DTU Transport
Institut for Transport

Glaucus
Data Requirement Document

Version 1.0
Date: 2008-02-05

Prepared by: Allan Olsen

Document ID: Glaucus -DRD

Document status: 2. rev

Revision History

Date	Version	Description	Author	Status
2007-08-22	0.1	Document Created	Allan Olsen	Draft
2007-09-16	1.0	Updated based on review comments, Updated Document Template	Allan Olsen	1.rev
2008-02-06	1.0	Database revision update	Allan Olsen	2. rev

Distribution

Name	Organisation
Oli B.G. Madsen	DTU - Transport
Anders Nørrelund	DTU - Transport
Jakob Buus Petersen	A.P. Møller - Mærsk

Danish Transport Research Institute (DTF) and Centre for Traffic and Transport (CTT) merged into one department at DTU on 1st of January 2008.
The new name of the organization is "Department of Transport" or just "DTU Transport". All existing research areas are maintained within the new department which will have about 65 employees. The visit and postal address of DTU Transport is Bygningstorvet 116 Vest (the former DTF), but the department will also have premises at the address Bygningstorvet 115 (the former CTT). The director of DTF, Niels Buus Kristensen, continues as Head of Department of DTU Transport.

Table of Contents

1. Introduction

1.1. Purpose, scope and overview

The Data Requirement Document (DRD) is a central document of the project, in which all information relating to data is gathered for agreement by the key stakeholders and then for guidance and information for those involved in the project.

The data requirements are listed in the following sections and describe the essential data requirements for the standard liner shipping model. The data of the liner shipping model is stored in a database in order to enable future implementation of a webservice and to enable the use of the convenient data analysis abstractions found in SQL based languages. Hence the DRD is focused on describing the database design rather than merely listing the data requirements as conceptual requirements.

The model requires data describing the ports, the vessels and the rotations in the network. Furthermore forecast demands specifying the expected traffic between ports in the network are needed.

1. Ports
2. Vessels
3. Timetables
4. Rotation-Vessel assignments
5. Forecast demands

1.2. Definitions, acronyms, and abbreviations

GIS	A **geographic information system (GIS)** is a system for capturing, storing, analyzing and managing data and associated attributes which are spatially referenced to the earth.
WGS84	The World Geodetic System defines a reference frame for the earth, for use in geodesy and navigation. The latest revision is WGS 84 dating from 1984 (last updated in 2004).
DTU	Technical University of Denmark

2. Requirements

2.1. Main port data

The main port data describe the names and geographic coordinates of all the ports in order to construct and visualize the network. Furthermore data concerning the port transshipment capacity and the average turn around time is needed to evaluate potential bottleneck problems in a port.

Main Port Data

Data Field Name	Description	Example
PORT_ID	The unique port id	*12*
PORT_NAME	The name of the port	*Aarhus*
PORT_RKTS_CODE	The RKTS abbreviation used for the port	*AAR*
PORT_LONGITUDE	The longitude in degrees for the port in standard lat-lon projection with WGS84 datum.	*10.2167*
PORT_LATITUDE	The latitude in degrees for the port in standard lat-lon projection with WGS84 datum.	*56.1500*
PORT_LOAD_CAPACITY	An estimated load capacity. The variable holds the port specific capacity for loading or unloading containers using cranes. The capacity is considered equal for both load and unload. Unit is containers/hour.	*20*
PORT_TURN_AROUND_TIME	An estimated turn–around-time, which averages the time spent from when a container discharge from a vessel and until the container returns to the port and is ready for another transport. Unit is hours / container.	*620*

2.2. Vessel data

The vessel data for the standard model require the name and associated capacities for the entire fleet. Both in regards to volume capacity, but also in terms of reefer plug capacities and weight capacities for the individual vessels.

Vessel Data

Data Field Name	Description	Example
VESSEL_ID	The unique ID of the Vessel	*12*
VESSEL_NAME	The name of the vessel	*Emma Maersk*
VOLUME_CAPACITY	The container capacity of the vessel in a forty feet equivalent mapping. Unit is FFE	*5500*
WEIGHT_CAPACITY	The weight capacity of the vessel. Unit is tons	*200000*
PLUG_CAPACITY	The number of reefer plugs in the vessel	*500*

2.3. Rotation Data

The rotation data includes an ID and a name.

