RFS Management

Data Model Specification

Version: 0.5

Date: 04/10/2023

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Revision History

Date	Version	Summary of Changes
April 14, 2023	0.4	Ch 9: - missing data attributes FOT added - Statement about liability added
October 4, 2023	0.5	Ch 10: - Custom Status added to RFS-data model - MRN number moved to Shipment level - Missing data attributes TMA added

1. Introduction

What is a data model?

Data models are visual representations of data elements and the connections between them. By helping to define and structure data in the context of relevant business processes, models support the development of effective information systems and information exchange components like API's.

What types of data models are there?

You can roughly distinguish the various types of models on the dimension of granularity.

[1] Low granularity
Examples: Conceptual Data Models
Objective: provide a model of the main data objects of a given business model or business.

[2] Medium granularity
Examples: Logical Data models for a business, Logical models for a system
Objective: provide a model of the main data entities, attributes and their relationships including particular business rules for data (like uniqueness rule).

[3] High granularity
Examples: physical data models
Objective: provide a model with enough details to easily create/generate an implementation. Most often a database.

What are the benefits of a data model?

In general, a data model has the same benefit as any other model: to provide a representation of something out of our real world with the objective to create an overview and/or common understanding of the scope. A Data Model is an instrument to achieve this from the data angle.

Looking to our industry the benefit of a data model is to have a technology-independent view on data that can be used to develop the information exchange.
When designing information exchange, we should avoid to design peer-to-peer interfaces, but design the data structure on a data foundation, the Data Model. Using the Data Model will ensure that the design of the information exchange is coherent and consistent, recognizing that each information exchange is not a stand-alone product but a piece in an information eco system.

How to read a data model?

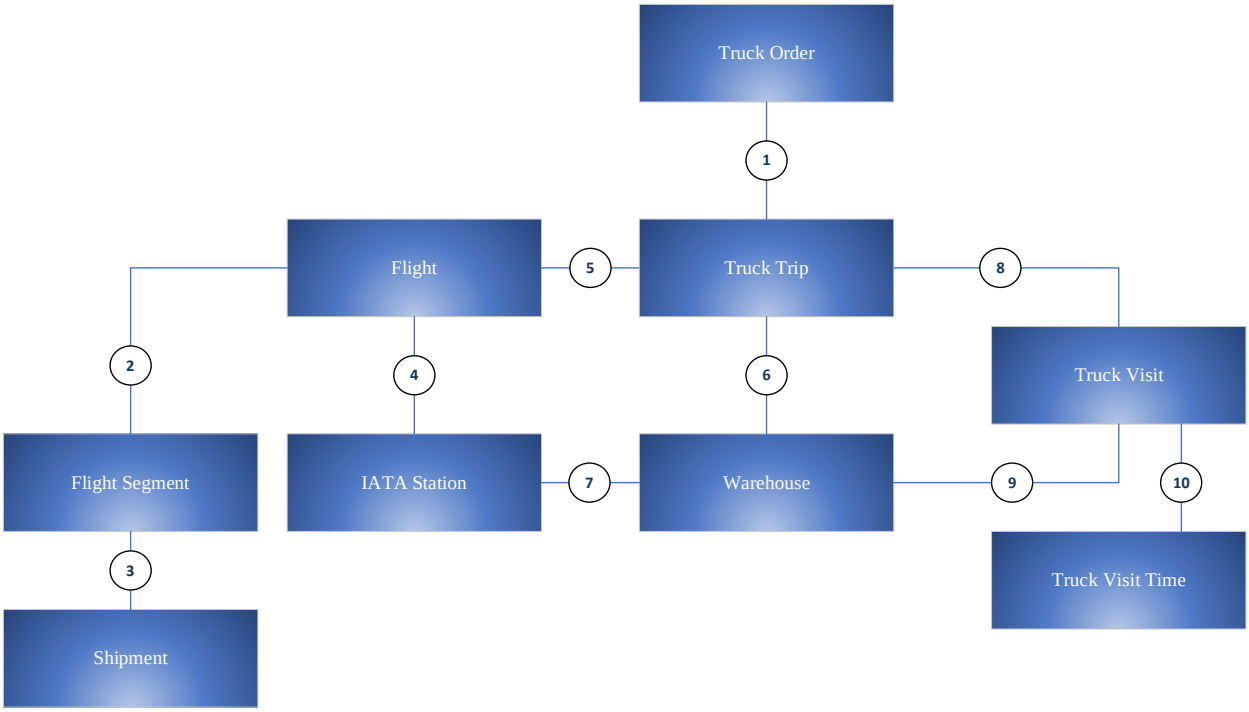
For those who are unfamiliar with Data Modeling, it would be a struggle to interpret a data model. Therefor a Data Model should preferably not be published as a picture only, but with an explanation. Most Data Model methodologies include a sophisticated grammar; you may recognize the symbols like and but unprepared readers might not have a clue what's behind. That's why there is a best practice to provide a written explanation of a Data Model where the business rules, that are visualized in the picture with 'difficult' symbols, are described in natural language.

Example: see 'Describing the Relationships' section in Chapter 2.

2. Conceptual Data Model

Overall Model

Below figure shows the Conceptual Data Model (CDM) for the scope of Truck Management. Each box represents a Data Object; a line represents a relationship between two objects. They are further described in the next sections. The entities in green are in scope of the Cargo IQ Care Protocol initiative, the entities in blue are existing entities which are not in scope but required.



Data Objects

Truck Trip

Definition: A Truck Trip is a route executed by a truck provided by a logistics provider.

Truck Order

Definition: A Truck Order is a a purchase order that represents the ordering of a truck service comprising one or more Truck Trips.

Flight

(IATA-) Definition: The execution of one or more consecutive flight legs under the same flight designator on a particular date.
A Flight can represent a Truck service. Typically a truck service is recognized by the usage of Aircraft Type ‘RFS’.

Flight Segment

(Cargo-) Definition: A Flight Segment is a track of one or more consecutive legs within a flight, identified by a departure and an arrival point, within the scope of a flight for which it is possible to load Cargo on the departure point and unload Cargo on the arrival point.

Shipment

Definition: A Shipment is one or more pieces of goods (physical goods) including their physical documentation (including electronic versions) from one export agent at one address, for moving on one Master Air Waybill to one

import agent or consignee at one destination address. It concerns the transport by one or more carriers starting at the agreed origin; ending at the agreed destination.

IATA Station
An IATA Station is a location as defined by IATA identified by the IATA Station Three Letter Code.

Warehouse
A Warehouse is location where Cargo is accepted, transferred, exported, imported, stored and/or picked up or delivered. Is more granular than an IATA Station.
A Warehouse is associated with a Network Point (mostly airports) if its location is within a range of 25 km of that Network Point.

Truck Visit
A Truck Visit is a visit of a truck to the yard/premises/parking lot of a GHA with the objective to pick-up and/or deliver Cargo.

Truck Visit Time
A Truck Visit Time is a registration of a timestamp that represents the achievement of a milestone of the visit of a truck related to a particular warehouse.

