EUROPEAN UNION AGENCY FOR RAILWAYS

Moving Europe towards a sustainable and safe railway system without frontiers.

Wagon and InterModal unit Operating database

Telematics TSI - Technical document - 102

Version 4.0

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Contents

A. Document management

A.1 Document properties

- File name: ERA_TD_102.docx
- Subject and document type: Telematics TSI - Technical document - 102
- Author: European Union Agency for Railways
- Version: 4.0

A.2 Change management

Updates to this technical document shall be subject to Change Control Management procedure managed by the Agency pursuant:

- the applicable requirements in the reference TSI
- Art. 23(2) of the Agency Regulation

If necessary, working groups are created in line with Art. 5 of the Agency Regulation.

A.3 Configuration management

A new version of the document will be created if new changes are considered following the Change Control Management Process led by ERA.

More specifically:

- if there is a change in the requirements which influences the implementation
- if information is added to or deleted from the technical document
- adding test cases to the field checking in messages or databases.

Modifications will have to be highlighted, so they can be easily identified.

Disclaimer:

Specific legal references to technical documents and legal acts shall be revised after the enter into force of the Telematics TSI. In some sections this text can be highlighted.

A.4 Availability

The version in force of this document is available on Agency's Gitlab repository. Any printed copy is uncontrolled.

A.5 Application and actors in the scope

Date of entry into force of reference TSI.

This document applies to all the actors in the scope of the reference TSI.

A.6 Document history

Table 1 - Document history

Version	Date	Comments
1.0	25.01.2011	Initial version
1.1	15.05.2012	Update of regulatory references and other references.
1.1	15.05.2012	Removal of references and text of legislation not in force.
1.1	15.05.2012	Inclusion of a new internal reference to chapter 6.
1.1	15.05.2012	Creation of chapter 6, including the list of xml elements to be used during the implementation phase. Due to this modification Annex 1 to this document is abolished.
2.0	08.08.2013	All the chapters were revised due to the TAF TSI Revision Process and the TAF TSI CCM WP cycle 2012 – 2013.
2.0	17.10.2013	Validated by the ERA TAF CCB on 11.09.2013.
2.1	18.03.2018	To define a new mechanism to exchange data between WIMO and RSRD. Endorsed by the ERA TAF CCB on 10.02.2015; Published on 18.03.2019
3.0	15.06.2021	Version number changed to 3.0.0
4.0	10.06.2025	Initial version for Telematics TSI

B. Acronyms, definitions and external references

B.1 Acronyms

Table 2 - Acronyms

Abbreviation	*Description*
ETA	Estimated Time of Arrival
ETI	Estimated Time of Interchange
EVN	European Vehicle Number
ILU	Intermodal Loading Unit
IM	Infrastructure Manager
LRU	Lead Railway Undertaking
NVR	National Vehicle Register
RU	Railway Undertaking
XML	Extensible Markup Language
XQL	XML Query Language

B.2 Definitions

Terms contained in this document are defined in the ERA Ontology.

B.3 External references

The referenced documents listed in **Error! Reference source not found.** are indispensable for the application of this document:

- For dated references, only the edition cited applies;
- For undated references, if any, the latest edition of the referenced document (including any amendments) applies.

Table 3 – Reference documents

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2 Functional Requirements Specifications

2.1 Initial requirements

The Functional requirements are derived from the requirements expressed in the Technical specifications for interoperability:

- Telematic Applications TSI
- Operation and traffic management (OPE-TSI)

They are restricted to the mandatory requirements of the Telematics TSI.

They support the EC goal to enlarge rail freight business by offering better quality of transportation services and reduced costs. Every single Functional Requirement Specification has to take into account the

- improvement of transport quality to attract more business and
- reduction of costs on the medium and long run.

2.1.1 Existing and used applications

Existing and used applications should be taken into consideration. E. g. the status reporting of the individual RUs could be used to populate / update the WIMO. This guarantees the reuse of existing investments of the individual RUs in their own systems and processes.

2.1.2 Requirements according to Telematics TSI

2.2 Overview of the WIMO

2.2.1 General objective

The purpose of the WIMO is the storage and provision of the data elements needed for operational purposes and for the tracking of wagons / Intermodal units within the geographical scope of the Telematics TSI.

The Telematics TSI covers single wagon traffic as well as train load or groups of wagons for the traffic within one RU as well as for interoperable traffic.

The Common interface (see Telematics TSI chapter 1.4) will handle the communications.

2.2.2 Functional objectives

To allow the tracking of wagon and ILU movements, the Wagon and Intermodal unit operational database (WIMO), updated at each relevant event in real time, must be installed.

Authorised entities such as LRU, keepers, fleet managers, etc must have access to the data relevant to fulfil their business functions, according to contractual conditions.

2.2.3 Data storage

The Wagon and Intermodal Unit Operational Database consist mainly of two parts:

- The Rolling Stock Operational Data and
- The Movement part of the WIMO

Wagon and Intermodal Unit Operational Data The Rolling Stock Operational	The Wagon / ILU Movement Data
Telematics TSI Requirements: Data shall include temporary data such as: 1. Restrictions 2. Current and projected maintenance actions 3. Km and fault counters 4. Load weight, dangerous goods 5. Extract from consignment data AND ALL DATA AS "STATUS" SUCH AS 6. Temporary speed restriction 7. Brake isolated 8. Needs for repair and fault	Telematics TSI Requirements: Movement Reporting: 1. Wagon ready for movement 2. Wagon pulled 3. Wagon departure from origin 4. Wagon arrival at intermediate location 5. Wagon departure from intermediate location 6. Wagon handed over 7. Wagon taken over 8. Wagon journey irregularity 9. Wagon journey rectified 10. Wagon arrival at destination 11. Wagon delivered STATUS SUCH AS Loading of the rolling stock

Figure 1: Wagon and Intermodal Unit Operational Data

2.2.3.1 The Rolling Stock Operational Data (Telematics TSI, chapter 3.3.4)

Beside the transport relevant (static) reference data for rolling stock stored in the individual keeper databases, the data representing the actual status of the rolling stock is the most important data for operational purposes.

