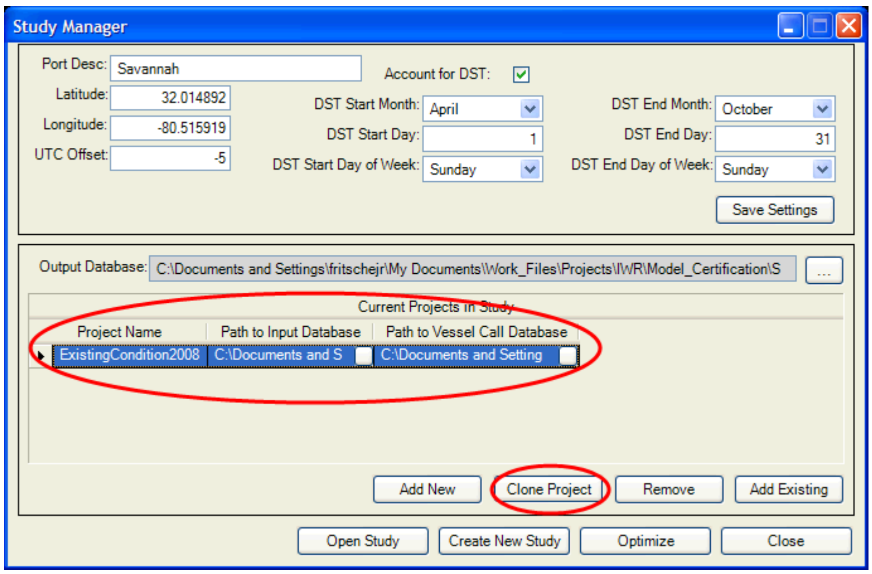


Figure 25 - Clone Project in HSD

For the Test Project, the Existing Condition project (named ExistingCondition2008) was cloned and named Deepened2008. This cloned project was altered in order to analyze the benefit of a deepened navigation channel and represents the with-project condition. In the Deepened project, the reach and dock depths were deepened from 42 feet to 48 feet. Once this was done, both the Existing Condition and Deepened projects were cloned for use in the 2030 planning horizon. The four HSD projects are shown in Figure 26. The current VCDBs linked to the 2030 projects are populated with 2008 data. New VCDBs will be created for the 2030 projects using the Loading Tools in the steps that follow.

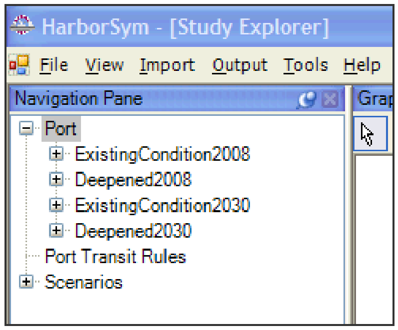


Figure 26 - HSD Projects

10.0 Generate Synthetic VCDB for Bulk Traffic

The BLT was developed to assist users in generating a synthetic future vessel call list, or VCDB, for non-containership vessels. The BLT is launched from the HSD Tools menu. The Navigation Pane provides the user with a tree structure that has 5 numbered items. These items are numbered according to the order the user should follow to create a synthetic VCDB for generalized bulk traffic.

A single HSD study is composed of several distinct Microsoft® *Access* databases. The BLT has been designed to reduce the amount of data input required by the user. Rather than reassert the basic parameters of the study, such as Docks, Vessel Types, Commodities, and Route Groups, the user can direct the BLT to the HSD IDB that already contains this information. Additionally, the BLT can be directed to a historical VCDB that contains pertinent Vessel Class information that is used to create the synthetic vessels for the future call list. This feature of the module not only saves the user time by eliminating the need for duplicate data entry, but it also ensures the accuracy of the data and its consistency with a HSD IDB.

10.1 Set Working Files

The user must link the BLT module to the appropriate input (IDB), vessel call (VCDB), and forecast (FCDB) databases (databases are explained in Table 3-1 of the HSD User's Guide). To begin, select "1. Set Working Files" from the Navigation Pane, as shown in Figure 27. When this is selected, a form will appear in the Options Pane that assists the user in specifying the databases. The Data Pane will be blank during this step. Note that until all the databases have been specified, no other option is available to the user in the Navigation Pane.

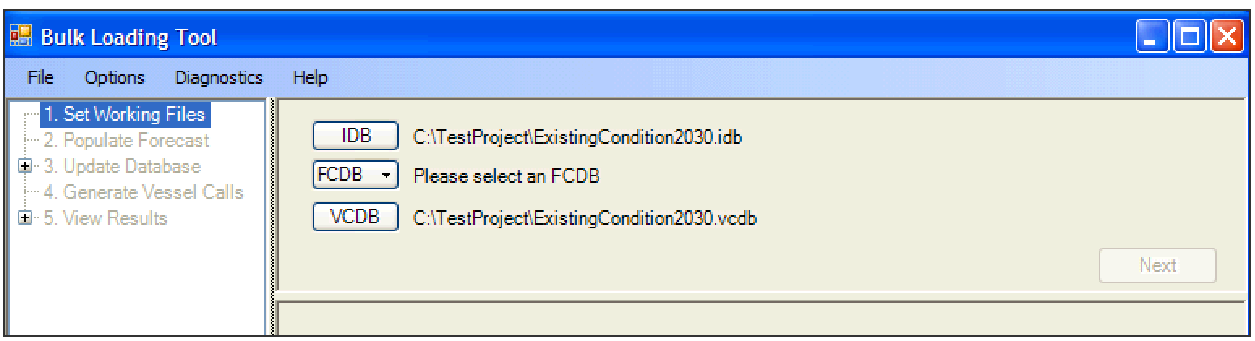


Figure 27 - Attach Databases to BLT

The IDB describes project layout, including the Docks, Vessel Types, Vessel Classes, and Commodity categories. It is important to attach the BLT module to the correct IDB, as this database defines the vessel and commodity classifications that provide the basis for a synthetically generated call list. For the Test Project, the ExistingCondition2030 IDB was selected.

The VCDB documents the unique vessels that call the port, and all the calls and commodity transfers made by these vessels. Initially, a populated VCDB, housing the existing condition data, should be attached to the BLT. An existing condition (or other populated VCDB) is used to populate basic information for the

BLT forecast, such as the logical constraints and vessel class statistics. For the Test Project, the ExistingCondition2030 VCDB was selected.

The final database that must be assigned is the FCDB, or forecast database. This database is unique to the BLT and stores information about commodity forecasts at docks, constraints on vessel class capability to carry commodities and serve individual docks, and the vessel fleet. In addition, the statistical information necessary to generate synthetic vessels is stored in this database. Initially, a blank FCDB should be attached to the BLT. This can be done by selecting "Create from Template" from the pull down menu under FCDB. Follow the prompts to provide a file name and save location for the new FCDB.

10.2 Populate Forecast

After attaching the BLT to the correct supporting databases, the blank forecast database (FCDB) must be populated. This is accomplished through either manually inputting the information in the tables or by generating a routine to populate the FCDB based on the linked IDB and VCDB. The information that is needed for the FCDB includes:

- Dock: constraints describing the docks available for bulk traffic. Only docks that are used by general bulk vessels should be entered.
- Fleet Specification: for each Vessel Class, the maximum number of port trips (vessel calls) available for the forecast year and the Vessel Class allocation priority; the allocation priority determines the order in which vessel classes are called upon to satisfy commodity forecasts (allocation priority of 1 is loaded first).
- Commodity Forecast at Dock: the total amount of each Commodity to be imported and exported at each Dock.
- Dock Vessel Class: the Vessel Classes that are able to service each Dock; if a Vessel Class – Dock combination is not present in this table, the Vessel Class will not be able to satisfy any of the commodity forecast at the dock.
- Vessel Class Commodity Category: an identification of the Commodity categories that can be loaded on each Vessel Class, as well as a description of cargo exchange behaviors including:
  - a triangular distribution (minimum, most likely, maximum values) for loading the vessels by import and export, describing the percent of the vessel capacity that will be loaded or unloaded at the study port);
  - direction of commodity movements: export only, import only, both import and export, or random (calls of the class can be either import only or export only movements but not both on a given call);
  - import percentage for vessel classes assigned as "random" loading.
- Vessel Class Route Group: the assignment of Route Group to each Vessel Class and a percentage of all calls by the Class that sail on the Route Group.
- Vessel Class Capacity Regression: a CDF capacity function for each Vessel Class.

- Vessel Class Regression: for each Vessel Class, regression information for deriving LOA, beam and design draft from capacity.

- Vessel Class TPI Regression: for each Vessel Class, an assignment of the beam, draft, capacity, and LOA coefficient to be used in developing the vessel TPI.

As these data requirements are extensive, the VCDB and IDB linked in the previous step can be used to populate the forecast database. The user has the option to select which tables should be populated with data from the existing vessel call database by deselecting any options they do not want populated, as shown in Figure 28. All selected tables will be filled with data corresponding to the information contained in the attached IDB and VCDB. For example, if the "Commodity Forecast at Dock" option is selected, the Commodity forecasts at each Dock will be populated in the forecast database with the actual Commodities transferred at the Docks in the VCDB referenced in the "Set Working Files" step. Using an existing VCDB to populate the FCDB is especially useful in generating the logical constraints (e.g., which Commodities move through each Dock and which Vessel Classes call each Dock) and populating the statistical tables. To complete the FCDB population, the user should select the desired tables to be filled, and then select the 'Populate Selected' button located on the right of the form.

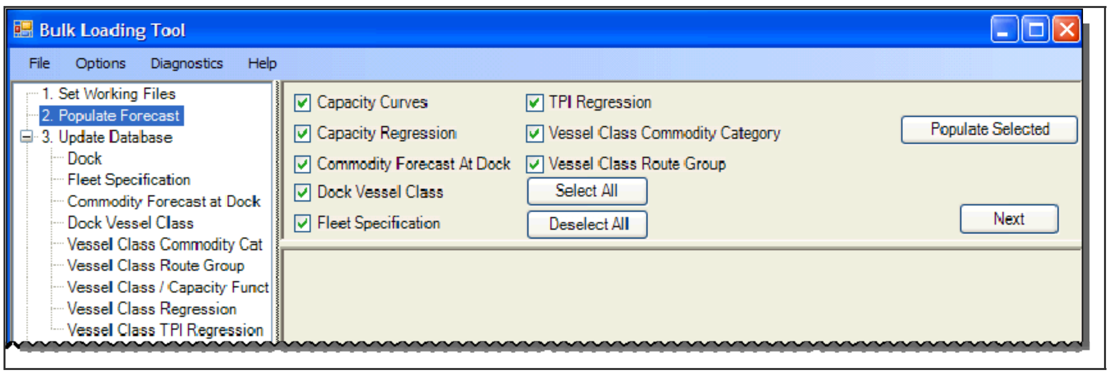


Figure 28 - Populate Forecast in BLT

10.3 Update Database

Selecting tables shown under "Update Database" will display the table data for review after the population routine has been executed. Using an existing VCDB to populate the forecast database reduces the data entry requirements, but does not eliminate the need to review and manually update the tables with appropriate forecast information. All data in the tables must be reviewed and adjusted, as necessary, to reflect the forecasted conditions for the planning horizon.

To begin, select a table to review under "Step 3: Update Database", as shown in Figure 29 and select a table to review. The key information that is editable within the FCDB that the user should review will display in the Data Pane. To aid the user in recalling IDB data specifications, a query form is provided in the far right of the BLT Data Pane. The query form allows the user to view additional details on Docks, Vessel Type, Vessel Class, Commodity Categories, and Route Groups.