Describing the Relationships

[1] Truck Order – Truck Trip
A Truck order is executed by a Truck Trip. A Truck order can be fulfilled by one or more Truck Trips.

[2] Flight– Flight Segment
For one Flight one or more Flight Segments can be defined depending on the routing. A Flight segment is always connected to exactly one flight.

[3] Flight Segment–Shipment
The transport of a shipment is planned by defining one or more the flight segments that cover the routing of a shipment from origin to destination. A shipment can be planned on zero, one or more flight segments. (N:M relationship)

[4] Flight - IATA Station
A flight can call in multiple IATA-stations. Each connection within a flight from a departure IATA Station to an arrival station is represented by a Flight Leg. A Flight leg has always one IATA departure station an done IATA arrival station.

[5] Flight – Truck Trip
One Truck trip is executed by one or multiple flights. In the context of RFS, flight is also referred to as truck or truck service.

[6] Truck Trip – Warehouse
A Truck trip can call in multiple warehouses. Each connection within the truck trip from a departure warehouse to an arrival warehouse is represented by a Truck Trip Leg. A Truck Trip leg has always one departure warehouse and one arrival warehouse.

[7] Warehouse IATA station

For a Warehouse the closest IATA station is known. Only one IATA Station is the closest.

[8] Truck Trip – Truck Visit

During a Trip two or more visits to a warehouse can be conducted.

[9] Warehouse – Truck visit

A Truck visit represents a visit to one particular warehouse.

[10] Truck Visit – Truck visit time

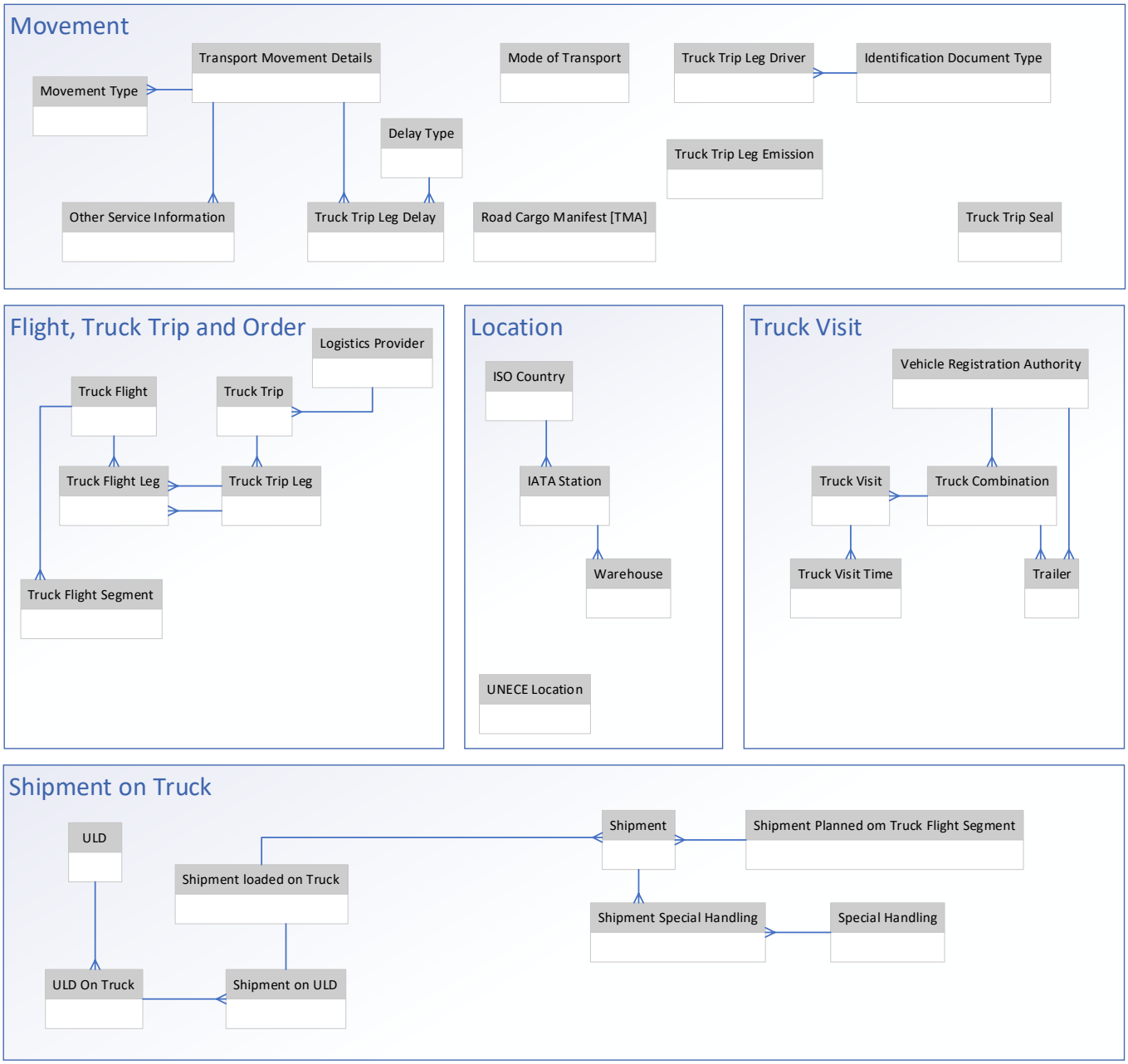
During a visit of a truck to a warehouse multiple activities can be conducted where the start or end time of such an activity is represented by a truck visit time.

3. From Conceptual Data Model to Logical Data Model

Where the conceptual model just provides a global, high over overview of the most import data object in an area, the function of the logical model is to be more precise. The Logical model shows the data attributes, their properties, keys, relation characteristics and more. It is the blueprint to create databases, information exchange, API's, processes and reports.