This data helps to avoid multiple data input, which increase especially the data quality, and they give a clear picture on all available installations and equipment at any time for fast decisions during the operation.

2.2.4 Actual technical status of each wagon:

This data shall include temporary data, such as restrictions, current and projected maintenance actions, km and fault counters, etc.; and all data that could be considered as "status" (temporary speed restrictions, brake isolated, needs for repair and fault description, etc.) (Telematics TSI chapter 3.3.1 and 3.3.2).

2.2.5 Actual load status of each wagon:

- Dangerous goods information
- Loading information e.g. weight of the load

2.2.6 The Movement Data

The movement part of the WIMO is the most important database for the tracking of wagons / Intermodal units. This database contains data about the movement of a wagon and of an Intermodal unit from departure to final delivery at customer sidings with ETIs and actual times at different locations until the final delivery time ETA and the different status of the rolling stock such as loaded/empty wagon on journey.

Special Intermodal Units update messages are not foreseen in the TSI. But according Telematics TSI chapter 3.3.2 the movement of Intermodal Units must be stored in the WIMO for tracking and tracing. This is done based on the wagon information within the WIMO itself.

The communication between the LRU and RUs in the co-operation mode is based on wagon and/or Intermodal unit numbers. Therefore an RU that communicates with the IMs at train level must break down these train reporting messages into wagon and Intermodal unit related one.

The wagon and Intermodal unit related movement information must be stored in the Wagon and Intermodal Unit Operational Database. Thus, the reporting on train movement leads to new entries / updates in the Wagon and Intermodal Unit Operational Database.

The train movement reporting itself is not stored in the WIMO data base. It is up to the IMs to store such information and make it available.

Movement reporting (Telematics TSI, chapter 3.3.2)

For the reporting of the movement of a wagon and the Intermodal units on it, the data of the following messages must be stored and electronically accessible. In addition they must also be sent on contractual bases to authorised parties. The detailed formats are defined in [4.5].

-
- Wagon ready for movement
- Wagon pulled
- Wagon departure from origin
- Wagon arrival at intermediate location
- Wagon departure from intermediate location
- Wagon handed over
- Wagon taken over
- Wagon journey irregularity
- Wagon journey rectified
- Wagon arrival at destination
- Wagon delivered

2.2.7 Status Information

The database also shows the different status of the rolling stock such as:

- Loading of the rolling stock
- Loaded wagon on journey
- Empty wagon on journey
- Unloading of rolling stock
- Temporary wagon speed restrictions

2.3 Benefits

2.3.1 Benefits of the Rolling Stock Operational Data

Prerequisites to generate benefits are next to the implementation of the WIMO the implementation of processes at individual RU / IM level that allows a high level of data quality, reported to the WIMO.

The Rolling Stock Operational Data will allow easy access to the relevant information to improve transit time reliability, prepare and operate trains and to manage the wagon fleets.

Benefits are expected in the areas train preparation and train operation

- reduced costs
- no need to collect information, stencilled on the wagon sides
- (all wagon related information needed e.g. for the wagon list and the brake sheet)
- support in case of interchange
- support for train splitting e.g. in case of infrastructure restrictions on short notice, if shunting terminal is available.
- In case of unplanned changes of RUs as Service Providers on short notice all information is easily available to the "new" RU
- improved data quality
- transparent responsibility for every data element Other benefits are expected in the area of Fleet management:
- Knowledge about he technical conditions of every single wagon
- Knowledge of availability for use

2.3.2 Benefits of the Movement Part of the WIMO

Benefits are expected by

- Improved Customer Service
- European wide tracing of individual wagons, IM units, and shipments
- Actual shipment status is available to the customers via the LRU
- Support for maintenance decisions based on km counter
- Improved Fleet productivity
- Tracing supports the fleet managers in better managing their fleet
- Single source of information for all wagons in "local" and “interline” traffic

2.4 General Assumptions and Remarks

2.4.1 Wagon Numbering

In the scope of Railway Undertaking’s operational activity in principle the wagon number is the relevant reference or entity to trace the wagon.

Vehicle numbering (EVN, encoded in the NVRs) is also a basic parameter of the OPE TSI for all types of vehicles including wagons, coaches and traction units.

The wagon number is used in the train composition message and in all wagon related messages and even in the consignment note (ConsignmentOrderMessage according to Data and Message Model Telematics TSI, Appendix C, index [105]) e.g. for wagon load. This number is the key element for the access to the rolling stock database. Therefore it must be a unique number and it must also allow the access to the historical data of a wagon.

Nevertheless, the coded information within the wagon number should never been used as such, but must be explicitly available in defined data field outside the wagon number field, e.g. type of the wagon or number of axles.

Due to the coding of the wagon number, the number may be changed several times during the lifecycle of the wagon. To have access to the history of a wagon, it is therefore important to have a mechanism, which allows this access.