Rotation Data

Data Field Name	Description	Example
ROTATION_ID	The unique ID for the rotation	*10*
ROTATION_NAME	The name of the rotation	*Scan-Med Service*

2.4. Timetable data

Rotations are cyclic sequences of ports calls. A rotation starts with a departure from the first port in the rotation and ends when the rotation finishes the cycle by arriving at the first port once again.

The timetable data specifies the id of each rotation and the list of ports being visited in one rotation cycle. The data format is based on a transit model, where transit means that both arrival and departure for a certain port is modeled on the same row.

Timetable Data

Data Field Name	Description	Example
TIME_TABLE_ID	The unique ID for the timetable	*8*
ROTATION_ID_FK	A foreign key ID for a rotation	*2*
SEQ_NUMBER	The sequence number. Starts from 1 and runs to **n**, where **n** is the number of port calls in a timetable.	*1*
PORT_ID_FK	A foreign key for a port	*34*
ARRIVAL_TIME	The arrival time in hours after departure from the first port call in the Timetable. Unit is hours.	*12*
DEPARTURE_TIME	The departure time in hours after departure from the first port call in the Timetable. Unit is hours.	*25*

To establish a generic model, the arrival and departure time for each visit to a port is based on a zero-based accumulated time measure. By definition the first transit in each basic rotation arrives and departs at 0. The following arrival and departure times are relative to the departure for the first transit. See timetable example below.

Each rotation is assigned a unique rotation id and each port call is given a running number starting from 1 describing the order in which the port calls are made within a certain rotation.

Timetable Example				
Rotation_ID_FK	**Seq_Number**	**PORT_ID_FK**	**Arrival (hours)**	**Departure (hours)**
1	1	AAR	0	*0*
1	2	BRV	12	*26*
1	3	LPL	32	*56*
1	4	AAR	70	*94*

2.5. Fleet Assignments

The actual assignment between vessels and rotations is modeled in the Vessel-Rotation data. Combining a starting time with a vessel following a specific timetable both assign vessels to rotations, but also allows us to properly model the timing between several vessels following the same timetable.

Fleet_Assignment Data		
Data Field Name	**Description**	**Example**
FLEET_ASSIGNMENT_ID	The unique ID for the fleet assignment	*8*
ROTATION_ID_FK	A foreign key ID for a rotation	*2*
VESSEL_ID_FK	A foreign key for a vessel	*3*
START_TIME	The date when the Vessel-Rotation pair becomes active by departing from the first port in the rotation. Short dateformat	*22-10-2008*
END_TIME	The date when the Vessel-Rotation pair is no longer valid due to re-allocation, service etc. Short dateformat.	*14-04-2009*

2.6. Forecast demand

The forecast demands gives information about the amount of containers of a given type and size that is expected to ship between a dispatch and destination port in a given period of time. All possible forecasts demands will be listed here and hence is a comprehensive list.

The table is designed for monthly forecasts, but the demand may be given in weekly, bi-weekly or in fact in any timeframe available. A more detailed forecast merely changes the type of the PERIOD field in the table.

Forecast Demand Data		
Data Field Name	**Description**	**Example**
PERIOD	The forecast period, MMYYYY	*062006*
LOAD_PORT_FK	The foreign key for the port where the demand is loaded.	*12*
DISPATCH_PORT_FK	The foreign key for the port, where the demand is dispatched.	*14*
CARGO_TYPE_FK	The type of the cargo: 1. Dry 20 container 2. Dry 40 container 3. Dry 45 container 4. Reefer 20 container 5. Reefer 40 container	1
AMOUNT	The number of containers of the specified type being shipped between the load and dispatch port in the specified month.	40

2.7. Links - Legs

In order to enable GIS based visualization it is convenient to have geo-coded information about the path that is followed during a port-to-port call. The GIS data is not essential to the project, but would ease the implementation of the prototype.

This information can be stored in multiple ways, but we suggest representing the links in a table, where from and to-port is combined with a text field containing Google Earth Style representation of the links. This means that data is in WGS84 projection and conforms to Google Earth standard. White space separated triples of longitude, latitude and altitude is used. See below.

Link GIS Data		
Data Field Name	**Description**	**Example**
LINK_ID	The Link ID	*4*
FROM_PORT_FK	The foreign key for the from port	*AAR*
TO_PORT_FK	The foreign key for the to port	*BRV*
LINESTRING	<!-- lon,lat[,alt] --> White space separated triples of <longitude, latitude, altitude>	12.2550785337791,36.07954952145647,2357 112.2549277039738,36.08117083492122,2357 112.2552505069063,36.08260761307279,2357

3. Appendix – Database Diagram