Logical Data Model – a global view

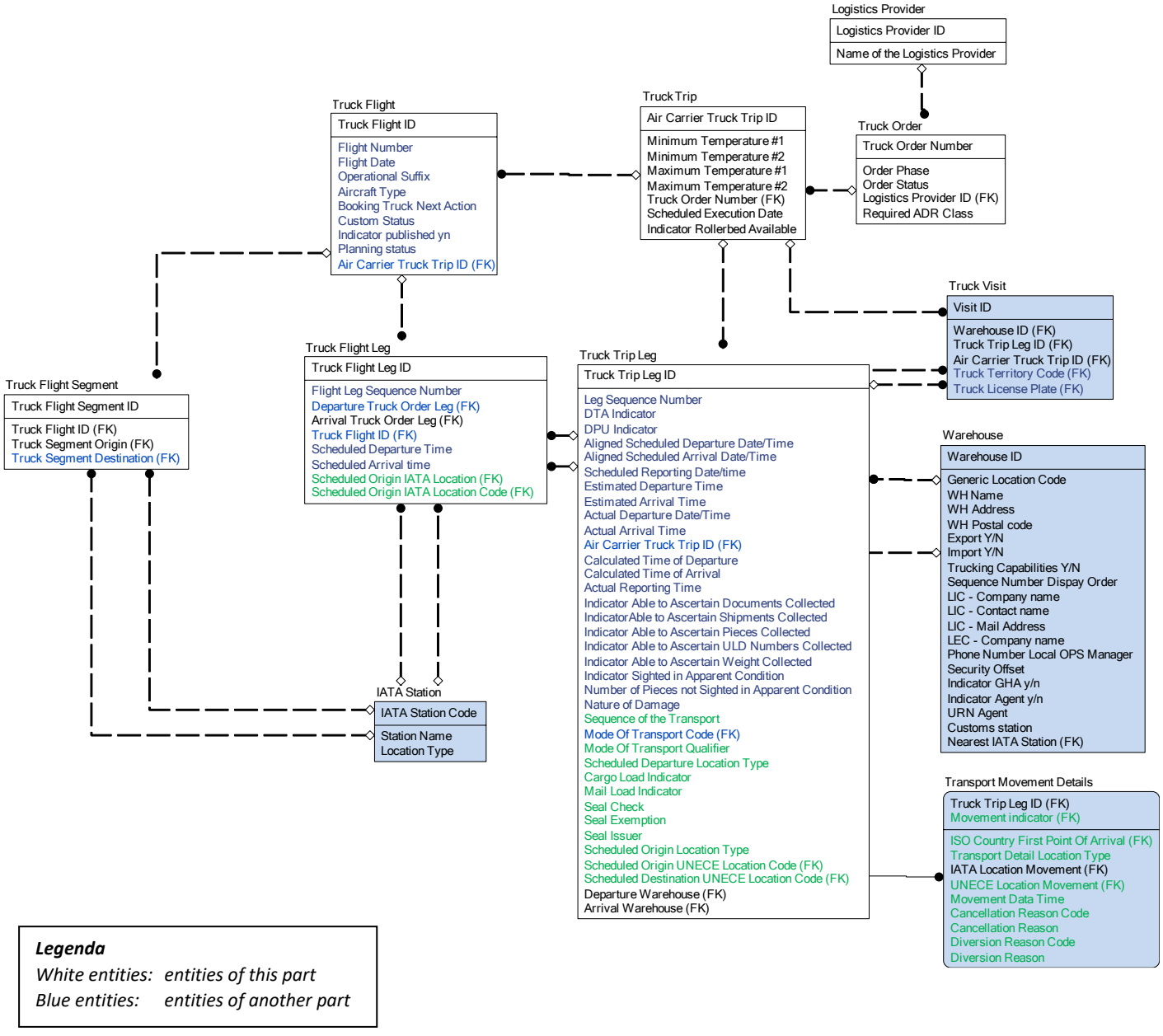
Below figure shows the complete data model on a more detailed level showing all entities, data attributes and relationships.



The model will be described in more details in the next chapters. One chapter per block.

4. Model part: Flight, Truck Trip & Order

Logical model for this model part



Design notes for this construction

Topic: Solve the problem of having multiple warehouses per Airport

Requirement: it should be possible to schedule truck rides with multiple destinations where two or more destinations do have the same closest IATA station and do not cause problems is scheduling systems. Most airline scheduling systems don't support legs where the IATA station for departure and arrival is the same. Example: FRA-AMS-AMS is not supported in most scheduling systems. Most inventory systems also don't support this.

The best work around for this problem is to issue two flights. In the example FRA-AMS and FRA-AMS **using different flight numbers to distinguish**. However the road logistics provider should always be informed with the schedule of the desired warehouse routing.

Data Model solution: a separation is made between the schedule of the road logistics provider and the schedule of the airline.
The schedule of the road logistics provider – unit of work: from Warehouse to Warehouse – is represented by the entities Truck trip & Truck trip Leg.
The schedule of the airline – unit of work: from IATA Station to IATA station – is represented by the entities Truck Flight & Truck Flight Leg following IATA standard.
For each Truck trip leg, defined by the transport between to warehouses, two relationships are modelled to know the closest IATA station. The first to connect the departure warehouse to the closest IATA Station; the second to connect the arrival warehouse to the closest IATA Station.

Entity definitions for part Flight, Truck Trip & Order

Entity: Logistics Provider

Entity definition: A Logistics provider is a company that provides logistic services like truck services.

Attribute list:

Attribute Name	Definition	Data Type	Mandatory	Key	Example
Logistics Provider ID	Unique reference for a Logistics provider	ID	Yes	PK	*12345*
Name of the logistics provider	Name of the Logistics provider	Text	No		*Jan de Rijk*

Entity: Truck Order

Entity definition: A Truck Order is a a purchase order that represents the ordering of a truck service comprising one or more Truck Trips.

Attribute list:

Attribute Name	Definition	Data Type	Mandatory	Key	Example
Truck Order Number	Identifies the order number	ID	Yes	PK	*12345*
Order Phase			**No**		
Order Status	The status of an order indicates the progress of the ordering process.	Text	Yes		*Draft, Final*
ADR Class	Describes the ADR-class	Text	No		*1.2*
Logistics Provider	See Parent		No	**FK**	

Entity: Truck Flight

Entity definition: A Truck Flight is a flight that is executed via road transport. A Truck Flight can be recognized by the Aircraft Type RFS.

Attribute list:

Attribute Name	Definition	Data Type	Mandatory	Key	Example
Truck Flight ID	Identifies the Truck Flight	ID	Yes	PK	*12345*

Entity: Truck Flight Leg

Entity definition: A Truck Flight Leg represents a route part from a departure station to an arrival station within the Truck Flight.

Attribute list:

Attribute Name	Definition	Data Type	Mandatory	Key	Example

Entity: Truck Flight Segment

Entity definition: A Truck Flight Segment is a track of one or more Cargo Network points identified by a departure and a arrival point, within the scope of a truck flight and for which it is possible to load Cargo on the departure point and unload Cargo on the arrival point.

Note: not all combination of departure and arrival points within a truck flight are segments. For some combination the carrier might not have the rights to transport Cargo.

Entity: Truck Trip

Entity definition: A Truck Trip is a route executed by a truck provided by a logistics provider.