2.4.2 Integrating and maintaining different consignment notes and wagons in WIMO

Wagon number can be changed during the transportation. Due to different track gauges, as the case is e.g. on the Sweden - Finland or Spain - France border, the goods must be reloaded from one wagon to another. In reloading phase the goods from one wagon can be reloaded into two wagons. WIMO system must integrate the different wagon numbers. Wagons are linked together with previous wagon number and information must be sent before departure from the reloading place.

The departure RU may enquire "Where is my consignment" and the system must give answer even if the goods are reloaded to another wagon. One wagon can also

contain several consignments. That is a usual case in intermodal carriage.

During the transportation leg several different Consignment Note types can be used.

E.g. transportation from Italy to Moscow has 4 different types of transport documents. First one is the CIM Consignment Note, second one is the Vessel Manifest, third one is the Finnish Domestic Waybill and the last one is the Joint Finnish- Russian Waybill. WIMO system must combine these transport documents as the system receives different types of Consignment Notes. Consignment Note information (through ConsignmentOrderMessage according to Data and Message Model Telematics TSI, Appendix C, index [105]) is updated with transport document information as the goods are being transported. Consignment Notes are linked to the consignment with wagon numbers or with the previous waybillnumber.

Information about Consignment Notes as well as relations between various Consignment Notes must be stored in WIMO. Furthermore the WIMO database must handle relations between transport units and wagons.

2.4.3 Train number

The train identification is a key element for IMs, RUs and other companies esp. in the international railway business (see Telematics TSI chapter 2.1.2).

The train identification shall not be changed during the whole train run and is a primary key for all partners involved. Even if the train service number for operational purposes changes due to e.g. the direction of the train, the train identification has to stay the same.

The *Train-Ident* shall be used by the IMs and RUs in each message where the train identification is required.

Train-Service-Number is the operational train number which identifies the train for traffic management purposes and is usually inherited from the Path Number. The OPE- TSI terms this as a 'Train Identifier', a 'Train Number' and a 'Train Running Number'.

A *Train-Service-Number* may be different from one IM to another and may also change during the run of the train.

Remark: The train number is stored in the WIMO only with the Wagon ETI / ETA messages and the Wagon Interchange Notice messages (Telematics TSI chapter 3.2.3), if the wagon is within a train. Therefore enquiries with the train number as a "search criteria" may deliver only uncompleted reports.

2.4.4 General Remarks

For each function the general purpose, more specific requirements, input, output, processing and further explanation is provided.

The Input for the WIMO database is mainly based on the messages from the various users. These messages may be sent directly from an user to the WIMO or via a client as a middleware within the system architecture. The descriptions of the functional requirements in this document assume the direct sending of the messages to make clear the responsibility for the delivery of the information.

Beside the described data also additional calculated data, status data and administrative fields may be needed, but are not reported in this document as they depend on the database layout and will be then defined therefore in the database design document.

Next to the verbal description of the Functional Requirements in this document the overview of the FRS in chapter 5 should be taken into account.

This Overview of the FRS informs about:

- Data and Message Input with reference to the Telematics TSI
- Classifying the information
- Plausibility checks and reaction on failures
- Required data quality, timeliness and data sensitivity
- WIMO availability and Fall back procedure
- Accessible data based on the role of the user
- Examples of benefits
- Examples of specific reports supported by WIMO

The kernel of the WIMO is a permanent record of each wagon that could be interchanged between RUs in the EU. This could include also wagons from outside the EU. A permanent record for the ILUs is not foreseen.

2.5 Data supply

The WIMO may be populated preferred automatically via messages. The data sent to WIMO via messages is normally available from the domestic systems. There is no intention to require from the Railway Undertaking or Infrastructure Managers to input large amounts of data manually for the system's purposes.

However some manual input may be necessary when automatic systems are not available or partially operating. For this data supply the users have to install their own HCI interface according their own demands. The data sent from this HCI interface to the WIMO via messages, have also to use the common interface ([1.4]). Thus the WIMO will get in any case data in transparent way.

The WIMO database monitors in particular the progress of Wagons and Intermodal units by receiving reports in form of Wagon reporting messages from the systems of the various Railway Undertakings.

Before starting an opening cycle for monitoring in particular the movement of a wagons and Intermodal unit the WIMO database must be pre populated with certain wagon data, especially with the wagon number. This function is described in chapter 4.1.

Thus, a wagon in operation must be contained in the Wagon and Intermodal Unit Database (WIMO). Wagons, not contained in the WIMO database, but made known by any wagon reporting message are handled as new entries into the WIMO and are to be reported as such to the sender of the message, who will be stored in the WIMO as keeper, marked as "provisional" entry.

2.6 Wagon and ILU Movement data

In this chapter the recording of Wagon Status Messages will be described for the events (according to Data and Message Model Telematics TSI, Appendix C, index [105] and Figure and sequence diagrams of telematics messages Telematics TSI, Appendix C, index [100]):

-
- Wagon ready for movement
- Wagon pulled
- Wagon departure from origin
- Wagon arrival at intermediate location
- Wagon departure from intermediate location
- Wagon handed over
- Wagon taken over

- Wagon journey irregularity
- Wagon journey rectified
- Wagon arrival at destination
- Wagon delivered.

Above messages and their events must be recorded in the WIMO database to track or update the events of a wagon.

Each record of the database must contain the

- Message Sender
- Message Recipient
- Message Creation data and time
- Message Sender's reference
- Message identifier
- Event's Reporting RU / Operator of Rail freight facility
- Freight wagon's number reported for the event
- Event Type
- Event's date and time.