All tables must be updated to properly reflect the future fleet and Commodity forecast for generalized bulk traffic. Data fields within each table should be carefully reviewed, understood, and updated prior to moving to the next step.

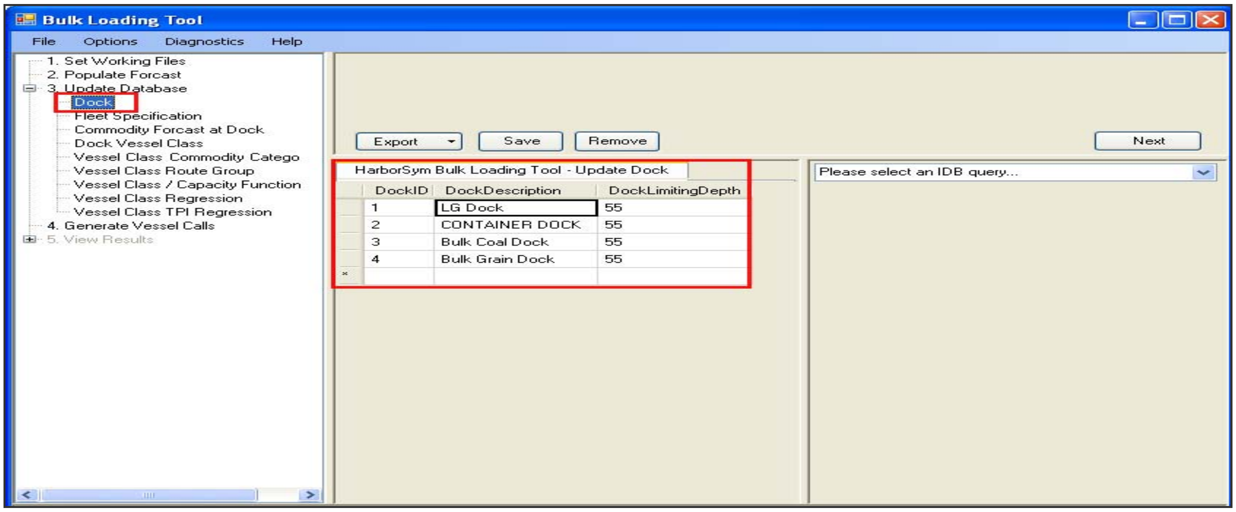


Figure 29 - Update Tables in BLT

Note: If the IDB and VDCB for the HSD project used to populate the forecast has a containerized Vessel Type with Classes or a containerized cargo Commodity group, then the tables provided under 'Update Database' in the BLT must be edited to remove any reference to containerized vessels or commodities. To delete references to containerships, the user must select the cell, click the Remove button above the table headings, and confirm the deletion. The user must click Save in order for the changes to be permanent. The premise of clicking Save after each table change applies whether rows are deleted or data updated.

10.4 Generate Synthetic Bulk Vessel Call List

After the vessel fleet availability, commodity forecasts, and other pertinent forecast inputs and parameters have been established, the BLT can be directed to create a synthetic vessel fleet and load the commodity forecast on these vessels.

Ultimately, the generation process will result in a fully populated VCDB capable of supporting a HSD simulation. The tool must be directed to create a blank VCDB database from template. **Be certain that the historical VCDB linked to the BLT in the previous step is NOT selected to avoid overriding its contents.** This is done by clicking on Generate Vessel Calls in the Navigation Pane (Number 4), and then selecting Create from Template in the Pane on the upper right of the user interface, as shown in Figure 30.

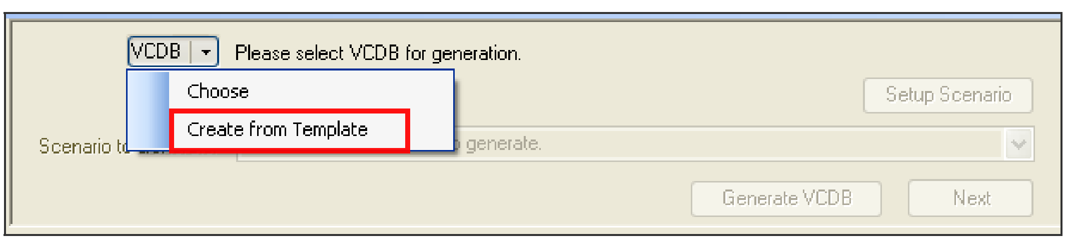


Figure 30 - Create New VCDB From Template in BLT

The parameters for the VCDB generation must be defined. This is done by clicking Setup Scenario in the same pane, available only after a VCDB for generation has been selected. The scenario parameters should be set within the form that appears as shown in Figure 31. Each field should be completed as follows:

- Forecast Scenario Name: the name assigned to the forecast scenario. Special care should be taken to provide a logical name for the scenario, as the name will be included in all output files generated by the scenario; without a reasonable naming schema the outputs will be difficult to differentiate.
- Forecast Scenario Description: provides a more detailed description of the forecast scenario for assistance in differentiating outputs and generated databases.
- Forecast Year: the year to be assigned to calls in the generated call list.
- Iterations: the number of iterations to be processed. Note that the BLT has the capability to produce a multiple iteration VCDB. This number must correspond to the number of iterations desired for the HSD simulation and thus the number of iterations ran using the CLT.
- Write to Vessel Call Database: activating this check box will populate the VCDB with the generated data. The user may desire to run a number of simulations without writing to the VCDB to speed up the process of testing the data inputs. Once data inputs are finalized, the user will want to activate this box in order to generate a VCDB that can be utilized by HSD.
- Seed: used to start the Monte Carlo simulation; this value should be greater than 0.
- Generation Period: number of days to generate a call list for, typically 365.

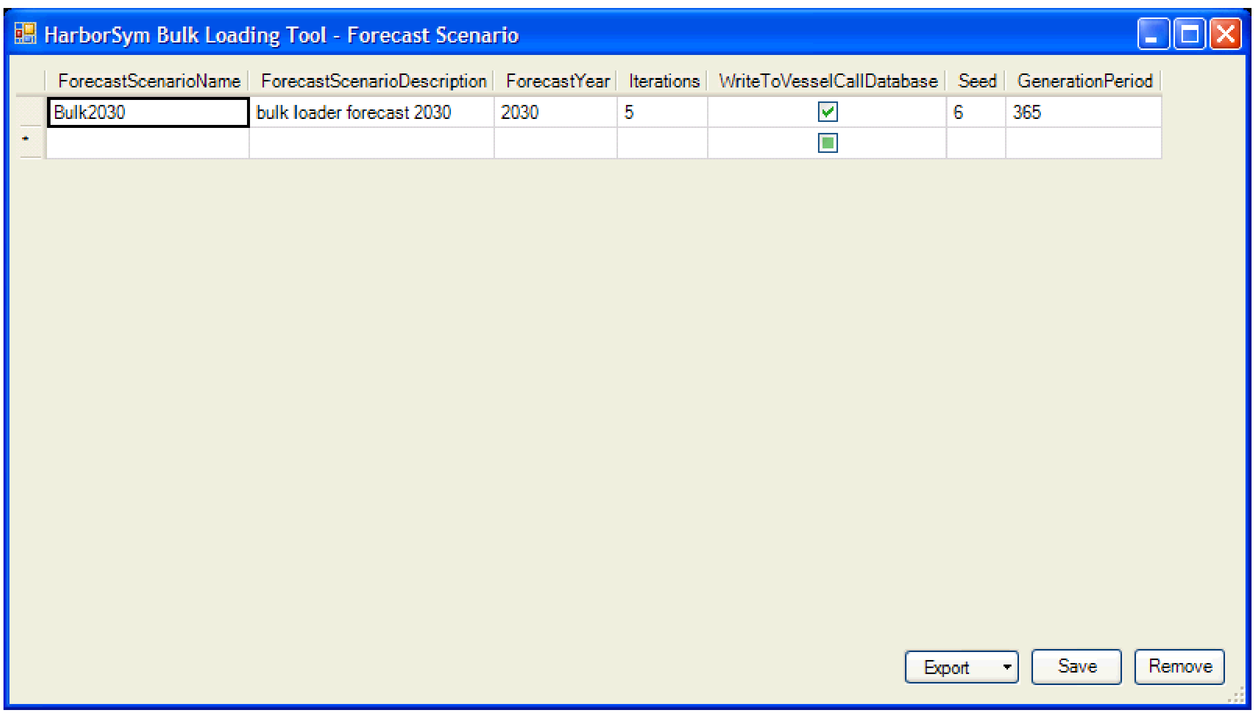


Figure 31 - BLT Scenario Form

After creating and saving the forecast scenario, this screen shown in Figure 31 can be closed. The newly created scenario will appear in the pull down menu under “Scenario to Generate”. The scenario can be launched by selecting it from the pull down menu and clicking the “Generate VCDB” button, as shown in Figure 32.

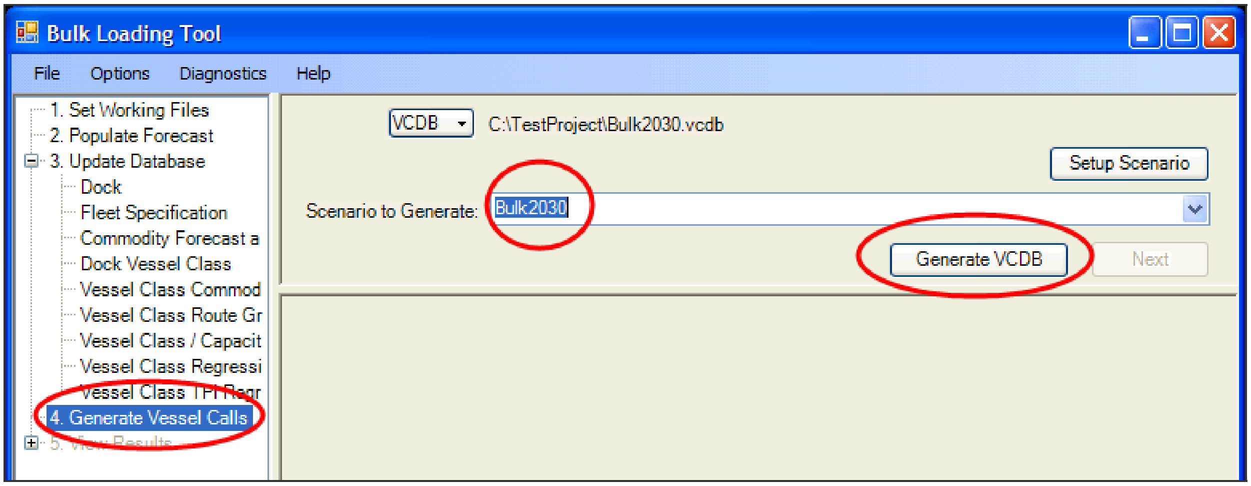


Figure 32 - Select Scenario for VCDB Generation

10.5 View Results

After the vessel fleet availability, commodity forecasts, and other pertinent forecast inputs and parameters have been established, the BLT can be directed to create a synthetic vessel fleet and load the commodity forecast on these vessels.

The generation process attempts to load the forecasted commodities on the available vessel fleet generated based on the user specifications. The successful loadings are formatted into a VCDB that can be linked to a HSD project. It is anticipated that the process of creating and loading a synthetic shipment list will be iterative. That is, reasonably matching the estimated number of vessel calls by class with the forecasted commodity imports and exports may require multiple revisions to the input data. If results are not within a reasonable range, the user should review all data inputs and assumptions for errors or inconsistencies. Reviewing the list of generated vessels paying special attention to the physical characteristics of the vessels is a good starting point.