Attribute list:

Attribute Name	Definition	Data Type	Mandatory	Key	Example

Entity: Truck Trip Leg

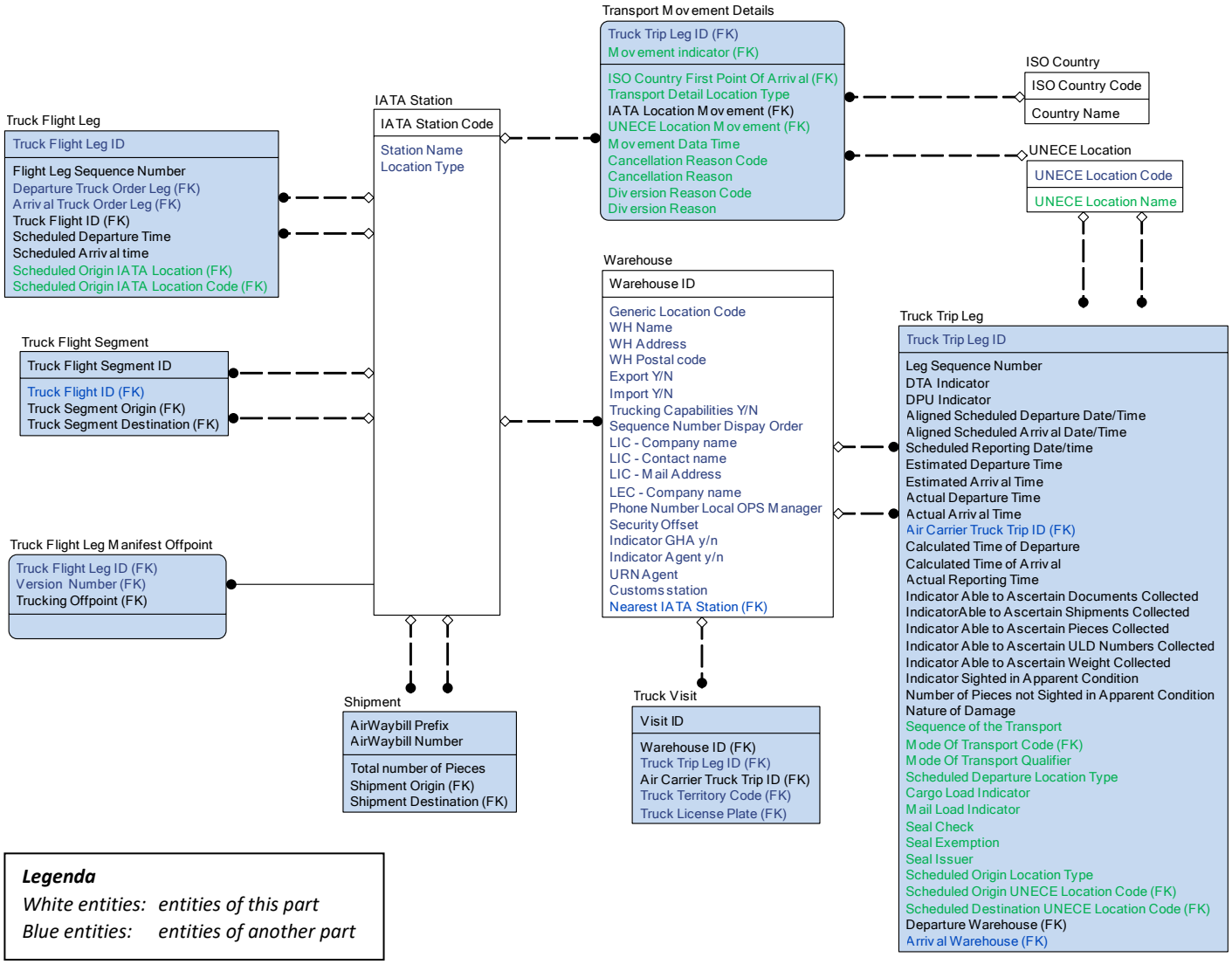
Entity definition: A Truck Trip leg is a route part within a Truck Trip from a Departure Warehouse to an arrival Warehouse.

Attribute list:

Attribute Name	Definition	Data Type	Mandatory	Key	Example

5. Model part: Location

Logical model for this model part



Design notes for this construction

Topic: Accommodate warehouse to warehouse AND Airport to Airport transports

Requirement: Trucking is about the transport from warehouse to warehouse whilst the Air Cargo business only plans Airport to Airport transport.
A road logistics provider needs to know the addresses of both the pick up and the delivery warehouse. The Airline needs to know the IATA airport code.

Data Model solution: Separate entities for Warehouse and IATA station. A mandatory relationship is applied between Warehouse and IATA station enforcing that for a Warehouse always the closest IATA station is registered.
Truck trips can be to and from a Generic Location Code, solving the potential issue of Origin/Destination being the same IATA code.

Entity definitions for part Location

Entity: IATA Station

Entity definition: An IATA Station is a station as defined by IATA identified by the IATA Station Three Letter Code.

Attribute list:

Attribute Name	Definition	Data Type	Mandatory	Key	Example
Logistics Provider ID	Unique reference for a Logistics provider	ID	Yes	Yes	*12345*
Name of the logistics provider	Name of the Logistics provider	Text	No	**No**	*Jan de Rijk*

Entity: Warehouse

Entity definition: A Warehouse is location where Cargo is accepted, transferred, exported, imported, stored and/or picked up or delivered. Is more granular than an IATA Station.
Rule of thumb: A Warehouse is associated with a Network Point (mostly airports) if its location is within a range of 25 km of that Network Point.

Entity: UNECE Location

Entity definition: A UNECE Location is a location listed on the UNECE location list that can be used to roughly indicate the start and end point of a Truck Trip leg.

Attribute list:

Attribute Name	Definition	Data Type	Mandatory	Key	Example

Entity: ISO Country

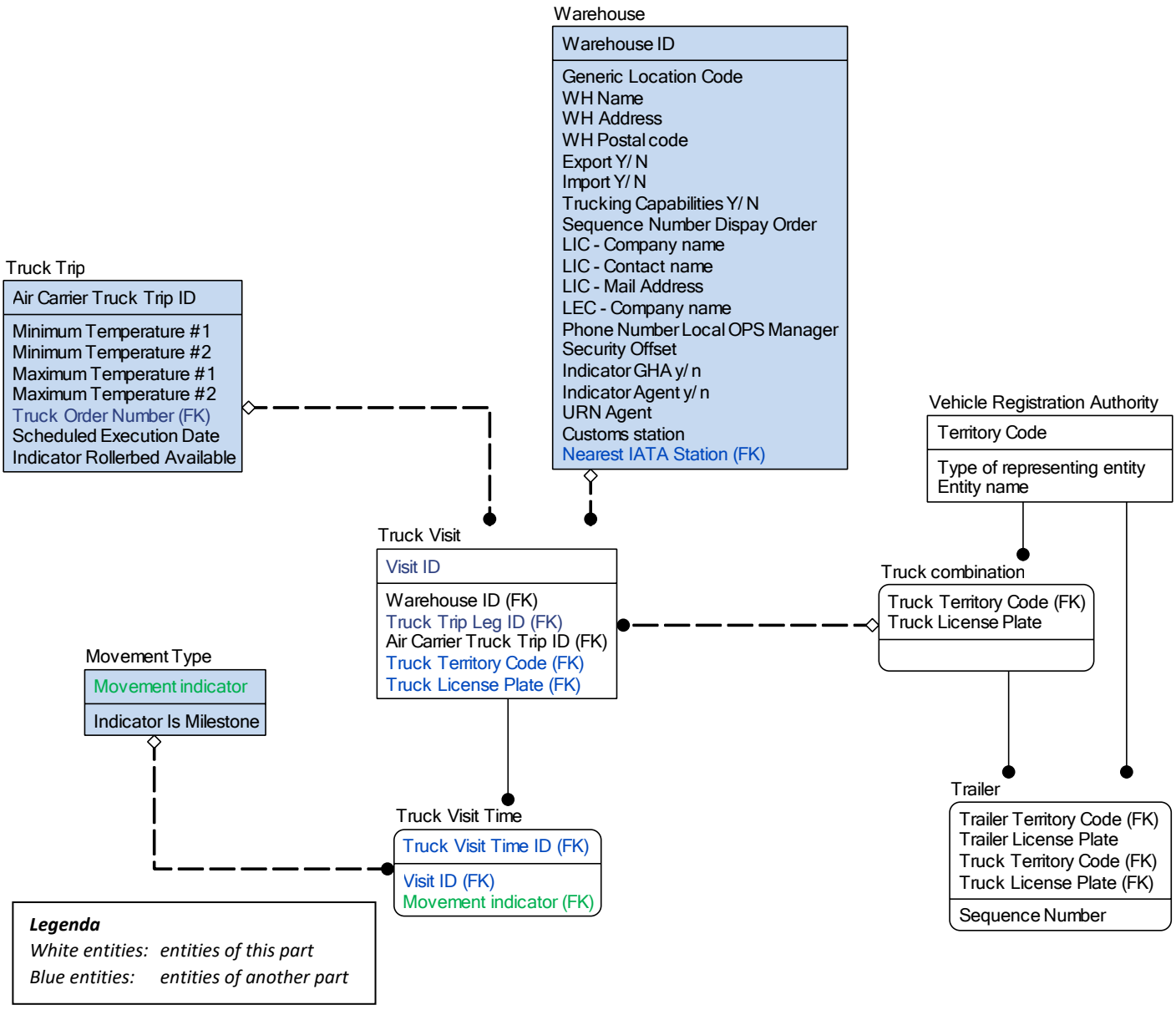
Entity definition: An ISO Country is a Country as identified by ISO, identified by the ISO Country code.