In addition, following event information can be recorded (subject to their transmission within the Wagon Status Messages):

- Location for which the event is reported
- Route section(s)
- Loading status of the wagon
- Shipping location of the wagon
- Destination location of the wagon
- Train identifier in which the wagon was running
- Consignment identifiers
- Involved carriers
- Wagon journey irregularities.

The recorded information will be shared between freight telematics stakeholders, which will have rights to access data, in accordance with Article 4.

2.7 Consignment note data – transport opening cycle

The consignment note data are required to open a transport cycle within the system. The information will be taken from the Consignment Note Data and the Wagon Orders and is used to populate the records related to the wagon number. The information is given by the Lead RU

(according to Data and Message Model Telematics TSI, Appendix C, index [105] and Figure and sequence diagrams of telematics messages Telematics TSI, Appendix C, index [100]).

2.7.1 Function "Consignment Data"

Purpose:

To store/update the information from the LRU regarding the shipment.

Requirements:

Consignment note data finalised

Input:

Consignment orders sent by the responsible LRU.

Required data content is defined in Data and Message Model Telematics TSI, Appendix C, index [105].

Processing:

Store/Update the consignment information linked to the wagon. Evaluate the wagon load data and store/update ILU data if load is an ILU **Output:**

These stored data must be accessible for the sending LRU. The access to the data for the Origin RU, Transit RU Delivery RU are specific of the role of the RU.

Explanation:

The LRU gets the data mainly from the Consignment Note from the customer. In case of subcontracting RUs, the LRU sends specific message to them, where the data are specific on the role of the subcontracting RU (Origin RU, Transit RU Delivery RU). For the data access by the various RUs, the WIMO must take this into account and Telematics TSI Act, Article 4.

2.8 Keepers Wagon data

The WIMO database shall be populated and maintained with data provided by the keepers from their Rolling Stock Reference database.

The processes regarding the creation, modification and deletion of data contained in the Rolling Stock Reference Database as well as the use of the RollingStockDataQueryMessage for enquiry purposes are not part of this document but are described in Reference Data Telematics TSI, Appendix C, index [103]).

