UNTTC | Transport and trade connectivity in the age of pandemics

Analysis of information in the EDIFACT format data interchange and data matching in rail transport and the UN/CEFACT Reference Data Model for Multimodal Transport (MMT-RDM).

Contents

1. Introduction

Objective of this paper: Analyze and match data between several key documents accompanying cargo in multimodal transportation, in particular, rail transport, and the UN CEFACT Multimodal Transport Reference Data Model (MMT-RDM).

At this project phase the data shall be matched with the MMT-RDM and the first steps to create the concept of data conversion between information on rail transport between Eurasia and Western Europe and with other modes of transportation.

Using the relevant UN CEFACT standards, the Consultant shall:

Assess the need and level of implementation of international (UN CEFACT) semantic standards for data and document exchange in data interchange between railway systems in particular (and data on multimodal transport and document exchange in general), especially, in the context of trade and transport flows between the Eurasian Economic Union and Western Europe.

As part of existing digitalization efforts in the Eurasian Economic Union (in particular, as a part of Intertran project), compare data and data structures between Intertran solutions (e.g., EDIFACT IFTMIN message-based exchange) and the UN CEFACT Multimodal Transport Reference Data Model (MMT RDM).

Working in coordination with Belarus, UN CEFACT and other consultants under this project, compare these solutions in the Eurasian Economic Union with MMT RDM with solutions for digitization and document exchange in the railway sector in Western Europe.

On this basis, working with consultants from Belarus and UN/CEFACT and other experts, prepare a plan for converting data between different solutions.

If necessary, use the UN CEFACT standards developed for CIM/SMGS and SMGS consignment notes (https://unttc.org/stream/electronic-trade-and-transport-documents-and-data).

assessment and conversion scheme should cover existing and proposed technologies, including UN EDIFACT messages, XML and JSON API,

work with the relevant government agencies of Belarus, Russia, the Eurasian Economic Commission and possibly Kazakhstan on the practical implementation of digital tools for rail and multimodal exchange of data and documents along the corridors of the Eurasian Economic Union.

Develop a concept note/draft for the development of a rail data conversion tool in the Eurasian Economic Union and Western Europe, aligned with the UN CEFACT Multimodal Transport Reference Data Model and the Eurasian Economic Commission Data Model.

Through this work, promote interoperability among transport modes (rail and other) based on the UN CEFACT Multimodal Transport Reference Data Model.

Consult regularly with UN CEFACT experts to ensure compatibility and consistency with UN CEFACT reference standards and models.

The goal is to promote harmonization of electronic data interchange using global standards (UN CEFACT) in transport, trade and logistics and to prepare standards for electronic documents based on UN CEFACT semantic standards and reference data models. Consultant will focus on data matching and converting data into electronic document equivalents using UN CEFACT tools in countries developing a digital multimodal transportation corridor.

When carrying out transportation of goods under the Agreement on International Goods Transport by Rail (hereinafter - SMGS) information support of transportation is provided through the exchange of information between the carriers, as necessary for the issuance of documents in electronic form related to the transportation of goods.

The technology of information support of cargo transportation determines the exchange of electronic data: the SMGS consignment note from the end of issuance of the SMGS consignment note at the station of departure up to the arrival of cargo at the destination station; about the train formation to issue an electronic transfer slip; in the interaction within the provision of preliminary information to customs authorities.

In order to provide information support for international freight traffic, the OSJD railroads carry out an electronic data interchange using electronic messages in the structure of the UN EDIFACT international standard.

2. Application of EDIFACT standard with OSJD

For uniform application of the OSJD electronic message standards, leaflets R942 "Technology of information support of SMGS freight traffic under the UN/EDIFACT standard in the electronic data exchange", R943 "Standard electronic message library for international SMGS freight traffic under the UN/EDIFACT standard" and R944 "List of classifiers and codes of the data elements" were developed and recommended for use. Library of the lists of codes for the freight traffic under the SMGS terms.