The BLT module provides robust outputs to identify unsatisfied demands and demonstrate problems with the user provided loading patterns and vessel statistics. Several of these outputs are viewable through the BLT user interface, including:

- Allocations: a description, by commodity and dock, of the import / export forecasts, quantity of import / export demand satisfied, quantity of import / export demand unsatisfied, and number of vessel calls.
- Generated Vessels: a listing of all unique vessels generated, including the assigned physical characteristics of LOA, beam, capacity, TPI factor, and design draft.
- Generated Calls: the vessel call list generated to satisfy the forecasted commodity demands, including the vessel name, arrival date and time, arrival draft, route group assignment, dock visited, and commodities transferred.

Additional detailed outputs are produced during the generation and are stored in the same location as the FCDB. The user may also view the generated VCDB using Microsoft *Access* or the HSD user interface (select 'Port Traffic' in the tree node once the VCDB has been attached to a HSD project).

11.0 Generate Synthetic VCDB for Containerized Traffic Using CLT

The CLT was developed to assist users in generating a synthetic future vessel call list, or VCDB, for containership vessels. The CLT is launched from the HSD Tools menu. The CLT module produces a containership-only synthetic future vessel call list based on user inputs describing commodity forecasts at docks and the available fleet. The module is designed to process in two unique steps to generate a shipment list for use in HarborSym or in standalone analyses. First, a synthetic fleet of vessels is generated that can service the port. This fleet includes the maximum possible vessel calls based on the user provided availability information. Second, the commodity forecast demand is allocated to individual vessels from the generated fleet, creating a vessel call and fulfilling an available call from the synthetic fleet.

In order to successfully utilize this tool on a planning study, users will need extensive data describing containership loading patterns and services frequenting the study port. A solid understanding of anticipated shipping patterns, loading behaviors, and forecast demands will be necessary to generate future call lists using the CLT.

The BLT and CLT were created at different times during the course of HarborSym development. The CLT user interface is essentially menu driven, unlike the BLT. In fact, while the general function of the CLT is similar to the BLT, there are many differences amongst the tools which should be considered and fully understood. For example, the specific vessel loading behavior of containerized vessels is different from generalized bulk vessels and thus the vessel loading routine in the tools is different. The BLT generates synthetic vessels using statistical routines while the CLT generates vessels by selecting from standard vessel definitions in a sub-class. The CLT allows for seasonal patterns in shipping throughout the year while the BLT does not. Differences exist amongst the user interfaces as well. The BLT is tree structured while the CLT is menu driven. The user is able to populate much of the BLT data requirements using a statistical routine while the user of the CLT must manually enter much of the required data. Data edited in the BLT tables must be saved before closing the table while edits to the CLT viewable tables are automatically saved. These differences should be understood when using both the CLT and BLT to generate a vessel call database. It is anticipated that future HarborSym development will result in the creation of a single loading tool that operates for both bulk and container loading.

The process described in the following steps outlines the process to create a VCDB that reflects the future forecast of available fleet, commodity transfers at the docks, and the depth constraints of the channels. This process must be completed for both the Existing Condition and Deepened projects, thus creating two VCDBs: one that reflects the current depths of the channels and one that reflects the deepened channel. The following steps are geared towards generating the Existing Condition. Section 11.9 provides an overview of what elements should be addressed to create a VCDB for the Deepened project.

11.1 Set Template Directory

Upon first using the CLT, or if a new install for HarborSym has been provided, the user will need to set the template directory for creating blank CFCDBs and VCDBs. This is done by selecting Options/Set Template Directory from the main menu, as shown in Figure 33 . A dialog will open to specific the location of the

HarborSym templates installed with the software. This will be located in the directory where the program files were installed, typically C:\Program Files\HarborSym\Templates.

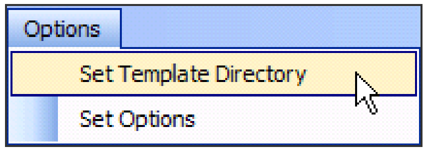


Figure 33 - Set CLT Template Directory

11.2 Set Working Files

As previously mentioned, a single HSD study is composed of several distinct Microsoft® *Access* databases. Before generating synthetic call lists, users must first attach the CLT module to the appropriate master, input IDB), vessel call (VCDB), container forecast (CFCDB), and geography databases. Table 3-1 in the HSD User's Guide describes the different information contained in each database. Figure 34 shows the CLT User Interface where databases are specified. Established databases can be linked by either selecting the box for the database or through the File menu. The File menu has additional options such as Copy Existing and Create from Template.

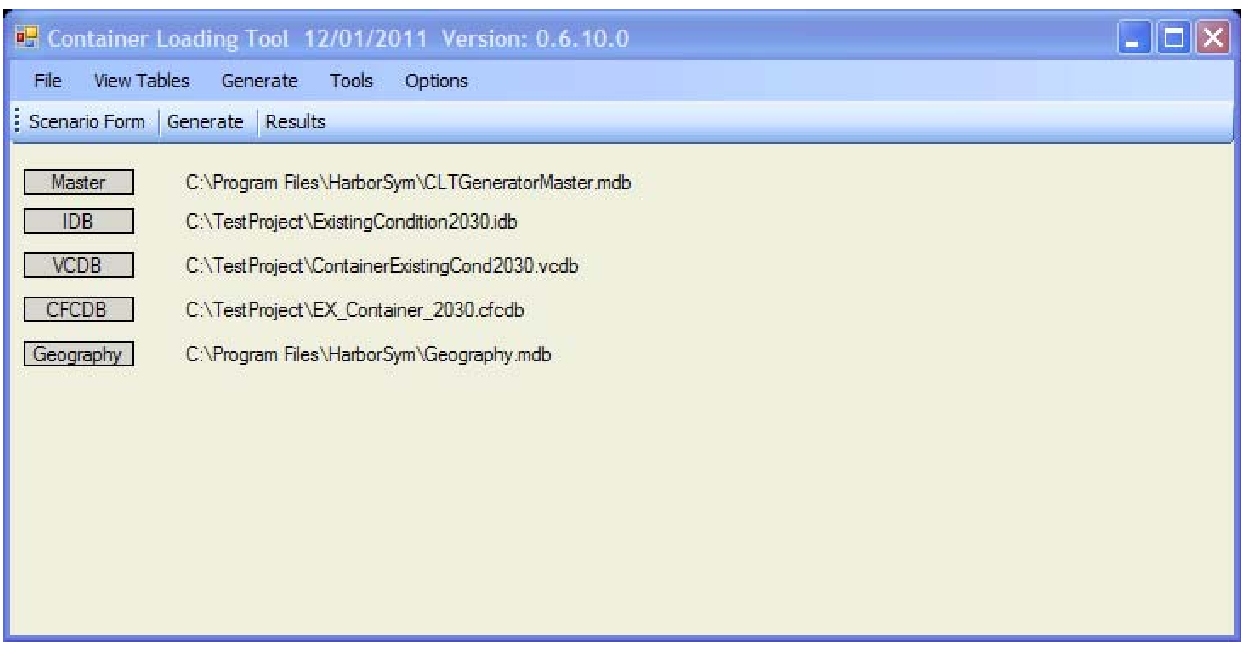


Figure 34 - Set Working Files in CLT

The Master database links together all relevant information needed for CLT generations. This database location should be specified first prior to specifying the additional databases. It can be found in the HarborSym programs files location, most typically at C:\Program Files\HarborSym. The file is named 'CLTGeneratorMaster.mdb'. If the user resets the link to the Master database, links to the remaining databases will be broken and will need to be reestablished.

The IDB describes project layout, including the docks, vessel types, vessel classes, commodity categories, and route groups. It is important to attach the CLT module to the correct IDB as this database defines the vessel and commodity classifications that provide the basis for a synthetically generated call list. The IDB specified here will be the HarborSym IDB corresponding to the future project for which the CLT is being used to generate a synthetic VCDB. For the Test Project, the CLT is linked to the ExistingCondition2030 IDB, as shown in Figure 34.

The VCDB documents the unique vessels that call the port, and all the calls and commodity transfers made by these vessels. The CLT vessel call database generation process varies from the BLT process in that the user will direct the CLT to create a VCDB from template rather than starting with an existing condition VCDB. **That is, the VCDB specified in this step is the VCDB that will be the output of the CLT generation process.** The template directory must be set prior to creating the VCDB from template. This can be achieved through the Options/Set Template Directory menu as described above. For the Test Project, the CLT is directed to create a blank VCDB from template. The file is named ContainerExistingCond2030, as shown in Figure 34. Once the CLT has generated the VCDB, this database will be populated and can be linked to a HSD project.

The next database that must be specified is the CFCDB, or containership forecast database. This database stores information about commodity forecasts at docks, the container fleet specification, parameter settings, seasons, dock parameters and vessel class specifications, services, regions, route groups, arrival draft functions, and vessel subclasses. Initially, a blank CFCDB should be attached to the CLT. This can be done by selecting "Create from Template" from the File menu. Follow the prompts to provide a file name and save location for the new CFCDB. Again, the template directory must be specified prior to creating the CFCDB from template. For the Test Project, the CLT is directed to create a CFCDB from template. The file is named EX_Container_2030.cfcdb, as shown in Figure 34. The user can also create a CFCDB by copying an existing CFCDB. This is useful when generating a Deepened project VCDB. Rather than repeating data entry that is exactly the same between the Existing Condition and Deepened projects, the user can copy the completed Existing Condition CFCDB and make adjusts to the data to reflect the deepened channel (or vice a versa). Copying an existing CFCDB is achieved through the CLT menu option File/CFCDB/Copy Existing.

Figure 35 provides a schematic overview of the CLT database architecture.

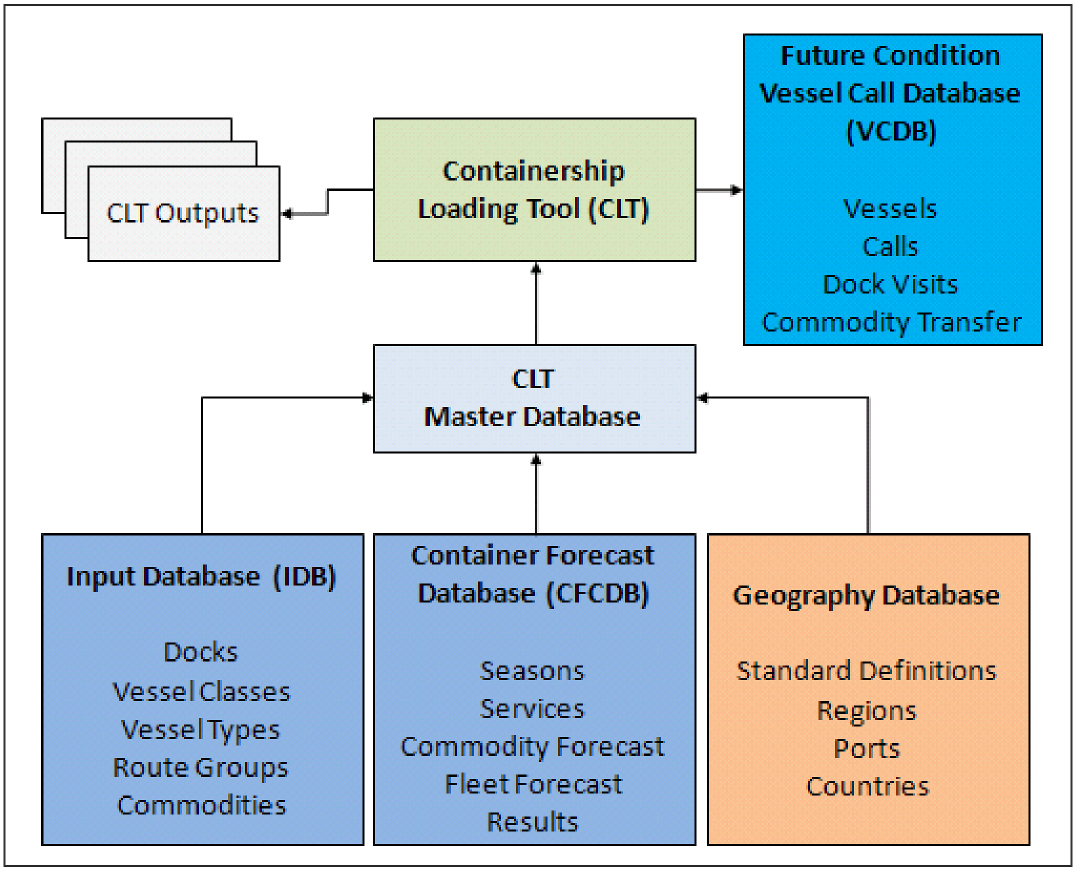


Figure 35 - CLT Architecture

11.3 Review IDB and Geography Databases

To assure that the correct IDB has been selected, the user should review the data tables available in the IDB through the View Tables/IDB menu option. Notice that the Dock Limiting Depth table name is in bold. This is to draw attention to the fact that only this table is editable through the CLT user interface. In addition to Dock depth, the user should review all data provided in these tables to ensure consistency in the CFCDB and thus CLT-generated VCDB and the HarborSym IDB that will be later be linked in HarborSym to run a port traffic simulation.