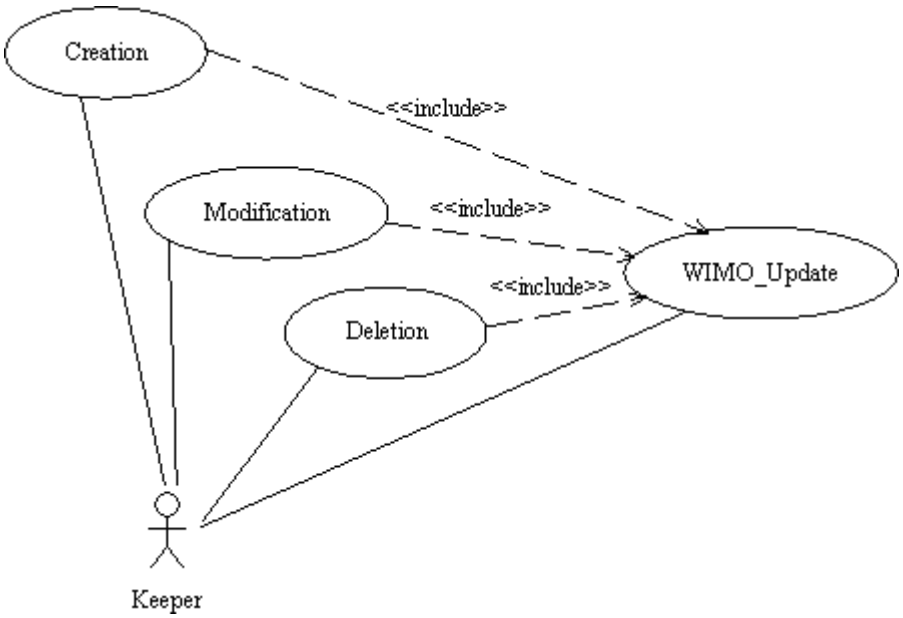

Figure 13: Creation, Modification (update) and Deletion Use Case

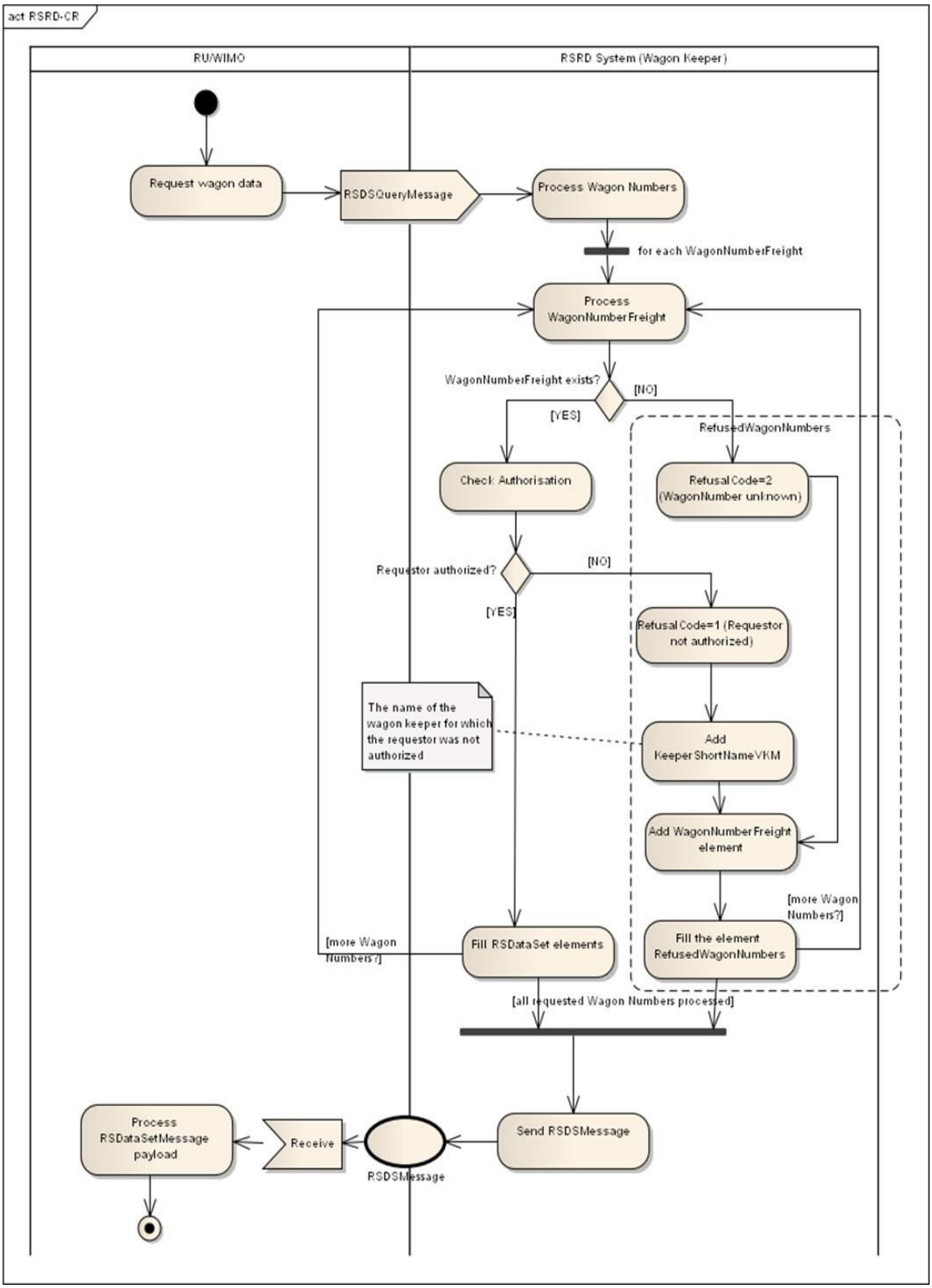

Figure 14: WIMO - RSRD Query Mechanism

2.9 Enquiries and Reports

Users must have the possibility to submit queries to the WIMO via the common interface. Responses to queries are returned by the WIMO module. The model below addresses the various query types. The subchapters describe the input parameters for the report generation and the response information from the WIMO module.

The response time for enquiries must be meeting the requirements quoted in Telematics TSI chapter 1.5.4 Timeliness. This message must have an identifier to which it refers.

Queries about consignments can be made by using query factors:

- Consignment number, if provided by the LRU (see also chapter 2.7)
- wagon number (see also chapter 2.7)
- transport unit number, if available
- consignment reference, if provided by the Lead RU
- location
- country of departure

Users are given a user profile depending on their role and access rights to information. Such roles may be Consignee, Consignor, Wagon keeper, Railway Undertaking, Infrastructure manager or any other. The recorded information will be shared between freight telematics stakeholders, which will have rights to access data, in accordance with Article 4.

The WIMO system must provide at least the following queries (not exhausted):

- Consignment query – 'Where is a consignment, which consignment number/container number/order number/wagon number is it?
- Location of customers consignments – 'Where are all consignments related to customer Y?'
- Incoming wagons and consignment they carry – 'Which consignments/wagons are due to arrive to place Y?'
- All incoming wagons and consignments to a certain location - 'Which consignments/wagons are due to arrive to place Y?'
- Location of wagons – 'Where is wagon number Z or where are group of wagons?'
- Wagons in a certain location – 'Which wagons are at place Y?'
- All wagons and consignments in certain location – 'Which wagons and consignments they carry are at place Y?'
- Delayed consignments and wagons – 'Which wagons/consignments are delayed?'
- ETA of wagon to a location – 'What is the ETA for wagon Z to place Y?'
- Transportation unit query – 'Where are all my wagons or Transport units?'

Recognised authorities

Recognised authorities i.e. Customs can have an own interface to WIMO system. In that case the WIMO system should provide at least the following queries:

- Customs Departure – 'Updating consignments, which are duty-paid and in free movement'
- Customs transit control – 'Which wagons are not in free movement, the customs clearance is missing?'
- Customs destination – 'Which consignments/wagons which are not duty- paid are due to arrive to customs centre Y?'

Simultaneous Consignment note number

In case there is more than one simultaneous consignment with exactly the same consignment number and query is made with on that basis, the user must enter additional criteria for the query, such as the country and place of departure or the country and place of delivery.

In the following chapters, some queries are more detailed described. Further enquiries will be defined in the design phase of the WIMO. AS an future oriented system, also during the operational phase the retrieval of information based on new defined enquiries shall be possible.

2.9.1 Enquiry about wagon deviation")

Purpose: LRU to enquire on the deviations to a specific wagon.

Key in Parameters	Response Data
WagonNumberFreight	WagonNumberFreight
LRU (Identification)	For each reporting point:
	Reporting location,
	Wagon reporting point status (departure, yard arrival, yard departure, interchange arrival, arrival at destination yard),
	Responsible RU at reporting location and according wagon reporting point status,
	Re-scheduled time (against current

	schedule if multiple reschedules),
	ETI, if Reporting point is an interchange point,
	Actual time at reporting point,
	For each deviation at that reporting point…
	Reason code and delay time for this reason.