Attribute list:

Attribute Name	Definition	Data Type	Mandatory	Key	Example
ISO Country Code	Code that uniquely identifies an ISO Country	A(2)	**Yes**	Yes	*DE*
ISO Country Name	Name of the ISO Country	Text	**Yes**	No	*Germany*

6. Model part: Truck Visit

Logical model for this model part



Design notes for this construction

Topic: Split between transport and visit

Requirement: each trucking milestone should be clearly connected to the rightful entity. No compromises. Departure and arrival milestones are connected can be connected to the transport. A milestone which cannot be connected to either the departure or arrival must be connected to the truck visit where truck visit is defined as 'A Truck Visit is a visit of a truck to the yard/premises/parking lot of a GHA with the objective to pick up and/or deliver Cargo'.

Example: Driver Reporting cannot be connected to a departure or arrival. If the truck only delivers Cargo, it cannot be connected to a departure. So the milestone 'Driver reported' is a property of the truck visit, not of the transport.

Data Model solution: Separate entities for transport and visit: Truck Trip leg and Truck Visit.

The movement type ‘Driver Reporting’ is only used in ‘Truck Visit time’. Truck visit time registered all events during the visit: reporting, start loading, end loading, gate out, etc.

Topic: how to identify a truck when the truck visits the premises of a GHA

Requirement: define a unique way of identifying a truck. Starting point: the vehicles used nowadays are composed of a truck and zero or more trailers. Because the truck might be changed during the transport, one could plead for choosing the trailer plate as a unique identifier for the transport. However, this doesn’t cover the no-trailer truck; and we need a solution for all possible truck combination. Knowing that there will be always a truck in a truck combination, for the truck visit, the truck license plate shall be used as the unique identifier.

Data Model solution: the entity Truck combination represents the vehicle that visits the yard. The unique identifier of this vehicle is the license plate + country code of the truck. In case the truck combination consists of a truck and one or more trailers, the entity Trailer is used to register the license plates of the trailers. Optionally, the entity License plate can be used as a referential source. To enable a correct verification using this identifier, the road logistics provider should share the license plate of the truck upfront arrival.

Entity definitions for part Truck Visit

Entity: Truck Visit

Entity definition: A Truck Visit is a visit of a truck to the yard/premises/parking lot of a GHA with the objective to pick-up and/or deliver Cargo.

Attribute list:

Attribute Name	Definition	Data Type	Mandatory	Key	Example

Entity: Truck Visit Time

Entity definition: A Truck Visit Time is a registration of a timestamp that represents the achievment of a milestone of the visit of a truck related to a particular warehouse.

Attribute list:

Attribute Name	Definition	Data Type	Mandatory	Key	Example

Entity: Vehicle Registration Authority

Entity definition: A Vehicle Registration Authority is an authority that is permitted to issue license numbers for vehicles on behalf of a state or territory. The authority is identified by a unique code of 1,2 or 3 letters that is displayed on vehicles to show the issuing authority. In this model the code is referred to as 'Territory Code'.

Examples:

State:	United States	Code: US
Territory:	Great Britain and Northern Ireland.	Code: GB
Territory:	Gibraltar	Code: GBZ

Attribute list:

Attribute Name	Definition	Data Type	Mandatory	Key	Example
Territory Code			Yes		*GB*
Representing Entity Type			Yes		*Territory*
Entity Name			Yes		*Great Britain and Northern Ireland*

Entity: Truck Combination

Entity definition: A Truck Combination is a vehicle dedicated to transport Cargo by road. A Truck Combination can comprise a truck only, a truck plus trailer or a truck plus multiple trailers.

Attribute list:

Attribute Name	Definition	Data Type	Mandatory	Key	Example

Entity: Trailer

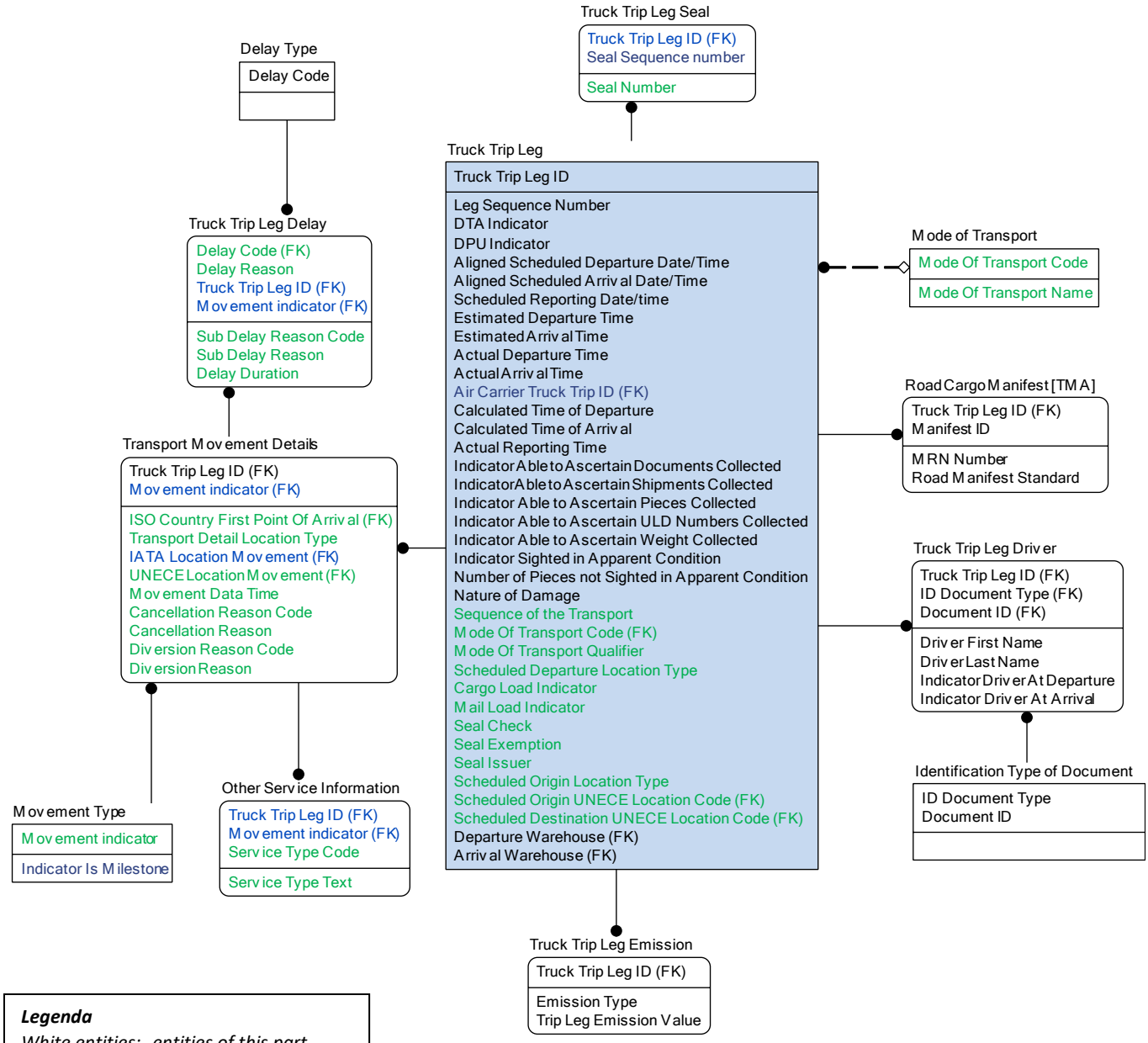
Entity definition: A Trailer is the rear part of a Truck Combination that doesn't have a cabin nor an engine.

Attribute list:

Attribute Name	Definition	Data Type	Mandatory	Key	Example

7. Model part: Movement

Logical model for this model part



Design notes for this construction

Topic: Truck Manifest

Requirement: a new milestone ‘TMA’ is needed to represent the fact that the Truck Manifest has been published. A TMA is not the same as a FFM.

Data Model solution: an entity ‘Road Cargo Manifest’ is introduced to accommodate this. Deliberately we didn’t choose to use the name ‘CMR’. There are two reasons for that:

1. CMR is not a worldwide standard.

2. Specifications for CMR and eCMR are not data specifications but document lay out specifications. In the digital era it is a must to separate data-structure from data presentation.

The Data Model should eventually be extended to publish a CMR, TMA message or any other road manifest. The entity 'Road Cargo Manifest' is in the picture because of the starting point that there is a unique document id that represents the digital version of the issued manifest.

Entity definitions for part Movement

Entity: Delay Type

Entity definition: A Delay Type is a type of delay that indicates the cause of the delay.

Attribute list:

Attribute Name	Definition	Data Type	Mandatory	Key	Example

Entity: Truck Trip Delay

Entity definition: A Truck Trip Leg Delay represents the registration of a Truck Trip Leg Delay.

Attribute list:

Attribute Name	Definition	Data Type	Mandatory	Key	Example

Entity: Transport Movement Detail

Entity definition: Transport Movement Details is a group of data attributes that specifies the details of a specific Movement Category.

Attribute list:

Attribute Name	Definition	Data Type	Mandatory	Key	Example

Entity: Movement Type

Entity definition: A Movement Type indicates a piece of information related to a truck movement.
Examples: Actual Arrival

Attribute list:

Attribute Name	Definition	Data Type	Mandatory	Key	Example

Entity: Other Service Information

Entity definition: Other Service Information is information corresponding to the given Transport Movement Details that is too specific for the given operator to be passed in a standardized way (There is no justification to pass this information in a separate data attribute).

Attribute list:

Attribute Name	Definition	Data Type	Mandatory	Key	Example

Entity: Truck Trip Leg Seal

Entity definition: A Truck Trip Leg Seal represents the registration of an issued seal for a truck.
The seal is identified by the seal number.

Attribute list:

Attribute Name	Definition	Data Type	Mandatory	Key	Example

Entity: Mode of Transport

Entity definition: The mode of transport specifies the typical physical barrier to overcome during the transportation.
Possible values: Sea, Land, Air.

Attribute list:

Attribute Name	Definition	Data Type	Mandatory	Key	Example

Entity: Road Cargo Manifest

Entity definition: A Road Cargo Manifest is a legal document listing details of the given Truck Trip Leg, to be used to show to authorities on request and therefor mandatory to be carried by the Driver of the Truck Trip Leg during the execution.
Example: CMR is an example of an implementation of a Road Cargo manifest.

Attribute list:

Attribute Name	Definition	Data Type	Mandatory	Key	Example

Entity: Truck Trip Leg Driver

Entity definition: A Truck Trip Leg Driver is a person that drives the truck during the execution of (a part of) the given Truck Trip Leg.

Attribute list:

Attribute Name	Definition	Data Type	Mandatory	Key	Example

Entity: Identification Type of Document

Entity definition: A Driver Identification is a type of legal document that a driver can use to identify themselves before, during or after the execution of the given Truck Trip Leg.
Example: Passport

Attribute list:

Attribute Name	Definition	Data Type	Mandatory	Key	Example

Entity: Truck Trip Leg Emission

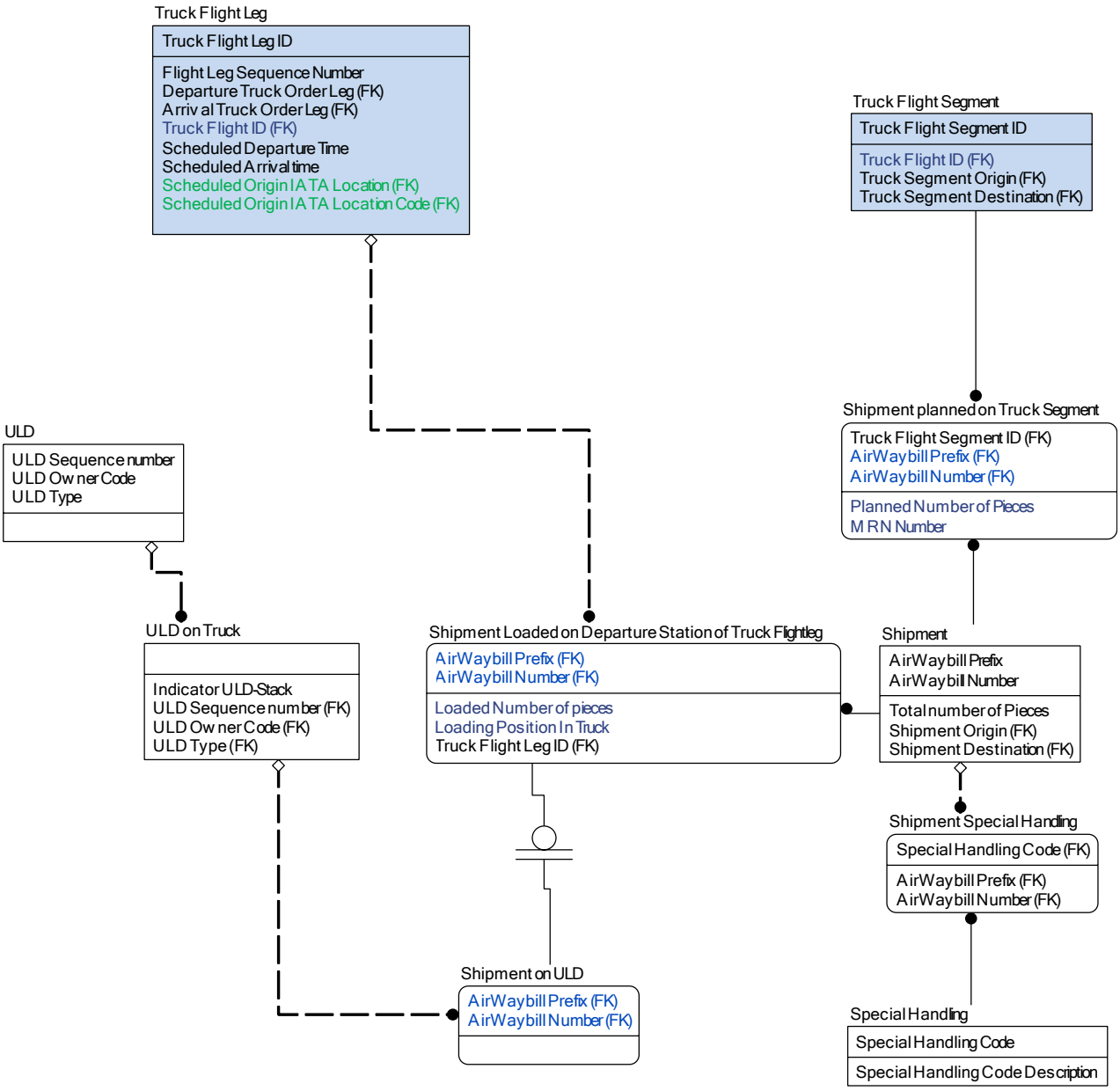
Entity definition: A Truck Trip Leg Emission is a recording of the emitted amount of a specific gas during the execution of the given Truck Trip Leg.

Attribute list:

Attribute Name	Definition	Data Type	Mandatory	Key	Example

8. Model part: Shipment on Truck

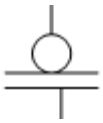
Logical model for this model part



Legenda
White entities: entities of this part
Blue entities: entities of another part

Design notes for this construction

Explanation of the concept of the subtype

The symbol  , used in this part of the data model represent the concept of a subtype.
The idea behind this concept is to distinguish subtypes of an entity. A subtype in this context is a group of occurrences of the given entity share a common characteristic that is relevant for the data model.

In the Data Model above the Shipment on ULD is considered as a sub type because the collection of occurrences of the entity 'Shipment Loaded on Truck' that are actually built on a ULD, share a common characteristic, the known ULD ID of the ULD which the shipment is built on.

Story line
A shipment transported on a truck will be planned on a truck segment representing the route from board point to off-point. The actual transport is registered on leg level to know exactly what is loaded in a truck for each leg.

Entity definitions for part Movement

Entity: Shipment

Entity definition: A Shipment represents one or more pieces of goods (physical goods) including their physical documentation (including electronic versions) from one export agent at one address, for moving on one Master Air Waybill to one import agent or consignee at one destination address. It concerns the transport by one or more carriers starting at the agreed origin and ending at the agreed destination.
Cargo carried or to be carried in an aircraft except (1) mail or other property carried under terms of an international postal convention and (2) baggage carried under a passenger ticket and baggage check. Unaccompanied baggage travelling moving under an AWB is Cargo. (IATA TACT)

Attribute list:

Attribute Name	Definition	Data Type	Mandatory	Key	Example

Entity: Special Handling

Entity definition: A Special Handling is a series of one or more standardized activities that are executed before or during the transport of a shipment because of regulations related to the characteristics of the shipment or on request of the customer. Activities vary from packaging instructions, care taking of live animals to temperature tracking.

Attribute list:

Attribute Name	Definition	Data Type	Mandatory	Key	Example
Special Handling Code	Code, also referred to as SHC, that uniquely identifies the Special Handling. SHC's are managed by IATA. See CXML code list 1.14 and 1.16.	A(3)	Yes	Yes	*COL*
Special Handling decription	IATA Description of the Special Handling.	Text	**Yes**	**No**	*Cool Goods*

Entity: Shipment Special Handling

Entity definition: Shipment special handling identifies the fact that for a given shipment a special handling is required. The special handling is identified with the Special Handling Code.

Attribute list:

Attribute Name	Definition	Data Type	Mandatory	Key	Example

Entity: ULD

Entity definition: A ULD is Device that is designed to transport Cargo with an Aircraft taking into account one or more characteristics of the space available within the aircraft like Position, Contour, Height etc.

Attribute list:

Attribute Name	Definition	Data Type	Mandatory	Key	Example

Entity: ULD on Truck

Entity definition: A ULD on Truck is the registration of the fact that a specific ULD is loaded on the given Truck Flight Leg.

Attribute list:

Attribute Name	Definition	Data Type	Mandatory	Key	Example

Entity: Shipment loaded on Departure Station of Truck Flight leg

Entity definition: A Shipment Loaded on a truck Flight Leg represents a shipment that is actually loaded to be transported on the route part represented by the Truck Leg.

Attribute list:

Attribute Name	Definition	Data Type	Mandatory	Key	Example

Entity: Shipment on ULD (sub type of the entity 'Shipment loaded on Truck Leg Manifest')

Entity definition: A Shipment loaded on ULD is the registration of a Shipment loaded on a specific ULD.

Attribute list:

Attribute Name	Definition	Data Type	Mandatory	Key	Example

Entity: Shipment Planned on Truck Segment

Entity definition: A Shipment Planned on a truck Segment represents a shipment that is planned to be transported on the route part represented by the Truck Segment.

Attribute list:

Attribute Name	Definition	Data Type	Mandatory	Key	Example

9. Example of applying the model: FOT

In this chapter an example is described how to apply the data model when specifying new messages.