At this time the user should become aware of the region assumptions inherent in the CLT's Geography database. While the Region table is currently editable by the user, it is not recommended that the Regions within this table be edited. The Regions listed in this table are consistent with the regions specified in the A-DAPP tool.

11.4 Populate CFCDB Tables

The CLT requires extensive data to generate a containership synthetic future vessel call database. The tables in the CFCDB should be completed in a specific order. The following subsections provide an overview of the data required in the CFCDB. In general, these steps should be completed in the order in which the information is presented. As the user becomes familiar with the tool and the data requirements, the steps to enter data will become more apparent.

The general order for entering data into the CFCDB is: Seasons, Dock Parameters, Dock Vessel Class, Service, Region-Service, Route Group-Service, Arrival Draft Function, Arrival Draft Function Detail, Service-Vessel Class, Vessel Subclass, Container Fleet Specification, Commodity Forecast at Dock, and CLT Parameter Settings. CFCDB data are entered through data grids accessible through the View Tables/CFCDB menu option, as shown in Figure 36.

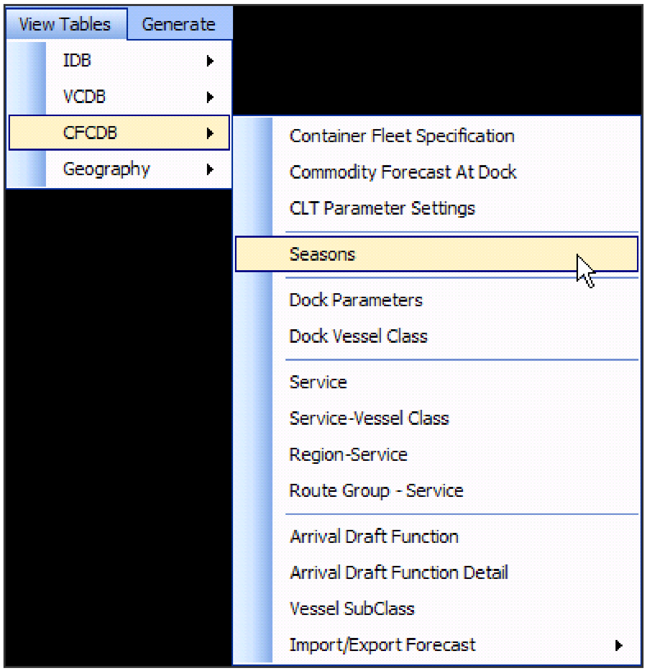
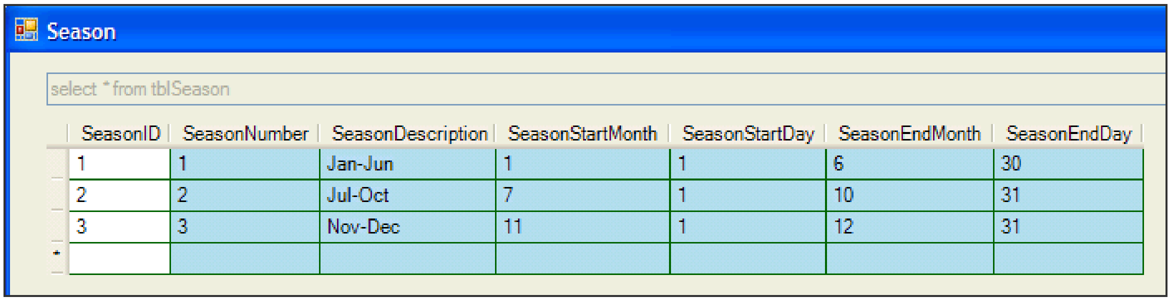


Figure 36 - Access CFCDB Tables for Data Entry through CLT View Tables Menu

Note that all tables in the CFCDB have a field in the first column position that provides a unique identifier for the each record in the table. Any column that is colored white is ready-only. Columns colored blue are editable by the user. All tables accessible through the View Tables menu can be exported to a CSV file by selecting the 'CSV' button in the upper-right hand of the table interface. Changes to the tables are automatically saved as made.

11.4.1 Seasons

The CLT allows the user to divide commodity forecasts and vessel availability into seasons. This allows the synthetic vessel call list to account for potential seasonal demands, such as increased toy shipments from China in preparation for the Christmas buying season. Seasons are user-defined and must cover the entire year. The user can specify as many seasons as necessary to capture unique shipping patterns inherent at the port of study. Each season is specified by a start month and day and an end month and day. For the Test Project, three Seasons were defined, as shown in Figure 37.



Season

select * from tblSeason

SeasonID	SeasonNumber	SeasonDescription	SeasonStartMonth	SeasonStartDay	SeasonEndMonth	SeasonEndDay
1	1	Jan-Jun	1	1	6	30
2	2	Jul-Oct	7	1	10	31
3	3	Nov-Dec	11	1	12	31

Figure 37 - Enter Seasons for Containership Forecast

The Seasons for the Test Project were defined by reviewing the final PCL created prior to copying it into the Lookup Spreadsheet (this copy should have the field 'containerized'). The monthly percentage to total annual imported/exported containerized commodities was calculated. These percentages were reviewed for any months we higher/lower demand than average, or grouping of months. The user should consider how the seasonal fluctuations may change in the future. DDNPCX should be consulted for the appropriate handling of seasonal forecasting in a channel deepening project analysis.

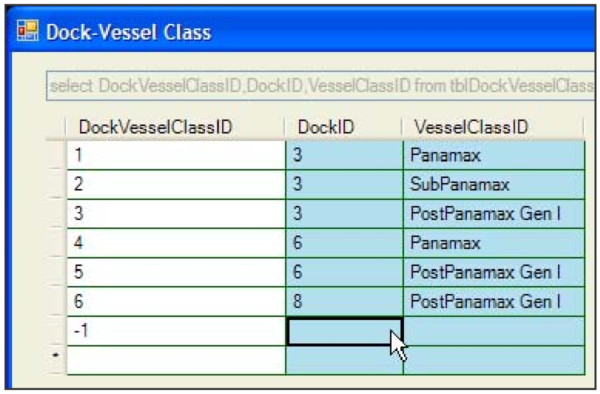
Once Seasons are established, it will be useful to return to the final PCL.xls file and add a column identifying the Season for a movement. This will assist in reviewing historical commodity transfers and fleet specifications by season.

11.4.2 Dock Parameters

Through this data grid, the user can specify the tidal availability for each dock in feet. The CLT will use this data to constrain how deeply drafted the containership can arrive and leave the port of study. Note that there is no duration associated with this value; it is assumed that the additional tidal value can be used by the vessel in reaching the dock. This table can automatically be expanded by selecting Tools/Expand Dock Parameters Table from the menu options. All docks within the IDB will be added to the table with "0" specified as the available tide. This value should be updated with the appropriate tide available. The Tide Tool can be used to determine the tide availability at the port of study's Docks. If stations are not available at the Docks, then secondary stations can be created if needed through the TideTool. It is important to note that the CLT only allows for a single entry of tidal availability for each Dock.

11.4.3 Dock Vessel Class

This table identifies the Vessel Classes that can use a particular Dock, and thus are available to satisfy forecasts at that Dock. Select a Dock ID from the drop down menu and then specify a Vessel Class that can service the dock. For the Test Project, data from the final Lookup Spreadsheet was reviewed to determine which Vessel Classes within the Containership Vessel Type use which Docks, as shown in Figure 38. The user should consider how this might change in the future and capture any dock expansion plans underway at the port of study.



DockVesselClassID	DockID	VesselClassID
1	3	Panamax
2	3	SubPanamax
3	3	PostPanamax Gen I
4	6	Panamax
5	6	PostPanamax Gen I
6	8	PostPanamax Gen I
-1		

Figure 38 - Dock-Vessel Class Constraint in CFCDB

11.4.4 Service

The concept of a Service plays an important role within the CLT. A service is a regular vessel transit between a set of regions. It is NOT defined at the port level. Within the geographic hierarchy in the Geography database, a port lies within a country, and a country falls within a region. Services are user-defined within the CLT, and stored in the CFCDB. Services must be given a name and description. Service information is available from the IWR-developed A-DAPP. Recall that Service was included in the PCL.csv file that was exported from the W-DAPP and was preserved in the final PCL.xls file.

Services for the Test Project were obtained from the final PCL.xls file. The list of possible Services was reviewed and condensed to 15 total Services, as shown in Figure 39. The names and descriptions shown in the example were provided directly from the A-DAPP. The A-DAPP names Services according to the regions visited. Within the A-DAPP, regions are coded with a single letter code, e.g. “c” for the Mediterranean, “m” for US West Coast. Each letter in the Service Name corresponds to a Region found in the Geography database. Maintaining this naming convention simplified data entry in other tables associated with Regions and Services, but is not strictly required for the CLT, where names can be user-defined.

11.4.5 Region-Service

The region-service table identifies the Regions that are visited by a particular Service. The order in how it is entered into the table is not important. This table allows the CLT to identify all of the Services that can be used to satisfy a particular forecast for a given Region. First the user will select a Service ID from a drop down menu and then select a Region ID that corresponds to the Service. All Regions visited within a Service should be specified in the matrix.

Note that the region containing the port of study will only need to be specified for a service if that region has an import/export forecast from the port of study. For example, if the port of study “Example Harbor” is located along the U.S. East Coast, the U.S. East Coast will only need to be specified as a Region visited by the Service if there is an import coming from or export going to a different port also located within the U.S. East Coast region.

For the Test Project, the Regions visited by each Service were easily recognized since, as previously mentioned, the Service ID indicates the Region Code visited. Figure 40 provides a screen capture of some of the Region-Service Matrix created for the Test Project.

