BTS Intermodal Facility Freight Transfer Database

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Abstract

The Bureau of Transportation Statistics (BTS), Department of Transportation contracted INDUS to develop an Intermodal Freight Facilities database. The provided relational Geodatabase responded to the user needs, is spatially accurate, and can be periodically updated and enhanced. This effort was initiated with an exhaustive research on Intermodal data to determine the structure of the data model. Data processing included the developing of a data processing tool to validate the data according to the business rules. Geodatabase presents multiple commodity associations and directionality types for each facility and up to four transportation modes per record.

Background

In 1998 Oakridge National Laboratory (ORNL) delivered an Intermodal terminals database to BTS. This database was a good benchmark and state-of-the-art at that time, but almost exclusively represented rail and port terminals with little consideration for truck and air facilities.

In August 2001 BTS contracted INDUS Corp. to develop an Intermodal freight facility database. The scope of the project was to: (1) expand the universe of terminals; (2) refine the geocoding to improve the accuracy of terminal locations; (3) establish a unique identifier for each facility; (4) continuously examine possible additional attributes for their potential utility to modal agencies and other organizations; and (5) examine and document methods to periodically update the database in a timely and automated manner. In July 2002, INDUS delivered a beta version of the Intermodal Freight Transfer Facilities Database to BTS. A second version of the database with expanded sources will be delivered in July 2003 with the NTAD 2003[1] data release.

Requirements for creating an Intermodal freight facility database were based on the scope of the project and the information gathered in meetings with experts and data users of the Intermodal freight transportation industry. This information was considered in the database design and selected data sources.

This is on-going project and is focused in the research and gathering of existing Intermodal freight facility data. Numerous potential data sources were researched and contacted including personal meetings, electronic and hardcopy publications and what

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[1] The National Transportation Atlas Databases (NTAD) is a set of transportation-related geospatial data for the United States released annually by BTS

were publicly available on the Internet. For the beta version of the Intermodal Freight Transfer Facilities database delivered in July 2002, data from 22 data sources were collected and processed to prepare the final product. Five data sources were added to the version to be delivered in July 2003.

Specific criteria were followed to identify, collect, and process the data. Data processing included data preparation, validation, and data entering. A data processing tool was developed in Microsoft Access to provide a common user interface for a person processing the data and facilitated the following tasks: data entry/input, update, storage, data validation, and processing of data. Input was manual due to the characteristics of the data sources, and some field values were selected via drop down lists. Creating a record for a facility automatically created a customer record, which inherited values from the facility record.

All commodity, shipment type (cargo) and available directionality information was added to the appropriate attributes using the processing tool. Additional available information provided by the source such as capacity was added to the Notes field for future reference. Tables with codes used for Commodities and Cargo Types are included in the Appendixes section. En example of an application using the commodity information is included in Figure 1. There it is represented the commodity occurrence for all the modes for the facilities located in the state of California.
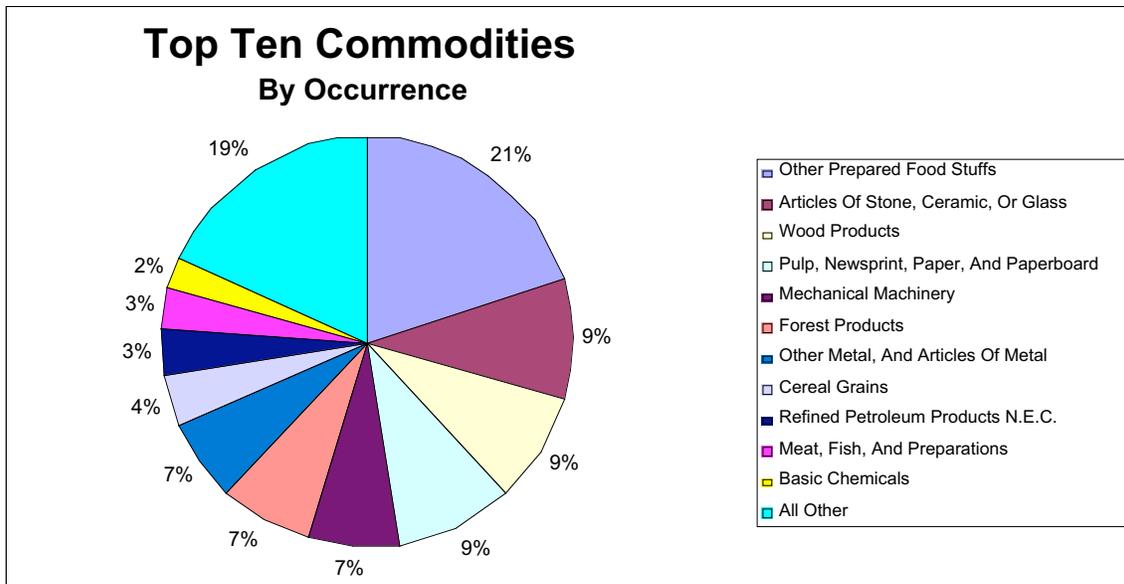