The UN/EDIFACT standard has three main components:

- The data elements, summarized in a dictionary (or in another way, a directory) are like words of a language which is used to transmit the data;

- Syntax which serves as a grammar of the language and is a set of rules underlying the structure of messages;

- Dictionary (library, directory) of standard messages serving as a reference base for the selection of specific business (transport) documents, built in accordance with the rules of syntax.

Description of the generation of electronic messages

A data element is a data unit for which methods for identifying, describing and representing a value are defined. The element directory is specified by the UNECE WG.4 (hereinafter CEFACT) and includes identifiers (qualifiers) and descriptions of elements according to the division into the following groups:

Group 0 - Service data elements
Group 1 - Documentation, references
Group 2 - Date, time, time periods
Group 3 - Parties, addresses, items, countries
Group 4 - Articles, circumstances, conditions, instructions
Group 5 - Cost amounts, percent
Group 6 - Indicators of measures, quantities (save for money)
Group 7 - Goods and products: descriptions and designations
Group 8 - Types and means of transport, containers
Group 9 - All other data elements (customs and government formalities, etc.)

A segment is a pre-determined set of functionally interrelated data elements identified by their ordinal positions in the set (for example: a partner, its address and location, date, period and their format, a document with its details, a currency with its description etc.). Each segment has a structure as defined and described in the UN EDIFACT Segment Directory. Two types of segments should be distinguished in one message - the service and application ones. The service segments always start with the letters UN (United Nations) and refer to the syntax. Application segments contain real data required by application programs. Their name TAG is an abbreviation of the full name in English (DOC for document, NAD for partner and address, LOC for location, etc.).

Segment groups. In a single message, segments can be combined into groups, so that it is possible to describe not only the entity, but also its characteristics.

For example: a segment group, which in the chapter contains a segment NAD (partner name) and is complemented by segments DOC

(documents and LOC (location), determines not only the partner, but also its documents and location.

Element in the segment. In terms of its representation in the segment it is necessary to distinguish between two types of elements: a single conventional element used (for example: country code, code for the name of the partner - consignor or consignee, etc.) and composite element (composite), which consists of different or identical sub-elements (for example: date, consisting of the day of month and year, address, composed of several lines - house, street, city, etc.).

Standard messages. An exchange message is defined as "a ranked set of data intended for the transmission of information". Message within the structure of the UN/EDIFACT standard is a set of segments, arranged in a sequence specified in the message directory. The set starts with the message header (UNH segment) and ends with the end of the message (UNT segment).

2.1 UN/EDIFACT reference books (directories)

International Trade Data Element **Directory - UNTDED** -. Standard data elements can be used in any method of data exchange, both on paper and through electronic data transfer. In addition to data elements, the directory includes a section with references to codes and international general-purpose classifiers that can be used to represent data in coded form.

Handbook for the Electronic Interchange of Trade (Transport) Data - **UNTDID.**

The Handbook contains general semantic and syntactic rules for performing standard data transfer functions.

The Handbook includes inter alia - the syntax rules (ISO 9735) of GOST 6.20.1.90.

Directories include message libraries (EDMD), segment libraries (EDSD) and element codes (UNCL).

The Data Segment Directory (EDSD) includes segment assignments, segment names (TAG) and their codes, segment specifications (codes, names, statuses, field lengths).

The Element Data Component Directory (EDCD) is intended for use in various segments to represent trade and transport information segments.

The directory of messages includes standard messages that have received the appropriate status and are recommended for use by the UNECE and the European Union (CEN).

The leaflets form the basis for a library of messages in the UN/EDIFACT structure that could be used by railroads, railway undertakings and/or in

interaction with the participants of transportation (customers, freight forwarders, customs and other public authorities, insurance companies, banks, etc.), which operate within the framework and according to the rules of the Agreement on International Goods Transport by Rail (SMGS) for freight transportation in international traffic.

The library allows its users to obtain a description of standard electronic messages in the form required for use in application projects and information technologies that ensure the procedure for the transportation of goods in international traffic under SMGS rules.

The scope of application extends to any international message interchange within the structure of the UN/EDIFACT standard.