Service

select * from tblService

ServiceID	ServiceName	ServiceDescription
1	ck	Mediterranean-U.S. East Coast
2	cqk	Mediterranean-Canada East Coast-U.S. East Coast
3	dsks	North Asia-Panama Canal-U.S. East Coast-Panama Canal
4	ekc	Europe-U.S. East Coast-Mediterranean
5	gt	South Asia-Suez
6	hgtk	Southeast Asia-South Asia-Suez-U.S. East Coast
7	jhgtk	Mid East-Southeast Asia-South Asia-Suez-U.S. East Coast
8	kb	U.S. East Coast-East Coast South America
9	ke	U.S. East Coast-Europe
10	ksfs	U.S. East Coast-Panama Canal-Oceania-Panama Canal
11	ksmnds	U.S. East Coast-Panama Canal-U.S. West Coast-South China-North Asia-Panama Canal
12	ksmns	U.S. East Coast-Panama Canal-U.S. West Coast-South China-Panama Canal
13	ndsks	South China-North Asia-Panama Canal-U.S. East Coast-Panama Canal
14	nsks	South China-Panama Canal-U.S. East Coast-Panama Canal
15	pk	Caribbean / Gulf-U.S. East Coast

Figure 39 - Enter Services into CFCDB

Region - Service

select * from tblRegionService

RegionServiceID	ServiceID	RegionID
1	ck	U.S. East Coast
2	ck	Mediterranean
3	cqk	Mediterranean
4	cqk	Canada East Coast
5	cqk	U.S. East Coast
6	dsks	North Asia
7	dsks	Panama Canal
8	dsks	U.S. East Coast
9	ekc	Europe
10	ekc	U.S. East Coast
11	ekc	Mediterranean
12	gt	South Asia
13	gt	Suez
14	hgtk	Southeast Asia
15	hgtk	South Asia
16	hgtk	Suez
17	hgtk	U.S. East Coast
18	jhgtk	Mid East
19	jhgtk	Southeast Asia
20	jhgtk	South Asia
21	jhgtk	Suez
22	jhgtk	U.S. East Coast
23	kb	U.S. East Coast
24	kb	East Coast South America

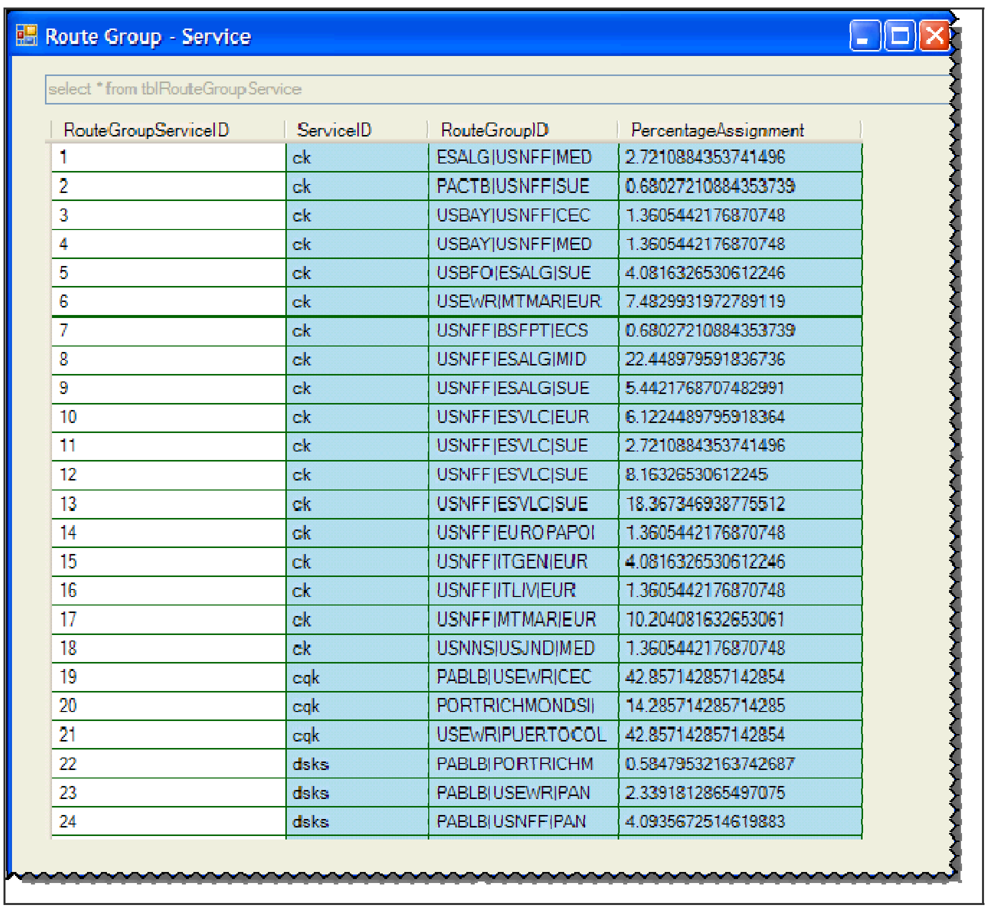
Figure 40 - Region-Service Matrix in CFCDB

11.4.6 Route Group-Service

The Geography hierarchy has Route Groups as a subset of Services. That is, a Service, which is defined at the Region to Region level, can have many Route Groups, which are defined at the abstract port to abstract port level. The Route Group – Service matrix table associates Route Groups with Services, and defines a numerical value indicating how many calls assigned to the Service should be assigned to the specific Route Group.

The final PCL.xls file can be used to inform which Route Groups are associated with which Service, and the historical percentage assignment for these associations. In the Test Project, the exact historical percent assignment was held constant for the future condition. The user should consider how these patterns may change in the future. A screen capture of the Route Group-Service matrix for the Test Project is provided in Figure 41.

When entering the percentages, 25 percent should be entered as "25". The Percentage Assignment field will accept decimal values but note that the percentage assignment of Route Groups should add up to exactly 100 for each Service. This is not currently checked by the user interface Generate/Check function so the user should ensure the summation (this can be done easily by exporting the file to a CSV, opening the file in Excel, and summing by Service). To populate the table, the user first selects the Service from the drop-down menu, then an associated Route Group from the drop down menu, and finally specifies the percentage.



RouteGroupServiceID	ServiceID	RouteGroupID	PercentageAssignment
1	ck	ESALG|USNFF|MED	2.7210884353741496
2	ck	PACTB|USNFF|SUE	0.68027210884353739
3	ck	USBAY|USNFF|CEC	1.3605442176870748
4	ck	USBAY|USNFF|MED	1.3605442176870748
5	ck	USBFO|ESALG|SUE	4.0816326530612246
6	ck	USEWR|MTMAR|EUR	7.4829931972789119
7	ck	USNFF|BSFPT|ECS	0.68027210884353739
8	ck	USNFF|ESALG|MID	22.448979591836736
9	ck	USNFF|ESALG|SUE	5.4421768707482991
10	ck	USNFF|ESVLC|EUR	6.1224489795918364
11	ck	USNFF|ESVLC|SUE	2.7210884353741496
12	ck	USNFF|ESVLC|SUE	8.16326530612245
13	ck	USNFF|ESVLC|SUE	18.367346938775512
14	ck	USNFF|EUROPAPOI	1.3605442176870748
15	ck	USNFF|ITGEN|EUR	4.0816326530612246
16	ck	USNFF|ITLIV|EUR	1.3605442176870748
17	ck	USNFF|MTMAR|EUR	10.204081632653061
18	ck	USNNS|USJND|MED	1.3605442176870748
19	cqk	PABLB|USEWR|CEC	42.857142857142854
20	cqk	PORTRICHMONDSI|	14.285714285714285
21	cqk	USEWR|PUERTOCOL	42.857142857142854
22	dsks	PABLB|PORTRICHM	0.58479532163742687
23	dsks	PABLB|USEWR|PAN	2.3391812865497075
24	dsks	PABLB|USNFF|PAN	4.0935672514619883

Figure 41 - Route Group - Service Matrix in CFCDB

11.4.7 Arrival Draft Function

Within the CLT context, the user may either specify a minimum/maximum arrival draft range for a vessel class on a given service, in which case the generation process selects randomly between the two values to assign arrival draft to a vessel, or the user may specify a cumulative distribution function (CDF) of arrival drafts, in which case the generation process uses the CDF to randomly assign the arrival draft. Only one of these techniques is used, and if a CDF is specified for the vessel class, that takes precedence over the range method.

If the user wishes utilize the range-based approach, to specify the minimum/maximum values for specification of the arrival draft of the synthetic vessel fleet for a particular vessel class, then a NULL function must previsouly have been created in the Arrival Draft Function table, as shown in Figure 42. . Note that the Function Name must be exactly as shown, "NULL". A function description can be provided if desired.

FunctionDescriptionID	FunctionName	FunctionDescription
1	NULL	

Figure 42 - Create NULL Function When Utilizing Min/Max Arrival Draft

Once the "NULL" function name has been created, it can then be specified in data entry for the Service-Vessel Class table (see section below) to trigger the range-based selection.

If the CDF option is desired, the user first specifies the CDF function names through the Arrival Draft Function table. The CDF option was utilized for the Test Project and the CDF function names and descriptions are provided in Figure 43. The user may have a single CDF function for all containerships or wish to specify CDF functions for each containership class, as with the Test Project. CDF Arrival Drafts are readily available from the A-DAPP, as discussed in the following section.

Function Description

SELECT tblFunctionDescription.FunctionDescriptionID, FunctionName, FunctionDesc

FunctionDescriptionID	FunctionName	FunctionDescription
5	SubPanamax	Subpanamax vessel CDF
6	Panamax	Pananmax vessel CDF
7	PostPanamax Gen I	PPGenI vessel CDF

Figure 43 - Create CDF Function Names When Utilizing CDF Functions for Vessels

11.4.8 Arrival Draft Function Detail

Through this data grid, the user specifies the CDF data points (X,Y) for containership vessel arrival drafts. The X value represents the arrival draft and the Y value represents the cumulative probability of vessels arriving at that draft. Data can be entered into this grid in two ways. First, Tools/Expand Function Table can be selected from the menu options. When this is selected, the CLT will automatically provide 20 X,Y data rows for each function description provided in the Arrival Draft Function table. Each X value will automatically be set at "0". Each X,Y pair should be updated by the user. Alternatively, the user can manually select the function description from the drop down menu and input each X,Y pair.

CDF data on containership arrival draft for a given port are available from the A-DAPP. To obtain these data, launch the A-DAPP and check that the appropriate port(s) and timeframe are specified. Under the tree structure Port View/Statistics/Arrival Draft select the appropriate aggregation level. Right-click in the CDF Arrival Draft graphic provided in the Data Pane and select 'Export Dialog…'. These steps are shown in Figure 44Figure 43. A window will appear allowing the user to save the CDF data points as text/data. Specify a directory and name (such as CDF_Subpanamax.dat) for the file and click 'Export…', as shown in Figure 45, Image 1. A second dialog window will appear allowing the user to specify if all or some of the data points are to be exported, whether to include labels, the export style, delimited type, and numeric precision, shown in Figure 45, Image 2. Specify the desired formats and select Export. This will create a ".dat" file in the directory that can be opened in Excel.

To open a .dat file in Excel, first launch Excel. Select File/Open from the Excel menu. Navigate to the directory where the file was saved. In the Excel Open dialog box, locate the drop down menu for "Files of type:" and select "All Files (*.*)". The .dat file should now be viewable in the directory. Select the file and click Open. Standard dialog prompts will appear assisting the user in opening the file.