Fig. 1. Top Ten Commodities for the State of California by Occurrence. This the based on a commodity count by facility for all supported transportation modes. The information is based on the commodity information of the 2003 Intermodal Freight Facility Geodatabase.

The last phase of data preparation included the creation of working tables, data validation and conversion, geocoding, and implementation of spatial quality control checks. The processing tool was used to produce six working tables: customer, facility, contact, directionality, cargo, and commodity. Data validation was also performed in the last phase of the data preparation. During the last phase, data quality control, and spatial quality control measures were implemented to ensure data quality.

Data was geocoded to find a match for an address and assign geometry (i.e., latitude and longitude coordinates) to the database. GDT Dynamap 2000 streets data was the source data for the Geocoding and had a high spatial accuracy (within 12 to 40 meters). Several rounds of geocoding were implemented in the data preparation process to increase records successfully geocoded.

Metadata for the Intermodal Freight Transfer Facilities Database was prepared according to the guidelines of the Federal Geographic Data Committee. The data details are provided for the source information as well as methodology, process, and data dictionaries. The metadata also includes information on key attribute relationships to join to primary data tables.

Two versions of the Intermodal Freight Transfer Facilities Database were produced, one public and one for internal use. The public version is more generalized and does not include proprietary or copyrighted information. Both versions of the Intermodal Freight Transfer Facilities Database include facilities, commodities, directionality, and cargo. Customers and Contacts are only provided in the internal version of the Intermodal. The data model for the public database is depicted in Figure 2. Please refer to Appendixes or more details on Database Structures and descriptions of data fields.
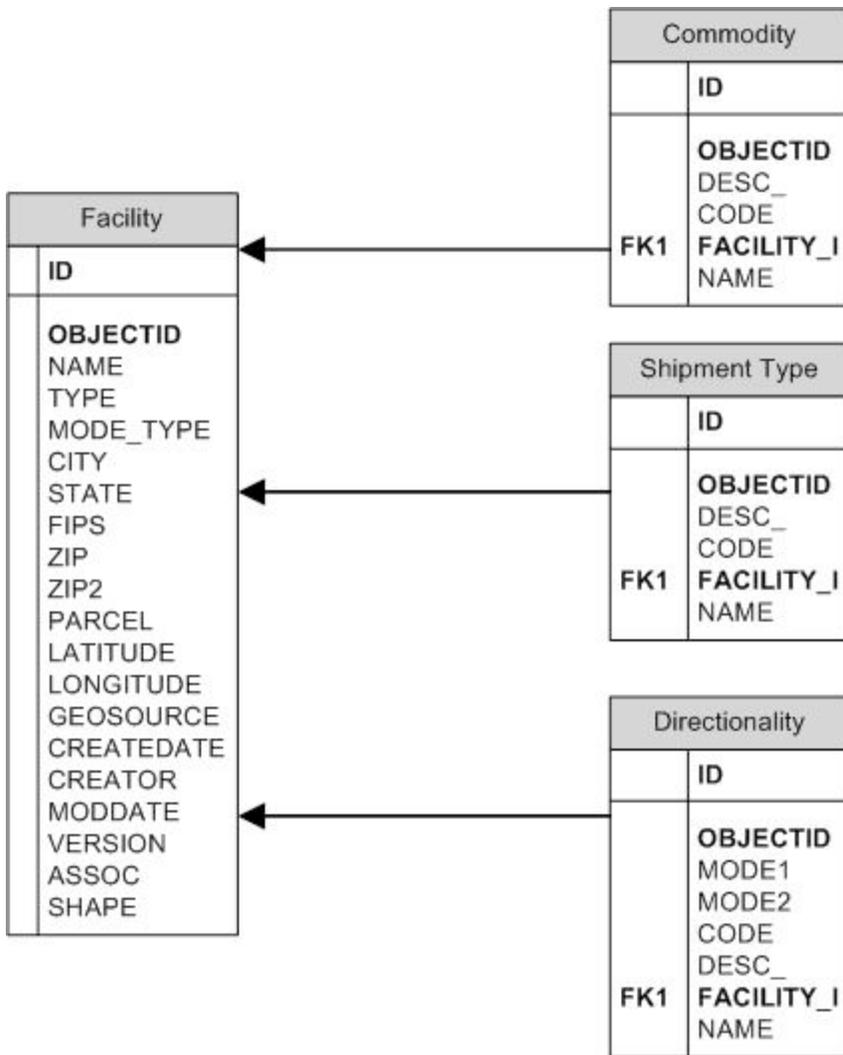
Fig. 2. Data Model Public Intermodal Freight Facility Database