The messages presented in the leaflet are intended for use in the interchange of information between railroads and railway undertakings affiliated with the OSJD under the SMGS agreement and also between railways with a gauge of 1520 mm. It is assumed that the interchange is carried out between the information systems of railway undertakings in freight traffic in international traffic, and that the participants of information interchange have entered into a relevant Data Interchange Agreement.

OSJD Leaflet R 943 defines the form of presentation of a standard electronic message, which is presented in the form of a description of the information message (Message-Guidelines) and contains the data:

- on the Message Branching Diagram;
- segment descriptions;
- a list of codes or names of codifiers (classifiers).

A message branching diagram is a diagram where the segments and groups of segments included in a message are arranged in a particular order among themselves and by levels. In the description text, the location of the segment on the diagram is determined by the symbols: m. mm. AAA, where:

m is the level at which this segment is located;

mm - the number of the segment group which part the segment is;

AAA - segment name (TAG) according to the Segment Directory.

For example: 1.03.LOC - means that the LOC segment is on the first level and is included in the third segment group.

It is to note that segments with the same name (with the same TAG) may be present in different branching coordinates. At the same time, they perform different semantic functions, while being identical in structure.

For example: the LOC segment - “location”, can, depending on its location in the diagram and association with a group, determine the location

of departure, arrival or transit stations, as well as the location of customs, consignor, freight forwarder, etc.

Please specify in the service part of the segment description the number of repetitions permitted at the specified location and the segment status:

M – mandatory;

C – conditional, optional, i.e., which is indicated under certain circumstances.

The segment description contains the detailed (elementwise) content of the segment and the order in which the variable data are entered in relation to its location. Concurrently, the description of the same segment (which has the same name - TAG) will differ depending on its location or repetitions (cases) of use.

Data elements or a group of elements - a composition - within a segment are given in strict compliance with its structure. For elements or a group of elements in their specific place, as well as for segments, their status is specified as follows:

M - mandatory

C - conditionally mandatory.

For each element, a representation of the data values is specified as follows:

a - alphabetic characters;
n - numeric characters;
an – alphabetic and numeric characters;
a3 – 3 alphabetic characters of constant length;
a3 – 3 numeric characters of constant length;
a3 – 3 alphabetic and numeric characters of constant length;
a...3 - up to 3 alphabetic characters;
n...3 - up to 3 numeric characters;
an...3 - up to 3 alphabetic and numeric characters;

The notes for a group of segments, segments, individual elements and groups of elements include the source and order of receipt of data, codes or other (textual) information. They include columns of source documents, codes, code lists, classifiers, as well as they may include lines and details of relevant electronic messages of national information systems.

It is to note that the message description may use, along with standard international codes, national and local codes, while respecting the EDIFACT structure and the relevant capabilities.

Description of the message is confined to a description of the data, summarized in standard segments or segment groups. Segment descriptions represent data elements and groups of data elements - compositions. Data elements contain codes that qualify the specification of the relevant data element. The

sequence of data elements within one segment is an unchangeable hierarchical structure.

The description shall include the index, field, status and name of the element (group of elements), as well as the value and directions for use. Furthermore, for relevant items the column of the SMGS consignment note is s specified to which these data relate.

In addition to the standard EDIFACT Data Element Library, the message description uses code lists adopted jointly by OSJD/UIC and not stipulated in these documents. At the same time, the OSJD is listed as the responsible organization (code 288). In all cases where the codes required for use are not included in the EDIFACT data element library, the description should be referenced via e.g. 1131 - name of the code list and e.g. 3055 - the organization responsible for the code list.

The status represents part of the EDIFACT standard and denotes the minimum which is required to fulfill the message structure requirements. For segments, segment groups, data items and item groups, a status indicator is used in the message description:

M = Mandatory;

C = Conditional.

The status indicator M means that the message shall mandatory contain this element.

The status indicator C in a particular application can be represented via an application (user) indicator with the values R, D, O or X. The status indicator C is used by agreement between the parties to the exchange.

No segment may be used without including at least one data element.