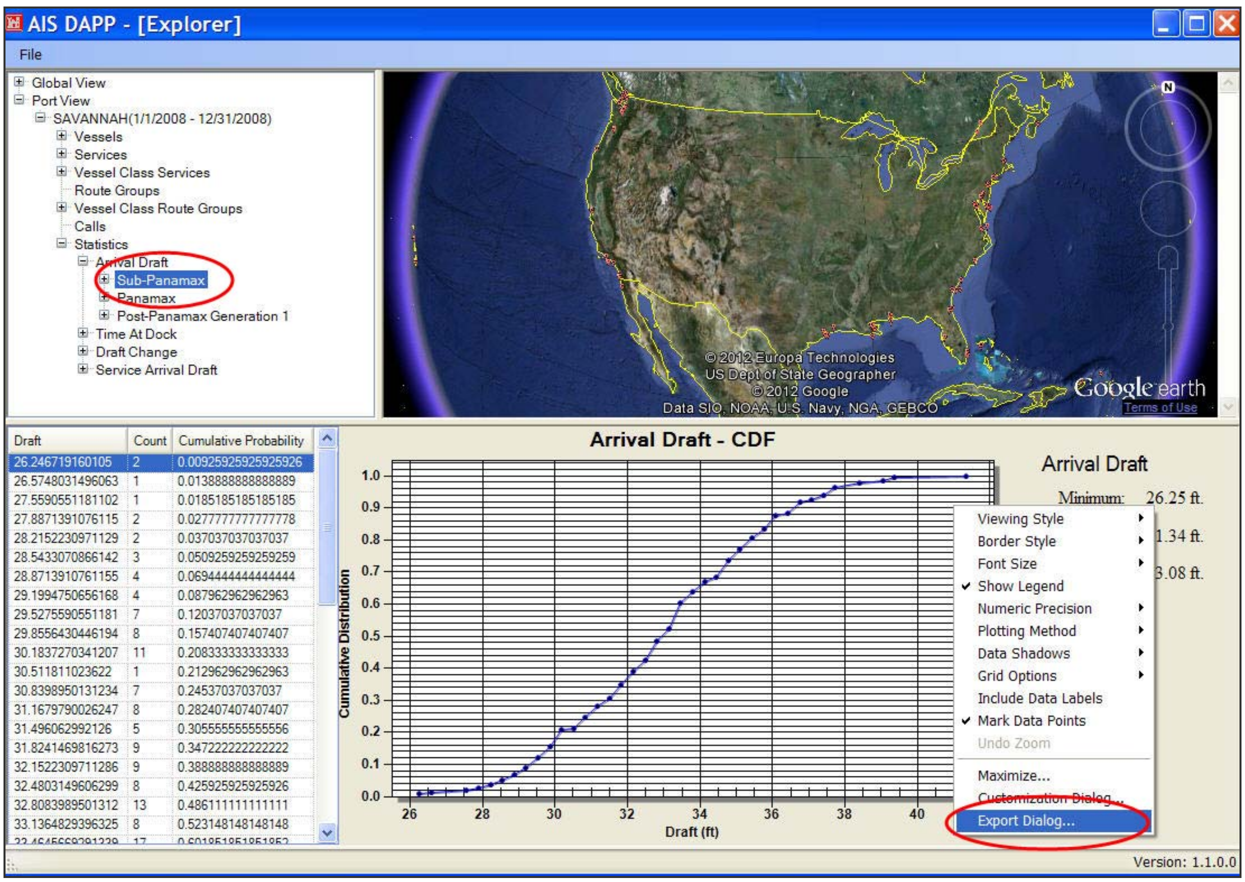


Figure 44 - Export CDF Functions from A-DAPP

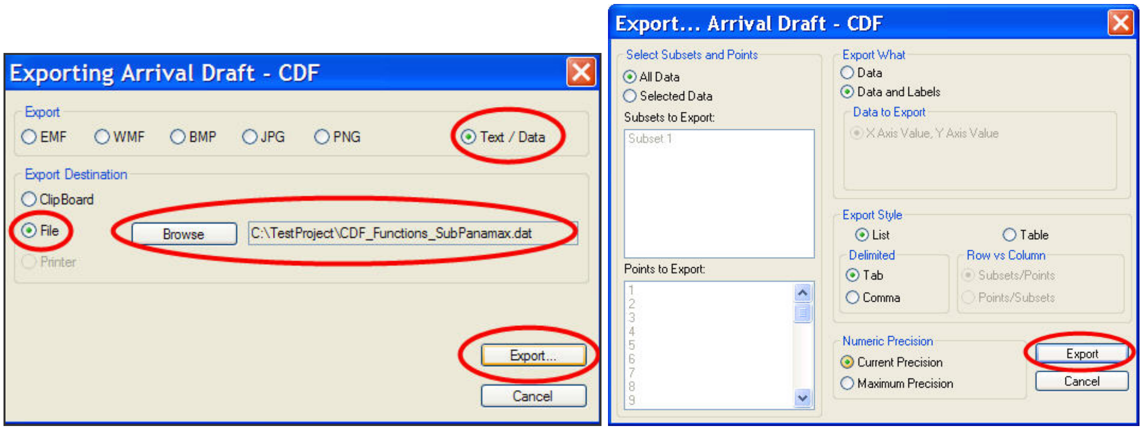
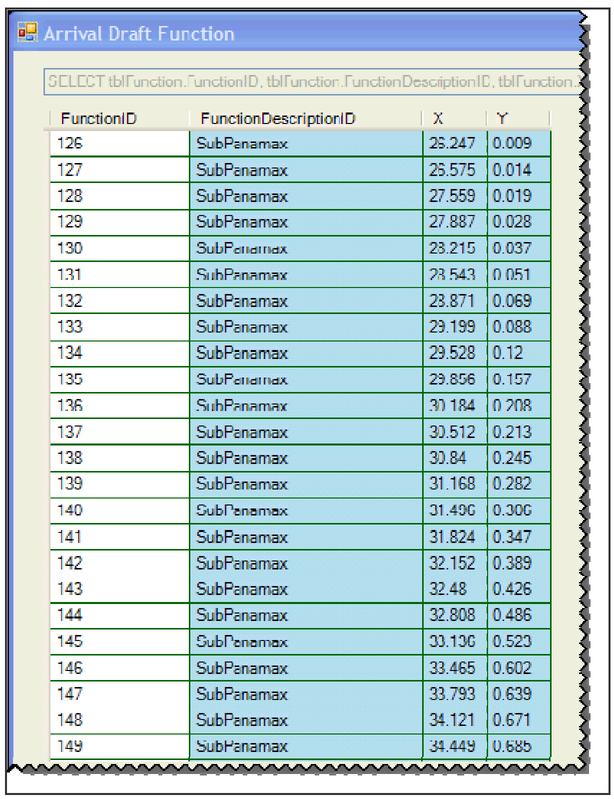


Figure 45 – A-DAPP CDF Data Export Dialog

For the Test Project this was done for the Subpanamax, Panamax, and Post-Panamax Generation 1 containership Vessel Types. The resulting CDF data points were reviewed, finalized, and entered into the Arrival Draft Function grid in the CFCDB, as shown in Figure 46.


Arrival Draft Function

SELECT tblFunction.FunctionID, tblFunction.FunctionDescriptionID, tblFunction.

FunctionID	FunctionDescriptionID	X	Y
126	SubPanamax	26.247	0.009
127	SubPanamax	26.575	0.014
128	SubPanamax	27.559	0.019
129	SubPanamax	27.887	0.028
130	SubPanamax	28.215	0.037
131	SubPanamax	28.543	0.051
132	SubPanamax	28.871	0.069
133	SubPanamax	29.199	0.088
134	SubPanamax	29.528	0.12
135	SubPanamax	29.856	0.157
136	SubPanamax	30.184	0.208
137	SubPanamax	30.512	0.213
138	SubPanamax	30.84	0.245
139	SubPanamax	31.168	0.282
140	SubPanamax	31.496	0.306
141	SubPanamax	31.824	0.347
142	SubPanamax	32.152	0.389
143	SubPanamax	32.48	0.426
144	SubPanamax	32.808	0.486
145	SubPanamax	33.136	0.523
146	SubPanamax	33.465	0.602
147	SubPanamax	33.793	0.639
148	SubPanamax	34.121	0.671
149	SubPanamax	34.449	0.685

Figure 46 - Arrival Draft Function Detail in CFCDB

Note that the CDF functions should be expanded in the Deepened project analysis to reflect the vessels drafting according to the deepened channel depth. No CDF function details need be provided if the user desires to use the minimum/maximum arrival draft.

11.4.9 Service-Vessel Class

The concept that different services and vessel classes have different container loading characteristics is basic to the CLT, in particular the loading factor analysis (LFA) and determination of vessel arrival drafts. This information is captured in the Service-Vessel Class table. Three basic types of information are stored: 1) information for use in determination of arrival draft; 2) information for use in the loading analysis; and 3) information for use in determining the fraction of the vessel load on arrival that is imported/exported to the subject port. The data grid can be initially expanded to provide a row for each Service ID and Vessel Class ID by selecting Tools/Expand Service Vessel Class Table from the main menu. Otherwise, the user may manually populate the data grid by selecting a Service ID and associated Vessel Class ID from the drop down menus provided in the cells of these fields.

A great deal of data must be entered into the Service - Vessel Class table. Each data field requirement for Vessel Class by Service is described in Table 2 as well as the source for the data, if known. Analyst should contact the DDNPCX or IWR for data regarding Empty TEU Allotment, Vacant Slot Allotment, Allowance for Ops, and Variable Ballast.

Table 2 - CLT CFCDB Service-Vessel Class Table Field Descriptions

FIELD	DESCRIPTION
AverageLadingWeightPerLoadedTEU	Average commodity weight per loaded TEU in metric tons; data available from W-DAPP
AverageContainerWeightPerTEU	Average container weight per TEU in metric tons
EmptyTEUAllotment	Number of empty TEUs allotted
VacantSlotAllotment	Number of vacant slots allotted
AllowanceForOperations	Allowance for operations, typically varies by vessel size
VariableBallast	Variable ballast in tons, ballast is the substance placed in the hold of a ship to enhance stability
MinimumArrivalDraft	If the CDF function is utilized, then minimum arrival draft values should be set at 0 and not left blank
MaximumArrivalDraft	If the CDF function is utilized, then maximum arrival draft values should be set at 0 and not left blank
FunctionDescriptionID	Select the CDF function from the drop down list for the Service/Vessel Class combination; if the minimum/maximum arrival draft values are utilized, then the CDF function "NULL" should be selected
ImportFractionDistributionParameterP1	Fraction of total imported tons to ship capacity, minimum value (example: enter 25% as 0.25), can be generated from PCL.xls
ImportFractionDistributionParameterP2	Fraction of total imported tons to ship capacity, most likely value (example: enter 25% as 0.25), can be generated from PCL.xls
ImportFractionDistributionParameterP3	Fraction of total imported tons to ship capacity, maximum value (example: enter 25% as 0.25), can be generated from PCL.xls
ExportFractionDistributionParameterP1	Fraction of total exported tons to ship capacity, minimum value (example: enter 25% as 0.25), can be generated from PCL.xls
ExportFractionDistributionParameterP2	Fraction of total exported tons to ship capacity, most likely value (example: enter 25% as 0.25), can be generated from PCL.xls
ExportFractionDistributionParameterP3	Fraction of total exported tons to ship capacity, maximum value (example: enter 25% as 0.25), can be generated from PCL.xls

11.4.10 Vessel Subclass

Within the CLT process, a vessel call is created based on a Vessel Class. Specific vessel characteristics are determined by choosing a vessel from pre-defined vessels in the vessel Subclass table. This is in distinction to the BLT, where vessel characteristics (capacity, beam, length, etc.) are derived from user input statistics. This is in distinction to the BLT, where vessel characteristics (capacity, beam, length, etc.) are derived from user input statistics. The Subclass table provides standard vessel data for sets of vessels within a given Vessel Class. This information has been defined by IWR for container ships, with 45 distinct Subclasses for 4 Vessel Classes (SubPanamax, Panamax, PostPanamax Gen1, and PostPanamax Gen2), and should not be changed by the user. The proportional assignment of vessel Subclasses to a Class is a user-entered parameter. Subclass information can be viewed by opening the Vessel Subclass table from the View Tables/CFCDB menu option. The only thing that should be changed by the user is the percentage of Subclass assignment to the Vessel Class (enter 25% as 25). The total percentage within a Class should sum to 100.