The Intermodal Freight Facility geodatabase to be release in July 2003 will contain 3280 facilities and will consist of a Shapefile with facility location; attribute files in DBF format with commodity, cargo and directionality, and an FGDC compliant metadata file. This database will be available from the GIS section of the BTS web site at:

http://www.bts.gov/gis/

or

http://www.gis.bts.gov

Based on the mode supported by the facilities the mode representation (%) of the geodatabase will be as follow:

Air	14%
Port	9%
Rail	77%

A display of the Intermodal freight facilities supporting rail and port modes are displayed in figures 3 and 4 respectively.
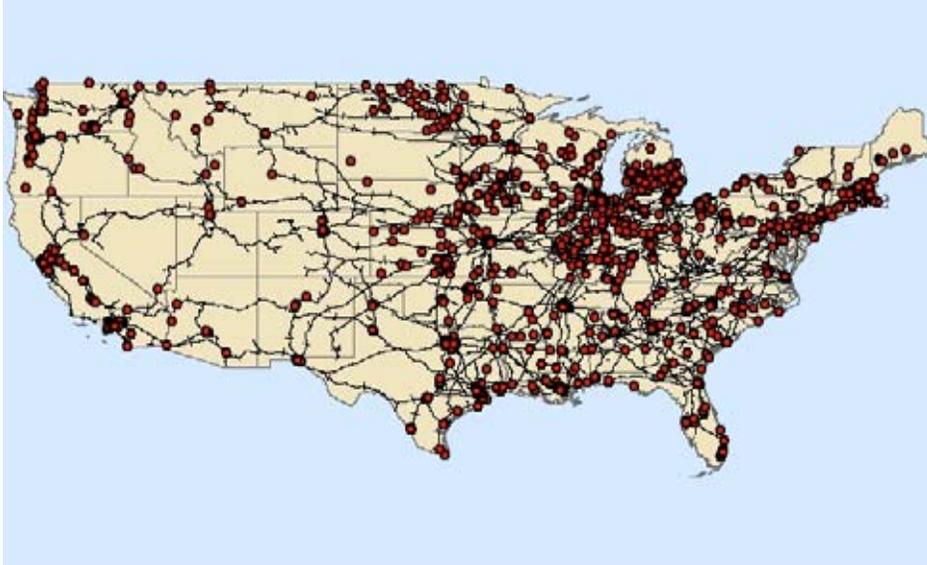
Fig. 3. Facilities Supporting Rail Mode

Fig. 4. Facilities Supporting Ports

The database structure of the July 2003 version of the Intermodal Freight Transfer Facilities Databases incorporated a number of improvements over the 1998 existing Terminals database. The most notable change was the movement to a relational design allowing for large and diverse attribute tables. Table 1 summarizes a comparison of these two databases.

Table 1 Intermodal Freight Facility Database Comparison

Intermodal Freight Transfer Facilities Database 2003	1998 Existing Database
Relational Geodatabase	Flat File
Differentiation of Customers and Facilities	Customers and Facilities are treated the same
Representative of several transportation modes: Rail, Ports, Trucks, and Air	Rail is the Primary modal coverage, no Air data included
Easily validated – contact data included	No contact data provided
Accurate latitude and longitude coordinates for facility and customers (within 12 to 40 meters) provided by geocoding with detailed street data	Approximate latitude and longitude coordinates for facilities (refer to metadata)
Supports more than two modes per facility or customer	Two modes per record
Differentiation of commodities and cargo	No differentiation between commodities and cargo
Commodity data required	Commodity is not always included
Multiple commodities, cargo, and directionality associations	Does not support multiple associations one commodity / cargo per record and no directionality

There is an on-going effort to maintain and enhance the Intermodal Freight Transfer Facilities Database. Future direction possibilities may include continuing to add data from newly identified data sources including additional trucking facilities data and integration of facilities into a BTS transportation network.