EDIFACT	Application	Notes
M = Mandatory	M = Mandatory	Indicates that the data element is mandatory in the message
C = Conditional	R = Required (required)	Indicates that the data item is to be transmitted according to the conditions of this application
C = Conditional	D = Depending	Indicates that the use of a data item depends on certain conditions. The conditions should be specified in the appropriate application manual.
C = Conditional	O = Optional	Indicates that the data element is

		transmitted at the consignor's discretion
C = Conditional	X	Indicates that the data element is not used in this application.

2.3. IFTMIN Electronic message about the cargo shipment (compilation of a shipping dossier) for the SMGS consignment note

The message has been developed for the application on the OSJD railroads in international freight traffic using the SMGS consignment note and is an electronic message on the cargo dispatch (preparation of a transport dossier for transportation) standardized for railway traffic under the SMGS consignment note.

Message IFTMIN is designed for a complete description of the boxes of the SMGS consignment note, sent by the consignor of the goods to the carrier, which is the railroad responsible for the transport of goods.

The message informs of the acceptance of cargo for carriage under the SMGS consignment note at the station of departure, as well as changes in the travel route for operations occurring with the cargo in transit and at the point of destination.

The use of the message to describe the consignment note and how the information is used is defined in the application project.

The data source for the IFTMIN message is the National Information System (NIS) database of the railway undertaking, which contains the transportation dossier.

The IFTMIN 97A message was used as the basis for developing the message, which was adapted and standardized by the Edifer Bureau for use in rail transport.

It is recommended to use the IFTMCS message for information of some events and operations occurring with the cargo in transit and at the destination point, which should be indicated in the consignment note.

A technical description of the IFTMIN data structure is given in *Annex 1*.

3. XSD-scheme of the Multimodal Transportation Data Reference Model and its integral components

The CIM/SMGS Multimodal Transport Reference Data Model UNCEFACT (RDM-MMT) Consignment Note Scheme comprises the target name space, which includes 3 external schema modules whose data structures apply for the issuance of the primary document, the electronic consignment note:

QualifiedDataType:103;
ReusableAggregateBusinessInformationEntity:103;
UnqualifiedDataType:27;
MMTCIM-SMGSConsignmentNoteURL - consignment note details

MMTCIM-SMGSConsignmentNoteURL_100pD20A.xsd:

```
<xsd:schema xmlns:rsm="urn:un:unece:uncefact:data:MMTCIM-
SMGSConsignmentNoteURL:100"
   xmlns:xsd="http://www.w3.org/2001/XMLSchema"
   xmlns:qdt="urn:un:unece:uncefact:data:standard:QualifiedDataType:103"

xmlns:ram="urn:un:unece:uncefact:data:standard:ReusableAggregateBusinessInfor
mationEntity:103"
   xmlns:udt="urn:un:unece:uncefact:data:standard:UnqualifiedDataType:27"
   targetNamespace="urn:un:unece:uncefact:data:MMTCIM-
SMGSConsignmentNoteURL:100"
   elementFormDefault="qualified"
   version="100.D20A">
  <xsd:import
namespace="urn:un:unece:uncefact:data:standard:QualifiedDataType:103"
schemaLocation="MMTCIM-
SMGSConsignmentNoteURL_100pD20A_urn_un_unece_uncefact_data_standard
_QualifiedDataType_103.xsd"/>
  <xsd:import
namespace="urn:un:unece:uncefact:data:standard:ReusableAggregateBusinessInfo
rmationEntity:103" schemaLocation="MMTCIM-
SMGSConsignmentNoteURL_100pD20A_urn_un_unece_uncefact_data_standard
_ReusableAggregateBusinessInformationEntity_103.xsd"/>
  <xsd:import
namespace="urn:un:unece:uncefact:data:standard:UnqualifiedDataType:27"
schemaLocation="MMTCIM-
SMGSConsignmentNoteURL_100pD20A_urn_un_unece_uncefact_data_standard
_UnqualifiedDataType_27.xsd"/>
  <xsd:element name="MMTCIM-SMGSConsignmentNoteURL"
type="rsm:MMTCIM-SMGSConsignmentNoteURLType"/>
  <xsd:complexType name="MMTCIM-SMGSConsignmentNoteURLType">
    <xsd:annotation>
      <xsd:documentation source="BN/BN">MMT CIM-SMGS Consignment Note
(URL)</xsd:documentation>
    </xsd:annotation>
    <xsd:sequence>
      <xsd:element name="ExchangedDocument"
type="ram:ExchangedDocumentType" minOccurs="0"/>
```

```
    <xsd:element name="SpecifiedSupplyChainConsignment"
type="ram:SupplyChainConsignmentType"/>
   </xsd:sequence>
  </xsd:complexType>
</xsd:schema>
```