Vessel Subclass percentages for historical years can be accessed through the A-DAPP as shown in Figure 47, although the user will be required to process the data into percentages. The user should consider how these percentages might change under future conditions.

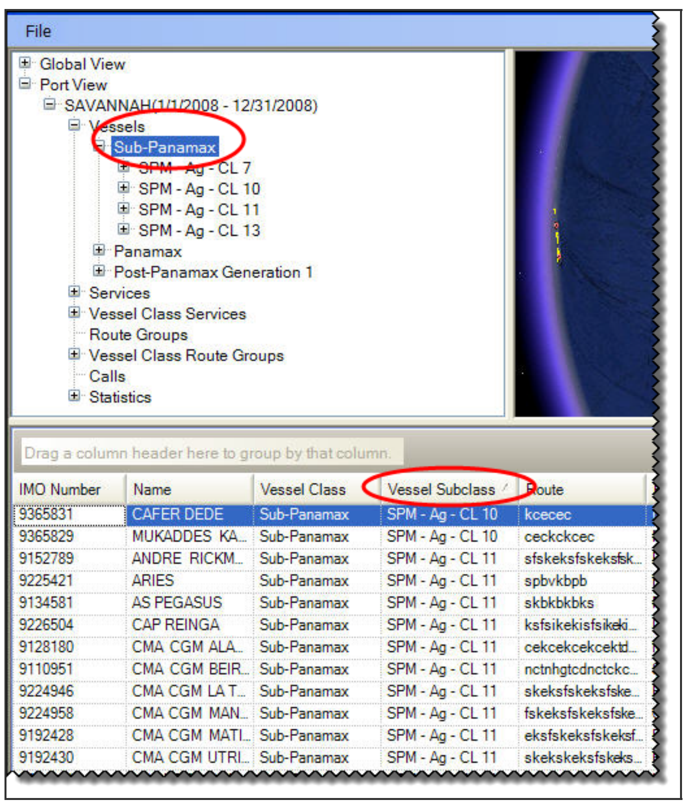
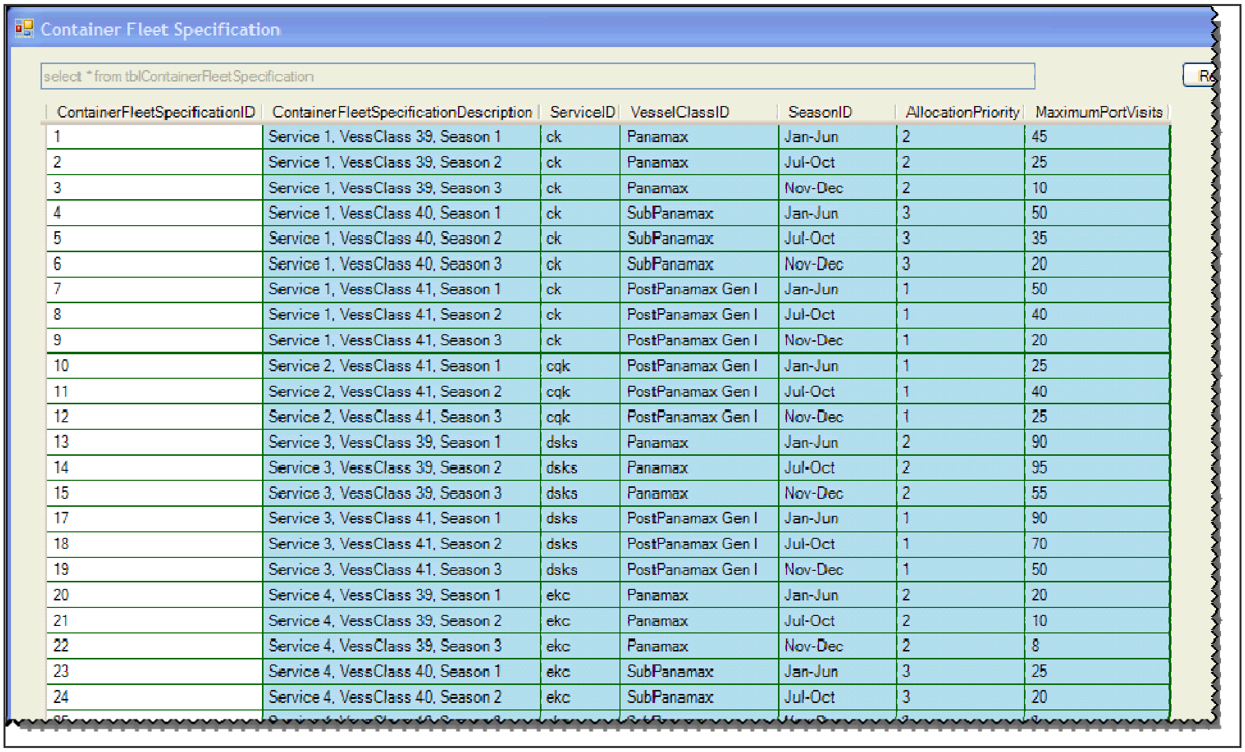


Figure 47 - Gather Containership Vessel Subclass by Vessel Class from A-DAPP

11.4.11 Container Fleet Specification

A fleet specification is defined as a maximum number of port visits within a given season of a given Vessel Class operating on a particular Service. A specification essentially says: "During the first Season of the year, there are 45 available calls of Panamax vessels operating on the East Coast US – Mediterranean Pendulum service". An allocation priority is assigned to individual fleet specifications, and the CLT observes these priorities, attempting to fill a forecast by using vessels from the fleet with the highest allocation priority before using vessels of a lower priority. Note that the highest allocation priority is 1, the larger the number, the lower the priority.

The Container Fleet Specification is developed outside of the CLT. In general, the PCL.xls file can be used as a starting point for analyzing historical fleets calling the port of study. Analyst should contact the DDNPCX or IWR for the proper procedures to develop the future fleet specifications. A sample Fleet Specification from the Test Project is provided in Figure 48. Note, however, that the sample is provided for reference in entering data only and in no way represents a true fleet forecast.



Container Fleet Specification

select * from tblContainerFleetSpecification

ContainerFleetSpecificationID	ContainerFleetSpecificationDescription	ServiceID	VesselClassID	SeasonID	AllocationPriority	MaximumPortVisits
1	Service 1, VessClass 39, Season 1	ck	Panamax	Jan-Jun	2	45
2	Service 1, VessClass 39, Season 2	ck	Panamax	Jul-Oct	2	25
3	Service 1, VessClass 39, Season 3	ck	Panamax	Nov-Dec	2	10
4	Service 1, VessClass 40, Season 1	ck	SubPanamax	Jan-Jun	3	50
5	Service 1, VessClass 40, Season 2	ck	SubPanamax	Jul-Oct	3	35
6	Service 1, VessClass 40, Season 3	ck	SubPanamax	Nov-Dec	3	20
7	Service 1, VessClass 41, Season 1	ck	PostPanamax Gen I	Jan-Jun	1	50
8	Service 1, VessClass 41, Season 2	ck	PostPanamax Gen I	Jul-Oct	1	40
9	Service 1, VessClass 41, Season 3	ck	PostPanamax Gen I	Nov-Dec	1	20
10	Service 2, VessClass 41, Season 1	cqk	PostPanamax Gen I	Jan-Jun	1	25
11	Service 2, VessClass 41, Season 2	cqk	PostPanamax Gen I	Jul-Oct	1	40
12	Service 2, VessClass 41, Season 3	cqk	PostPanamax Gen I	Nov-Dec	1	25
13	Service 3, VessClass 39, Season 1	dsks	Panamax	Jan-Jun	2	90
14	Service 3, VessClass 39, Season 2	dsks	Panamax	Jul-Oct	2	95
15	Service 3, VessClass 39, Season 3	dsks	Panamax	Nov-Dec	2	55
17	Service 3, VessClass 41, Season 1	dsks	PostPanamax Gen I	Jan-Jun	1	90
18	Service 3, VessClass 41, Season 2	dsks	PostPanamax Gen I	Jul-Oct	1	70
19	Service 3, VessClass 41, Season 3	dsks	PostPanamax Gen I	Nov-Dec	1	50
20	Service 4, VessClass 39, Season 1	ekc	Panamax	Jan-Jun	2	20
21	Service 4, VessClass 39, Season 2	ekc	Panamax	Jul-Oct	2	10
22	Service 4, VessClass 39, Season 3	ekc	Panamax	Nov-Dec	2	8
23	Service 4, VessClass 40, Season 1	ekc	SubPanamax	Jan-Jun	3	25
24	Service 4, VessClass 40, Season 2	ekc	SubPanamax	Jul-Oct	3	20

Figure 48 - Sample Container Fleet Specification

11.4.12 Commodity Forecast at Dock

This data grid stores the commodity forecast for containerized movements for the given planning horizon. Forecasts are defined at the Commodity, Dock, Season, and Region level, as import and export quantities in the unit specified for the commodity A forecast name should be provided (e.g. "FC1") for use in referencing output to a particular forecast. In addition to the expected import and export quantity, standard deviations (also in metric tons) should be provided for each forecast unit combination. Standard deviations for the import/export forecast are used by the CLT to select an import/export quantity during the Monte Carlo simulation.

Like the Fleet forecast, the Commodity forecast is developed external to HSD or the CLT. The PCL.xls export can be used as a starting point for analyzing historical commodity shipments. Analysts should contact the DDNPCX or IWR for the commodity forecast details. A sample Commodity forecast table from the Test Project is provided in Figure 49. Note, however, that the sample is provided for reference in entering data only and in no way represents a true commodity forecast.