2.9.2 All incoming wagons at a location

Purpose: LRU to enquire on all incoming wagons at a specific location within a specified time interval.

Key in Parameters	Response Data
LRU (Identification)	WagonNumberFreight
Date/Time (to/from)	Last recorded location
Location	Date/time at last recorded location
Country	Place of destination
	Empty/Load Status
	ETA

2.9.3 All wagons in a certain location

Purpose: LRU to enquire on all wagons at a specific location.

Key in Parameters	Response Data
LRU (Identification)	WagonNumberFreight
Location	Last recorded location

Country	Date/time at last recorded location
	Place of destination
	Empty/Load Status
	ETA

2.9.4 Delayed wagons

Purpose: LRU to enquire on the deviations of all wagons at a specific location within a specified time interval of departure from a given location.

Key in Parameters	Response Data
LRU (Identification)	WagonNumberFreight
Date of Departure (from/to)	Last recorded location
Location	Date/time at last recorded location
Country	Place of destination
	Empty/Load Status
	ETA

2.9.5 ETA of Trains/wagons to a location

Purpose: LRU to enquire on the ETI/ETA of wagons depart within a specified time interval from a given location.

Key in Parameters	Response Data
LRU (Identification)	WagonNumberFreight
Date of Departure (from/to)	TrainNumber (if available)
Location	Place of Destination
Country	ETA
WagonNumberFreight	

2.9.6 Incoming wagons depart from a certain location

Purpose: LRU or RU to enquire on the incoming wagons which are depart within a specified time interval from a given location.

Key in Parameters	Response Data
LRU or RU Identification	WagonNumberFreight
Date of Departure	Last recorded location
Location (of departure)	Date/time at last recorded location
Country (of departure)	Place of destination
Location (incoming)	Empty/Load Status
	ETA

2.9.7 Location of all Wagons with load for a specified Customer

Purpose: LRU to enquire on the locations of all wagons for a specified customer, where the wagon is depart within a specified time interval.

Key in Parameters	Response Data
LRU (Identification)	WagonNumberFreight
Date of Departure	Customer Reference
Customer Name	Last recorded location
	Date/time at last recorded location
	Place of destination
	Empty/Load Status
	ETA

2.9.8 Location of a specific Wagon

Purpose: To enquire on the location of a specific wagon.

Key in Parameters	Response Data
Keeper, LRU or RU	WagonNumberFreight
WagonNumberFreight	Train-Ident (if the Train-Ident is available)
	Last recorded location

	Date/time at last recorded location
	Place of destination
	Empty/Load Status
	ETA

2.9.9 Train/Wagons at a certain location

Purpose: To enquire on all wagons together with the Train-Ident (if the train- Ident is available) at a specified location.

Key in Parameters	Response Data
Keeper, LRU or RU	WagonNumberFreight
Location	Train-Ident (if the Train-Ident is available)
Country	Date/Time
	Place of destination
	ETA

2.9.10 Wagons of a train

Purpose: To enquire on all wagons of a specific train depart at a specified location within a specified time interval.

Key in Parameters	Response Data
LRU or RU	WagonNumberFreight
Date of Departure	Place of Destination
Location	ETA
TrainNumber	

See remark in chapter 2.4.2

The recorded information will be shared between freight telematics stakeholders, which will have rights to access data, in accordance with Article 4.

3 TECHNICAL REQUIREMENTS

The design of the WIMO should allow easy access, high performance and response time and low transaction costs.

In addition the WIMO design must be able to carry the workload of all parts and users, described in this document.

3.1 WIMO Users

The users of the system can be classified as:

A) users working at the domestic operational centres (i.e. directly involved in operations management). These are the parties responsible for rolling stock during transport operation:

- Railway Undertaking as Duty holder during its transport control,
- Keeper of rolling stock and
- User (Hirer) of rolling stock.

For all three different parties the operational rolling stock data must be accessible by the authorised user, down to his predefined authorised level, using the single key given by the wagon ID (wagon number).

B) users responsible of the management information systems at each RU an LRU (i.e. who can have more technical responsibilities about the system management, password authorization, configuration and integration with other systems).

C) users working at Infrastructure managers and other Organizations (according to the authorization provided).

D) additional freight telematics stakeholders as defined in Telematics TSI Article 3 (9).

3.2 Access right

Access rights that protect the vital interests of the various entities are required to use the WIMO. Some aspects of the access rights are also described in the FRS “Common Interface” ([4.5]) and in the FRS “Rolling Stock Reference Data base for Wagon Keepers” ([4.7]).

Access to the WIMO system through an Internet user interface or in any other way requires a valid user ID and a password. The User ID is linked with profile information defining the scope of user and query authorities.

The system operator of the WIMO system is responsible for the maintenance of WIMO user profiles. Each information provider maintains their own users’ information and forwards the information to the operative party

responsible for user information updates.

3.2.1 Access Rights for Specific Data

The user rights will be based on specific profiles for each type of user. The confidential information is on the data level so each field must be identified with specific read and update rights for each user. The basic user rights are outlined in the table below.