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Appendix 1. Definitions

For the purpose of the intermodal facilities database project, specific definitions were used. These definitions evolved during research and analysis of the Intermodal Facilities data and from interviews with various organizations and entities associated with, or with an interest in, intermodal facilities data.   These project specific definitions are:

- Intermodal refers to two or more different modes of transportation.

- Intermodal Facility is a physical location that supports two or more modes of transportation and is where freight is transferred from one mode of transportation to another.

- Customer is considered the individual entity that uses the Intermodal Facility to transfer goods and may use the facility's services to carry out the transfer.

- Commodity is the individual goods or products that are being transferred from one location to another (for examples, grain or refined metals).

- Cargo is the configuration of the commodities when in transport (for example, grain is transferred as dry bulk).

- Directionality is the mode transfer direction (e.g., commodity is transferred from rail to truck) and describes whether cargo flows into or out of a facility. Directionality determines the limitations on type of mode used for entering or exiting the facility.

- Freight is any commodities or cargo transported to another location

Appendix 2. Codes for Commodity and Shipment Type

Table 2. Commodity Codes

Code	Description of Commodity
1	Live Animals And Fish
2	Cereal Grains
3	Other Crops
4	Animal Feed, Pet Food, And Products Of Animal Origin
5	Meat, Fish, And Preparations
6	Milled Grain Products And Preparations And Bakery Products
7	Other Prepared Food Stuffs
8	Alcoholic Beverages
9	Tobacco And Manufactured Tobacco Substitutes
10	Monumental Or Building Stone

Table 3. Description of Shipment Type

Code	Description of Shipment Types
100	General cargo "anything other than bulk"
110	Manufactured
120	Semi-manufactured
130	Package goods
200	Break-bulk cargo
210	Food and kindred products
220	Lumber and logs in the rough
230	Metal products -- primary and finished
240	Machinery
250	Motorized and other vehicles, including parts

Appendix 3. Data Dictionary for the Public Version of the Intermodal Freight Facility Database

Table 5. Facility Table

Columns	Description	Definition
ID	Primary Key Unique ID	Varchar2 (50)
Name	Unique name for the facility location Not Null	Varchar2 (50)
Type	Name Of the function of the primary function of the facility Not Null	Varchar2 (6)
Mode_Type	Defines all the modes that are affiliated with this facility. Not Null	Number (2)
City	The city for the facilities location	Varchar2 (50)
ST	The state abb. for the facilities location	Varchar2 (2)
Zip	The zip for the facilities location	Number (5)
Zip2	Detailed zip	Number (4)
Parcel	Indicates if a mail carrier is affiliated with this location	Number (2)
Latitude	Latitude for the location	Number (15,10)
Longitude	Longitude for the location	Number (15,10)
GeoSource	Source information of the latitude/longitude: either per-determined or geocoded with	Varchar2 (50)
CreateDate	The date of when the information was placed into the database	Date
Creator	The group of individuals responsible for populating that record	Varchar2 (20)
ModDate	Date of modifications to that facility	Date
Version	BTS tracking number	Varchar2 (2)
Assoc	List of other major business associated with this facility	Varchar2 (100)

Table 6. Shipment Type Table

Columns	Description	Definition
ID	Primary Key Unique ID	Varchar2 (50)
Desc	Brief description of the cargo Not Null	Varchar2 (50)
Code	Cargo Code that was based from the Oak Ridge's standards	Varchar2 (10)
FacilityID	Foreign Key - Unique ID	Varchar2 (50)

Table 7. Commodity Table

Columns	Description	Definition
ID	Primary Key Unique ID	Varchar2 (50)
Desc	Brief description of the commodity Not Null	Varchar2 (50)
Code	Commodity Code which will adopt the CFS standards	Varchar2 (50)
FacilityID	Foreign Key - Unique ID	Varchar2 (10)

Table 8. Directionality Table

Columns	Description	Definition
ID	Primary Key Unique ID	Varchar2 (50)
Mode_1	The first mode used to unload the shipment	Varchar2 (50)
Mode_2	The mode used to load the shipment	Varchar2 (50)
Code	Commodity or Cargo Code used to track the movement	Varchar2 (50)
Desc	Brief description of the commodity or cargo Not Null	Varchar2 (255)
FacilityID	Foreign Key - Unique ID	Varchar2 (10)