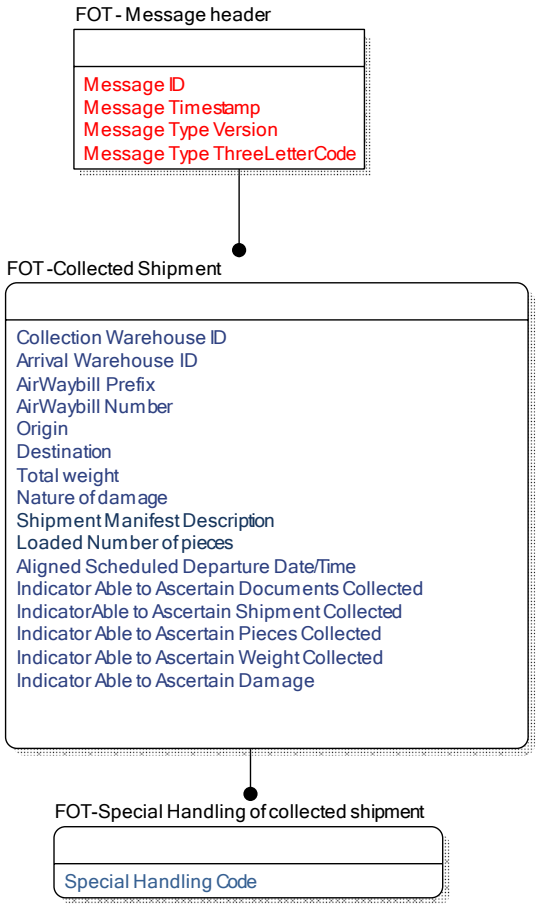
Goal

Goal of the FOT-message is to inform the forwarder that one shipment has been handed over from a warehouse operator (or pick-up location custodian) to the Air Carrier, commissioning a RFS-provider to collect the Cargo.
FOT-message is only used when FOH is not provided by the warehouse operator e.g. in case of a pick-up.
FOT-message does not replace FOH. FOH is still to be published by the next warehouse operator on the shipment route.
Like with the FOH message, the FOT message is published for one shipment.

Liability: with the issuing of the FOT and depending on the ascertained information, the liability on the shipment is transferred from the shipping agent to the Air Carrier .

The TMA-message will be used by the RFS-provider to publish the information, captured just before the loading, about the shipments that actually have been loaded.

Model of the message, derived from the overall Data Model



Note: Red data attributes represent message meta data

Mapping Table	
FOT Data Attribute [Entity.DataAttribute]	**Inherited data attribute from RFS Data Model**
FOT-Collected Shipment.Air Waybill Prefix	Shipment. AirWaybill Prefix
FOT-Collected Shipment.Air Waybill Number	Shipment. AirWaybill Number
Etc.	

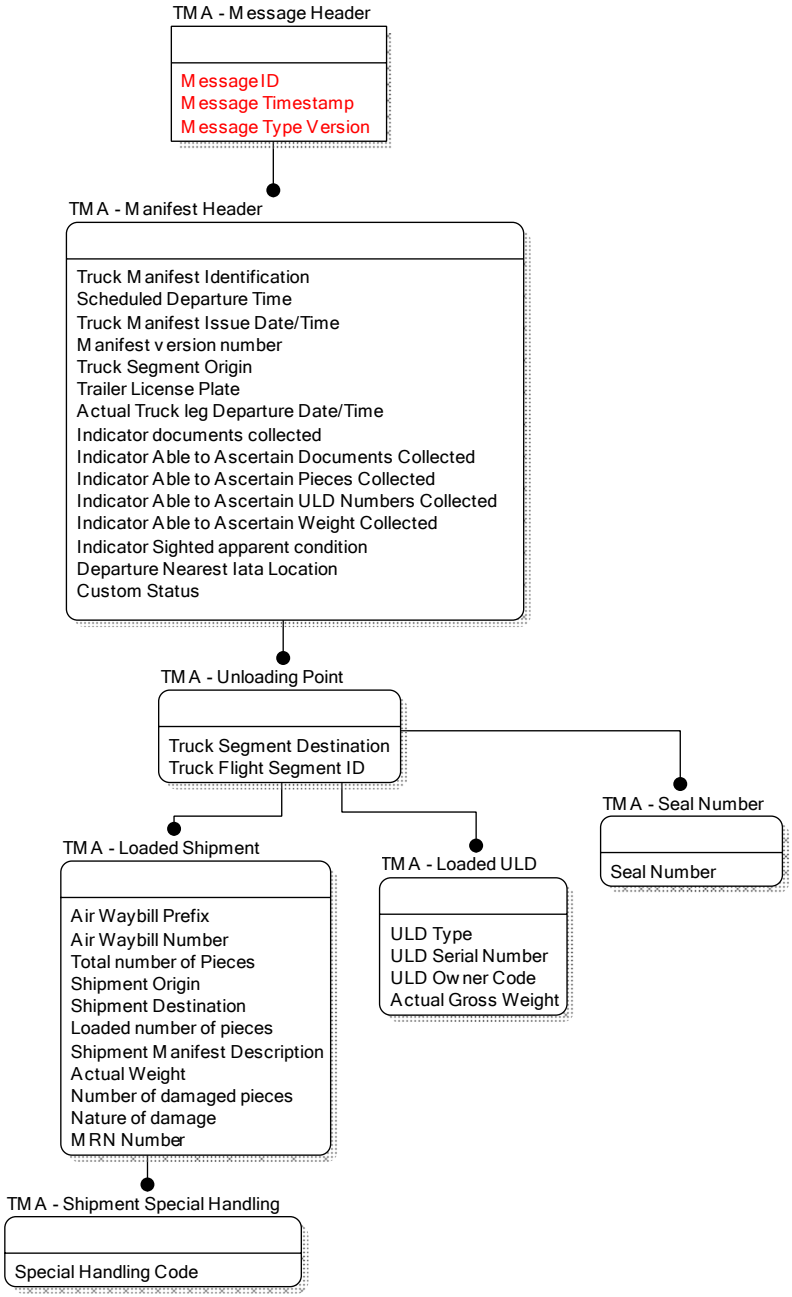
10. Example of applying the model: TMA

In this chapter an example is described how to apply the data model when specifying new messages.

Goal

The goal of the TMA-message is to report shipments confirmed loaded onto a departed truck. Legal custody passes from warehouse operator (or pick-up location custodian) to the Air Carrier commissioning the Motor Carrier collecting the goods, unless 'Freight on Hand' already given by contracted warehouse operator.
TMA could be sent to the next station.

Model of the message, derived from the overall Data Model



Note: Red data attributes represent message meta data

Mapping Table	
TMA Data Attribute [Entity.DataAttribute]	**Inherited data attribute from RFS Data Model**
TMA-Loaded Shipment.Air Waybill Prefix	Shipment. AirWaybill Prefix
TMA- Loaded Shipment.Air Waybill Number	Shipment. AirWaybill Number
Etc.	
TMA-Manifest Header.CustomStatus	Truck Flight.Custom Status
TMA-Manifest Header.Departure Nearest IATA Location	Truck Flight Leg.Scheduled Origin Location
TMA- Loaded Shipment.MRN Number	Shipment Planned on Truck Segment.MRN Number