Profile ID	Actor	Accessible Information	Rights
P1	IM	Participant in the itinerary - Departures, Transit, Interchanges and Arrivals (movement data)	Read all in own territory
P2	Lead RU	Responsible on overall transportation	Read All
P3	O-,T- or D-RU	Participant in the itinerary – Departures, Transit, Interchanges and Arrivals (can be also Operator of rail freight facility when consignment leaves from or arrives to a rail freight facility)	Read All, for which it is the Duty holder
P3.1 P3.2 P3.3 P3.4	Origin, Transit, Delivery RU or Operator of Rail freight facility	Consignment Data	Read, All, according the role Origin, Transit, Delivery
P4	Customer	Transport order data. Must be identified as Consignor or Consignee in the Consignment. The access rights are linked with P2 as the Lead RU must explicitly allow	Read, All

		the access for a customer according to Telematics TSI legal text Article 4.	
P5	Freight Payer	Transport order data Must be identified in the Consignment	Read, All
P6	Third Party	Transport order data Must be identified in the Consignment	Read, All

Profile ID	Actor	Accessible Information	Rights
P7	Keeper	Must be identified as owner of the wagon in the Keepers data part of the WIMO	Read / Update only Status , counters; Read position information
P8	Authorities	Must be a recognised authority (i.e. Customs) from a country identified in the itinerary	Read, to be specified in details in design documents,
P9	Maintenance responsible entity, Fleet manager.	Must be identified as such in the keeper data	Read, All

3.2.2 Authorisation concept

Definition of user rights: users grouped by any means, i.e. do all users have access to all information, i.e. alerts. Users can only make queries about their own consignments, wagons etc. Users have different roles, which affect the available queries and the results of queries:

System Operator - as an system operator, you see information on all consignments.

Infrastructure Manager - as an IM, you see information on trains in which you are involved either as an Origin, Departure or Transit IM.

Lead Railway Undertaking – as a LRU, you see information on consignments in which you are involved as LRU.

Origin, Departure or Transit Railway Undertaking – as a ORU, DRU or TRU you see information on consignments in which you are involved either as a Origin, Departure or Transit RU. When a consignment leaves from or arrives to a Rail freight facility, then its Operator have similar rights on consignments.

Customer - as a customer, you see information on consignments in which you are involved either as a consignor or a consignee. You can also authorise another customer to see information on your consignments. The access rights for a customer are linked with the Lead RU as the Lead RU must explicitly allow the access for a customer to meet the requirements quoted in Telematics TSI Article 13.

Keeper - as a keeper, you see the same information as with Customer's rights, plus information on your own wagons.

Third party - third parties see information on the consignments for which they have been given the authorisation.

Authority- as an Authority, e.g. Customs, who can have rights to make queries to certain stations only.

Maintenance responsible entity- as stated in the keepers data e.g. an RU, which has the obligation during the use of the wagon to take care on all maintenance issues.

Fleet manager- as stated in the keepers data e.g. an RU.

3.3 System Integrity and Security

Under the following points are listed the requirements which must be supported by the WIMO databases according Telematics TSI chapter 1.7. These are:

Authentication

The database must support the authentication of users of the systems before they can gain access to the database.

Security

The database must support the security aspects in the meaning of controlling access to the database. The possible encryption of the database contents itself is not required.

Consistency

The database selected shall support the ACID principle (**A**tomicity, **C**onsistency, **I**solation, **D**urability).

Access Control

It must be ensured that only authorised users may gain access to WIMO and that they can only gain access to the relevant parts and information of the system The access control shall be supported down to a single attribute of a data record. The database shall support configurable, role based access control for insertion, update or deletion of data records.

Tracing

The database must support logging all actions applied to the database to allow for tracing the detail of the data entry (Who, What, When did the contents change).

Lock strategy

The database must implement a locking strategy which allows access to the data even when other users are currently editing records.

Multiple Access

The database must support that data can be accessed simultaneously by several users and systems.

Reliability

The reliability of the database must support the required availability.

Availability

The database must have an availability on demand of at least 99,9 % based on percentage of 24 x 7 operations, which means outage minutes per year of max. 500.

Maintainability

A maintainability of the database must support the required availability.

Safety

The database itself is not safety related. Hence safety aspects are not relevant. This is not to be confused with the fact that the data - e.g. wrong or not actual data - may have impact on the safety operation of a train.

Compatibility

The database must support a data manipulation language that is widely accepted, such as SQL or XQL.

Import facility

The database shall provide a facility that allows the import of formatted data that can be used to fill the database instead of manual input.

Export facility

The database shall provide a facility that allows to export the contents of the complete database or its part as formatted data.

Mandatory Fields

The database must support mandatory fields that are required to be filled before the relevant record is accepted as input to the database.

Plausibility Checks

The database must support configurable plausibility checks before accepting the insertion, update or deletion of data records.

Response times

The database must have response times that allows users to insert, update or delete data records in a timely manner.

Performance aspects

The database shall support the queries necessary to allow the effective run of about 60.000 train runs per 24 hours. About 50% of these train runs are deemed to take place within two hours.

The number and kind of queries or updates per train are dependent on the overall process for planning and running a train.

Capacity aspects

The database shall support the storage of the relevant data for all freight wagons respectively the network. It shall be possible to extend the capacity by simple means (i.e. by adding more storage capacity and computers). The extension of the capacity shall not require replacement of the subsystem.

Historical data

The database shall support the management of historical data in the meaning of making of data available that has been already transferred into an archive. The system shall keep on-line historical data for at least 13 months.

Historical data from an archive shall be accessible in a manner, that is safe from damage and allows accurate retrieval of information for at least 7 years or the maximum statute of limitations in any one Member State of the EU.

Backup strategy

A backup strategy shall be in place to ensure that the complete database contents for up to a 24 hour period can be recovered.

The above requirements shall be handled by a standard Database Management System (DBMS).