Commodit...	CommodityForecastDescription	CommodityCategoryID	DockID	SeasonID	RegionID	ImportQuantity	ExportQuantity	ImportQuantitySD	ExportQuantitySD
141	1	General Cargo	3	Jan-Jun	Caribbean / Gulf	104000.78493669906	188797.46774602667	520.00392468349526	943.98733873013339
142	2	General Cargo	3	Jul-Oct	Caribbean / Gulf	124739.85497880559	137815.33718045286	623.699274804478	689.07668590226433
143	3	General Cargo	3	Nov-Dec	Caribbean / Gulf	39749.974095283105	55555.118550688916	198.74987047641554	277.77559275344458
144	4	Chemical Products	3	Jan-Jun	Caribbean / Gulf	7361.261668310789	10021.190956605322	36.806308341553944	50.105954783026611
145	5	Chemical Products	3	Jul-Oct	Caribbean / Gulf	6953.1031565922858	18946.082113957251	34.76551578296143	94.730410569786258
146	6	Chemical Products	3	Nov-Dec	Caribbean / Gulf	2315.6978894738027	4904.244590285407	11.578489447369014	24.521222951427035
147	7	Machinery/Electrical	3	Jan-Jun	Caribbean / Gulf	8490.0150686470461	6708.5055366516635	42.450075343235234	33.542527683258321
148	8	Machinery/Electrical	3	Jul-Oct	Caribbean / Gulf	6978.1468396904756	7675.0648676956325	34.890734198452378	38.375324338478165
149	9	Machinery/Electrical	3	Nov-Dec	Caribbean / Gulf	2847.7361247760869	2007.9746291774989	14.238680623880434	10.039873145887494
150	10	Mineral Products	3	Jan-Jun	Caribbean / Gulf	6175.7264464696545	16600.720529528618	30.878632232348274	83.003602647643092
151	11	Mineral Products	3	Jul-Oct	Caribbean / Gulf	9189.5766241951442	13007.112697756063	45.947883120975725	65.035563488780312
152	12	Mineral Products	3	Nov-Dec	Caribbean / Gulf	3750.2528332904949	7757.3962248240987	18.751264166452476	38.786981124120494
153	13	General Cargo	3	Jan-Jun	Canada East Coast	124454.39620012579	381706.51216235064	622.271981000629	1908.5325608117532
154	14	General Cargo	3	Jul-Oct	Canada East Coast	60439.68903762351	234884.34803811758	302.19844518811755	1174.4217401905878
155	15	General Cargo	3	Nov-Dec	Canada East Coast	58425.738154188592	113466.45833379644	292.12869077094297	567.33229166898218
156	16	Chemical Products	3	Jan-Jun	Canada East Coast	4837.6372307268311	20854.908030025188	24.188186153634156	104.27454015012594
157	17	Chemical Products	3	Jul-Oct	Canada East Coast	2286.6185886151293	12980.333756277794	11.433092943075646	64.901668781388977
158	18	Chemical Products	3	Nov-Dec	Canada East Coast	3347.4515786323591	7018.2466058282089	16.737257893161797	35.091233029141044
159	19	Machinery/Electrical	3	Jan-Jun	Canada East Coast	7229.9743917024571	15796.663334952236	36.149871958512286	78.983316674761184
160	20	Machinery/Electrical	3	Jul-Oct	Canada East Coast	3061.763274258054	18688.250550524172	15.30881637129027	93.441252752620855
161	21	Machinery/Electrical	3	Nov-Dec	Canada East Coast	2881.7594370296906	9407.4487009678833	14.408797185148453	47.037243504839417
162	22	Mineral Products	3	Jan-Jun	Canada East Coast	8149.6999193358524	26331.71631457466	40.74849959667926	131.65858157287329
163	23	Mineral Products	3	Jul-Oct	Canada East Coast	3056.9663882777459	18605.640999401054	15.284831941388729	93.028204997005275
164	24	Mineral Products	3	Nov-Dec	Canada East Coast	729.77180523694017	12177.933402982319	3.6488590261847009	60.889667014911595

Figure 49 - Commodity Forecast by Dock and Region in CFCDB

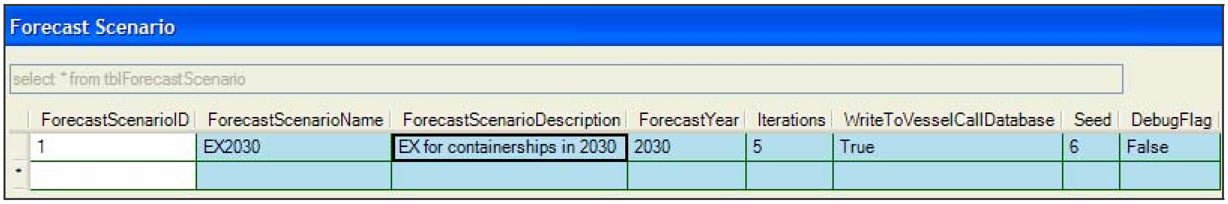
11.4.13 CLT Parameter Settings

This table is designed to store, in a tag-value format, information for the simulation. The tag-value format is easily extended as new port-wide values are incorporated in the CLT algorithms. At present, the only value in this table is for a port-wide sea level change value. Sea level change is applied uniformly to all docks within the port. If the user wishes to utilize the sea level parameter in the CLT, please take care that the Route Group prior and next port limiting depth reflects an appropriate sea level change as well.

11.5 Specify and Set Scenario

Once all data have been entered into the CFCDB, the user should specify the scenario parameters through the Scenario Form, accessed through the Generate/Scenario Form menu option or the Quick Access Bar. The Scenario Form, shown in Figure 49, allows the user to specify a name, the forecast year, the number of iterations desired, and a seed number. The user should set the “WriteToVesselCallDatabase” field to True if a VCDB generation is desired. The user may want to test data assumptions prior to generating a VCDB. The “DebugFlag” field is for CLT developer use and should be set to False under normal circumstances. **Note that the number of iterations must be compatible with the number of iterations ran in the BLT and the number desired in the HSD study.**

Once the desired scenario is specified, the user should set the scenario for generation through the menu option Generate/Set Scenario/Set Forecast Scenario. Be certain to click Save after selecting the desired scenario.


Forecast Scenario

select * from tblForecastScenario

ForecastScenarioID	ForecastScenarioName	ForecastScenarioDescription	ForecastYear	Iterations	WriteToVesselCallDatabase	Seed	DebugFlag
1	EX2030	EX for containerships in 2030	2030	5	True	6	False

Figure 50 - Set CLT Scenario Form

11.6 Check Data

A small number of data checks have been implemented through the CLT user interface. This option is available from the menu option Generate/Check. Any issues identified through the data check should be resolved prior to generating a VCDB.

11.7 Generate VCDB

Once all data have been entered into the CFCDB, the scenario parameters have been defined, and the data check returns no errors, the user can generate a containership vessel call forecast and a VCDB. Selecting the Generate button from the user interface will begin the process. During each season, the satisfaction of each forecast and the fleet utilization is shown graphically. Each individual graph can be manipulated (zoom/pan) and the image saved, by right-clicking on the graph to get a context menu. Feedback is provided regarding what iteration and what stage within the iteration the CLT is currently processing. The graphic display may be turned off through the Option/Set Options menu.

Generation of a complete and balanced VCDB for containerships may require multiple generations and data adjustments. Results should be reviewed to test forecast assumptions and adjustments made as needed. Note that the CLT will not process a VCDB if any data errors are present in the CFCDB. If the generator does not process, return to the CFCDB tables and review all data.

11.8 View Results

Once the CLT has finished processing the loading simulation, a number of output files are available:

- PRN File: This file is lightly populated. It will eventually contain summary information for the scenario run on fleet specification usage and forecast satisfaction.
- ECH file (echo): This file is intended to provide a record of input data read from the database. It is only partially populated at this time.
- DBG file (debug): The debug file provides information for analyzing the container loading process. It is intended primarily for developers, not end users.
- Generated VCDB: The fundamental goal of the CLT is to generate a VCDB that reflects the specified fleet availability, forecasts, and depth constraints. The generated VCDB can be run through a HarborSym simulation to estimate congestion effects and cost allocation to the subject port.
- Output Tables in the CFCDB: The CLT writes three tables into the CFCDB. Each of these tables can be viewed from the interim UI, in the standard data grid format:

- Allocation results giving the export and import deficits by forecast, together with the number of unique vessels used to satisfy each forecast.
- Fleet specification results, showing the maximum provided port visits, and the visits used by the allocation process.
- Commodity transfer results, providing import/export information for each forecast specified by each vessel. Note the shaded rows where a single vessel is satisfying two different forecasts.

11.9 Generate VCDB that Reflects Deepened Project

The CLT loads vessels according to the depth constraints of the docks. Under the with-project condition, the water depth available for containerized vessels is increased. The CLT should thus be used to generate both an Existing Condition and Deepened project VCDB. The previous steps were geared towards generating the Existing Condition VCDB, with a few notes regarding data considerations for the Deepened project. The user must now generate a VCDB that reflects the Deepened condition. The following provides notes for generating a VCDB with the CLT for the Deepened project.

- Set Working Files:
  - The IDB should be changed to the Deepened project IDB (the Deepened2030.IDB for the Test Project).
  - A new blank VCDB should be created from template, be careful not to override the VCDB generated for the Existing Condition.
  - It will be useful to copy the Existing Condition CFCDB populated in the previous steps, thus greatly reducing the amount of duplicate data entry required. Select File/CFCDB/Copy Existing from the main menu. Select the CFCDB created and populated in the previous steps. Provide a name indicating the Deepened project.
- Arrival draft should be expanded to reflect the deepened channel. Depending on which option was used in the Existing Condition, either the Min/Max arrival draft should be adjusted or the CDF functions should be expanded.
- Review the attributes of the Service-Vessel Class table.
- Available vessel fleet and the commodity forecast should not change.
- Create a new scenario named Deep 2030. Remaining parameters of the scenario should be the same as with the Existing Condition scenario.
- The data check should be executed to ensure no errors were introduced.

Once all data have been adjusted in the CFCDB, the scenario parameters have been defined, and the data check returns no errors, the user can generate a containership vessel call forecast and a VCDB for the Deepened project. Selecting the Generate button from the user interface will begin the process. Results should be reviewed to test forecast assumptions and adjustments made as needed. Comparing results to the Existing Condition VCDB will highlight the sensitivities of the data assumptions for both conditions.

12.0 Combine VCDBs

Given the nature of the HarborSym database structure, the BLT and CLT-generated VCDBs must be combined into a single VCDB for cases where both types of traffic are to be modeled. The Combiner module was developed to address this need.

The Combiner is quite simple to use. The user specifies the IDB that corresponds to the VCDBs that are to be combined. This should be the HarborSym IDB for the given year and with or without project status. The user then specifies the BLT-generated VCDB and CLT-generated VCDB under either VCDB 1 or VCDB 2, shown in Figure 51. When the user selects the Output VCDB, a dialog box will appear allowing the user to specify a directory and name for the combined VCDB. Once all databases are set, the user can perform a data check using the main menu option. Any noted discrepancies should be resolved prior to combining the VCDBs. The user merges the VCDBs into a single database by selecting the menu option Combine.

The user must be certain the two VCDBs selected have an equal number of iterations. Once the generation is complete, the combined VCDB should be linked to the proper HSD project through the File/Study Manager menu option.

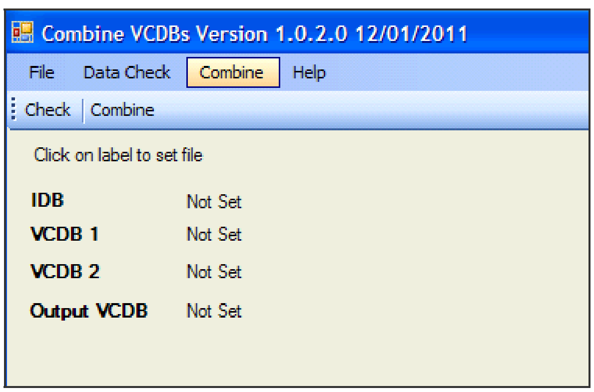


Figure 51 - Combine VCDBs User Interface

For the Test Project, the VCDB generated with the BLT was combined first with the CLT-generated "ContainerExistingCond2030.VCDB" to generate an "ExistingCond2030.VCDB" that reflects both bulk and containerized movements. Then, the VCDB generated with the BLT was combined with the CLT-generated "ContainerDeepened2030.VCDB" to generate a "Deepened2030.VCDB" that reflect both bulk and containerized movements under the deepened channel condition.

13.0 Link VCDBs to HSD Projects and Create Scenarios

Once the VCDBs reflecting future bulk and containerized traffic are generated and combined into a single VCDB, these databases should be linked to the corresponding 2030 projects created in Section 9.0 Clone Existing Condition HSD Project. The user may now proceed by specifying simulation settings and launch scenarios in HSD.