Each external module is comprised of the following objects:

1. Module MMTCIM-SMGSConsignmentNoteURL_100pD20A_urn_un_unece_uncefact_data_standard_ReusableAggregateBusinessInformationEntity_103.xsd (XML schema shown in *Annex 2*) - aggregate business information object which is comprised of data structures that ensure the issuance of an electronic image of CIM/SMGS consignment note in xml format for each specific shipment. The module includes elements containing composite data types:

AuthoritativeSignatoryPersonType
CrossBorderRegulatoryProcedureType
DocumentAuthenticationType
DocumentClauseType
ExchangedDocumentType
LogisticsLocationType
LogisticsSealType
LogisticsServiceChargeType
LogisticsShippingMarksType
LogisticsTransportEquipmentType
LogisticsTransportMovementType
NoteType
ProductClassificationType
ReferencedDocumentType
SupplyChainConsignmentItemType
SupplyChainConsignmentType
SupplyChainTradeLineItemType
TradeAddressType
TradeContactType
TradeCurrencyExchangeType
TradeDeliveryTermsType
TradePartyType
TradeProductType
TransportDangerousGoodsType
TransportEventType

TransportRouteType
UniversalCommunicationType

2. **Module MMTCIM-SMGSConsignmentNoteURL_100pD20A_urn_un_unece_uncefact_data_standard_QualifiedDataType_103.xsd** (XML schema is shown in Annex 3) containing qualified data types, which are defined UBL (Universal Business Language), and containing standardized directories and libraries used to describe document types, standard operations. Represents a list of classifiers and data element codes used in the electronic data exchange and is comprised of:

the composite data types:
CountryIDType
CurrencyCodeType
DangerousGoodsPackagingLevelCodeType
DangerousGoodsRegulationCodeType
DeliveryTermsCodeType
DeliveryTermsFunctionCodeType
DocumentCodeType
MarkingInstructionCodeType
MessageFunctionCodeType
PackageTypeCodeType
SealTypeCodeType
TransportEquipmentSizeTypeCodeType
TransportMovementStageCodeType
TransportServicePaymentArrangementCodeType
UnitMeasureType
WeightUnitMeasureType
And simple data types:
CountryIDSchemeAgencyIDContentType
CurrencyCodeListAgencyIDContentType
DangerousGoodsPackagingLevelCodeListAgencyIDContentType
DangerousGoodsRegulationCodeListAgencyIDContentType
DeliveryTermsCodeListAgencyIDContentType
DeliveryTermsFunctionCodeListAgencyIDContentType
DocumentCodeListAgencyIDContentType
MarkingInstructionCodeListAgencyIDContentType
MessageFunctionCodeListAgencyIDContentType
PackageTypeCodeListAgencyIDContentType
TransportEquipmentSizeTypeCodeListAgencyIDContentType

TransportMovementStageCodeListAgencyIDContentType
TransportServicePaymentArrangementCodeListAgencyIDContentType

3. Module MMTCIM-SMGSConsignmentNoteURL_100pD20A_urn_un_unece_uncefact_data_standard_UnqualifiedDataType_27.xsd - containing unqualified type (UDT) UNCEFACT (XML schema is shown in Annex 4), which describes attributes of standardized data types:

AmountType
CodeType
DateTimeType
IDType
NumericType
QuantityType
RateType
TextType

4. **Module MMT CIM-SMGS Consignment Note (URL)** - containing service information of data interchange, information about the transported cargo, consignor, consignee, as well as procedures and operations performed en route. It has two integral elements:

A) element name="ExchangedDocument" type="ram:ExchangedDocumentType" minOccurs="0" – service information containing the exchange header, sender/recipient of the interchange, technical information about the consignment note and attached documents.