The usage of the database is embedded into various workflows. The general workflow is a request / response mechanism, where an interested party requests information from the database through the Common Interface (Ref. Telematics TSI chapter 1.7). The DBMS responds to this request either by providing the requested data or by responding that no data can be made available (no such data exists or access is refused due to access control).

3.4 Data Quality

Chapter 1.7 of the Telematic TSI documents the essential requirements for Data Quality. This is a prerequisite for effective data exchange and comprises the following elements:

Completeness, Accuracy, Consistency, Timeliness and Uniqueness

The sender of each message will be responsible for the correctness of the data sent and must verify that it is in compliance with the guidelines stipulated for that message. This means that the data must not only be complete and conform to the metadata requirements (syntax-level), but must also be accurate, timely and consistent for the receiving application to effectively import the message. This requires various distinct levels of validation, which are described in other Functional Requirement Specifications of the subsystem Telematic Applications for freight.

3.5 Data lifecycle

Regarding the data lifecycle in the WIMO databases, the following data types must be considered:

Keepers data and other reference data in the WIMO

This data remain over the whole system life in the WIMO database. Regarding the update see chapter 2.6, 2.7 and 2.8.

Counters

After the maintenance of the wagon the accumulated counters shall be reset after the storage of the whole wagon record in the history storage.

Status data

The status data of a wagon are updated based on the wagon messages.

Consignment Data and Movement Data

The lifecycle of the consignment data and the movement data normally ends after the wagon has been delivered at the customer sidings and the WIMO has received the delivery message. After that time the data related to the wagon inclusive of the wagon status information shall be stored together with the linking in the history storage and the movement data as well as the consignment data, but not the wagon status information, shall be deleted in the active part of the WIMO.

In the case, that no delivery message was received, but a message related to a new transportation use of the wagon is sent to the WIMO all the actual consignment data and movement data inclusive of the wagon status information related to the wagon must be stored together with the linking in the history storage and deleted – besides the wagon status information - in the active part of the WIMO, before the new transportation cycle can start.

3.6 Error messages

It must be distinguished between technical errors and application errors. For both errors the codes needs to be defined in the further design documents together with the receiver of such error messages. For error messages on the application level, the receiver is normally the sender of requests or update messages for the WIMO.

Technical error codes need to be defined and harmonised within the whole community.

The structure of the error messages and the codes must be central administrated in the repository and distributed. These technical error messages are mainly handled in the common interface (see [4.5]).

3.7 Manual Input

Manual data input is needed

- To provide essential data supply in case of unavailability of the domestic systems
- To allow users of the system to access the WIMO and query for specific data, subject to particular authorizations.

See chapter 2.5 “Data Supply”.

4 DATA LISTS

The complete WIMO data are shown Telematics TSI Data and Message Model Telematics TSI, Appendix C, index [105]. All these data in this document are to be used as a baseline and are subject to change during the implementation phase. In the following tables the cardinality defining the number of occurrence of entries is defined as:

(0,1): entry is optional and has a maximum occurrence of 1 (0,*): entry is optional and has an unlimited maximum occurrence (1,1): entry is obligatory and has a maximum occurrence of 1

(1,*): entry is obligatory and has an unlimited maximum occurrence (2,1): entry is conditional and has a maximum occurrence of 1

(2,*): entry is conditional and has an unlimited maximum occurrence

The data description of the following subchapters is a functional definition to understand the information exchanged.

4.1 Data Exchange between WIMO and RSRD

For detailed data description see “RollingStockDataSetQueryMessage” and “RollingStockDatasetMessage” as described in in Data and Message Model Telematics TSI, Appendix C, index [105].

4.2 Consignment Data - Opening the Cycle

This document doesn’t describe the database design, which gives more clearly the picture on the organisation of how the data are stored. Therefore, the following list shows only, which data are available. The data shall be stored in an “efficient” manner. The data must be based on the consignment order messages. The definition of the data structure is quoted Telematics TSI Data and Message Model Telematics TSI, Appendix C, index [105] and Common Interface Telematics TSI, Appendix C, index [104], including the specification of the data, the provider, user rights and timing.

4.3 Movement Data

For detailed data and message description see Telematics TSI Data and Message Model Telematics TSI, Appendix C, index [105] and Common Interface Telematics TSI, Appendix C, index [104].

The movement data are based on the event reporting for wagons from the responsible Railway Undertaking. Events must be reported by all of the Railway Undertakings and the Infrastructure Managers in the pre-defined route of the shipment. The reporting shall take place within one hour of the Event being reported. The Infrastructure Managers will be reporting on the train level to the Railway Undertakings, while the Railway Undertakings will be reporting on the Wagon / ILU level to the WIMO, mainly based on the train reporting messages. The WIMO system will

match the reporting, it checks the consistency of the data contents with the contents of the same already existing ones, updates specific information and stores additional one. This document doesn't describe the database design, which gives more clearly the picture on the organisation of how the data are stored.

The data shall be stored in an "efficient" manner. All reports and answers on queries based on this data shall show the logical transport chain of a wagon / shipment without redundant data.

5 DATA REQUIREMENTS

The complete definition of all the dataset elements to be used for the operation of WIMO are located at Telematics TSI Data and Message Model Telematics TSI, Appendix C, index [105]), which encloses the whole xml catalogue for the implementation of Telematics TSI after every Change Control Management cycle. Within this document is specified all the different elements, complex types and simplex types of the so called Telematics TSI data catalogue, among them the elements and messages used to implement the functionality described on this Appendix B for WIMO database.