B) element name="SpecifiedSupplyChainConsignment" type="ram:SupplyChainConsignmentType" - information about a particular shipment.

4. Criteria used in data comparison.

In order to compare data and data structures used in rail transport in the Eurasian Economic Union (including Intertran) and RDM MMT CEFACT UN, as well as to build a concept of the data conversion tool it is required to:

1. Compare the segments containing the composite data types of SMGS consignment note in EDIFACT format and composite data types of Multi-Modal Transport Reference Data Model (MMT-RDM), as well as decomposition of composite elements of SMGS consignment note into simple types for mutual association with simple data types of Multi-Modal Transport Reference Data

Model (MMT-RDM).

2. Consider that the segments of the SMGS consignment note, contain elements included in the appropriate libraries of classifiers of reference information. For example: the element IFTMIN CUX+1:X+3:Y - X= currency of the tariff underlying the calculation of the carriage charges to be charged to the recipient, Y= currency in which the carriage charges to be charged to the recipient, in MMT-RDM - target namespace urn:un:unece:uncefact:codelist:standard:ISO:ISO3AlphaCurrencyCode:2012-08-31, which contains simple data type - currency codes:

```
simpleType name="ISO3AlphaCurrencyCodeContentType">
    <xsd:restriction base="xsd:token">
      <xsd:enumeration value="AED"/>
      <xsd:enumeration value="AFN"/>
      <xsd:enumeration value="ALL"/>
      <xsd:enumeration value="AMD"/>
      <xsd:enumeration value="ANG"/> etc.
```

3. It is to note that in IFTMIN the segments of the same name can be present in different branching coordinates, for example: the LOC-DTM segment group is present both in the 1st segment group describing the locations and date/time relevant for the entire message, e.g.: place of transfer of cargo to the subsequent carrier, also in segment group 9 - describing the locations and date/time related to the transportation phase - for example: origin of shipment, place of destination. The LOC segment is present in segment group 11, which identifies the participants of transportation, links to their relationships, location and contacts, the necessary documents and invoices to be paid by the partner. At the same time, all the above segments perform different semantic functions, while being identical in structure.

It is to note that for the purpose of comparison of data elements, they can be divided into the following groups:

1. Technical data of the interchange - message identifiers, source and recipient of information, date and time of message transmission, etc.;

2. Master data are characteristic properties that describe objects and subjects on a "What is it" basis. They can include information about carriers, places of border crossing, qualitative and quantitative characteristics of the cargo.

3. Operational data is the so-called reference information, which is usually associated with the master data and describes the sender and recipient name, the classifications applied, delivery dates, etc.;

4. Trade data - containing information about the cost performance of the goods transported, carriage charges, etc.;

5. Information about the characteristics of the carriage of goods - data affecting the safety of transportation and cargo security.

Therefore, it allows to compare segments and data elements EDIFACT IFTMIN with tags and data elements MMT-RDM using elementwise decomposition of xsd-scheme reference data model, the work of UNECE experts in describing the standard data model, as well as UN CEFACT standards developed for CIM/SMGS and SMGS consignment notes (https://unttc.org/stream/electronic-trade-and-transport-documents-and-data).

This approach ensures more correct finding the data match, which is taken into account by UN/CEFACT experts when preparing versions of the CEFACT Reference Data Model.

The following features are identified in the course of finding a data match:

1. The mandatory service data elements in IFTMIN, which provide the rules for message construction and syntax, may not be considered in the CEFACT reference data model. This is due to the simpler syntax for building XML files. Such data include "Syntax Identifier", "Message Identification". Then it should be considered that the conversion of data from the IFTMIN EDIFACT to the reference model data will be performed either by the person who received this IFTMIN or by the next carrier.

2. The absence of the code of the supplementary consignment note (qdt:DocumentCodeType) in the library of RDM-MMT directories of document types, which does not allow conversion and transfer of data to the recipient of information in case of uncoupling of railcars from the main dispatch.

Paragraph 33 of the Rules for Freight Traffic (Annex 1 to the Agreement on International Goods Transport by Rail) stipulates that if on route one or several wagons are uncoupled from a group of wagons carried under one consignment note, the carrier makes a note "Wagon uncoupled" in the field "Carrier's notes" in the Wagon List or Container List in front of the information about the uncoupled wagon or in the field "Wagon" in the consignment note. If the wagon will be sent to the destination station, the carrier issues a document for each uncoupled wagon and in the column "Carrier's Notes" of the consignment note the carrier puts a mark "Wagon No. is supplementary sent (name of the document, its number)", which it certifies with its stamp. (See *Annex* 5 for instructions on how to fill out the supplementary consignment note).

Peculiarities of transferring IFTMIN information for the supplementary consignment note for the uncoupled wagon are given in Appendix 6.

3. Different data formats in IFTMIN have the same meaning. So, for example, the mandatory element associated with the date and time of the transmitted message has the format YYMMDD (element UNB.S004.0017) and HHMM (element UNB.S004.0019), and the DTM segment has the format ***CCYYMMDDHHMM.*** The RDM-MMT reference data model XSD schema references a single udt :DateTimeType element for all elements related to date and time.

4. Segments with the same name and structure have different semantic functions. At the same time, they are present in different branches of the IFTMIN branching. The semantic functionality of a segment when interchanging data is determined by the description of the data element, which has a coded form for use within EDIFACT. Therefore, the FTX (free text) segment is used to indicate:

- transportation status,
- additional marks on the OP SMGS (line 64) - to be filled out by the carrier;
- information not intended for the carrier (SMGS line 25);
- of the consignor's statements (line 3 of SMGS);
- travel route (border crossing stations) (line 6 of SMGS);
- marks for the calculation and collection of carriage charges (line 64 of SMGS) - to be filled out by the carrier;
- marks of the carrier (line 30 of the SMGS);
- information of the carrier's statement (line 31 of SMGS);
- extension of delivery time (line 32 of SMGS) - to be filled out by the carrier;
- sign of paperless transportation (electronic consignment note).

The mutual association of identical elements of the Reference Data Model is provided by the full description of the segment without breaking it into separate elements.

The FTX segment is also present in Segment Group 4 - Government Requirements. For OSJD conditions, this segment is used to submit notes for customs and other administrative formalities. The FTX segment cannot be used without filling out the GOR segment. Therefore, the mutual association must be performed on the two segments with the corresponding elements with RDM-MMT.

A comparison of IFTMIN segments with the same structure and their quantitative use with RDM-MMT elements is shown in *Annex 7*.

5. The reference data model provides data elements that describe the documents attached by the BSP Master/Exchanged_ Document/Reference sender. Referenced_ Document. In the xsd schema the element structure consists of several data types:

```
<xsd:element name="ReferenceReferencedDocument"
type="ram:ReferencedDocumentType" minOccurs="0" maxOccurs="unbounded">
```

```
            <xsd:complexType name="ReferencedDocumentType">
               <xsd:annotation>
                 <xsd:documentation source="BN/BN">Referenced
Document</xsd:documentation>
               </xsd:annotation>
              <xsd:sequence>
                 <xsd:element name="StatusCode"
type="qdt:DocumentStatusCodeType" minOccurs="0">
                    <xsd:complexType name="DocumentStatusCodeType">
                      <xsd:simpleContent>
                        <xsd:extension
base="clm61373:DocumentStatusCodeContentType">
                          <xsd:attribute name="listAgencyID"
type="qdt:DocumentStatusCodeListAgencyIDContentType" fixed="6" />
                        </xsd:extension>
                      </xsd:simpleContent>
                    </xsd:complexType>
                 </xsd:element>
        <xsd:element name="TypeCode" type="qdt:DocumentCodeType"
minOccurs="0">
          <xsd:complexType name="DocumentCodeType">
           <xsd:simpleContent>
            <xsd:extension base="clm61001:DocumentNameCodeContentType">
             <xsd:attribute name="listAgencyID"
type="qdt:DocumentCodeListAgencyIDContentType" fixed="6" />
            </xsd:extension>
           </xsd:simpleContent>
          </xsd:complexType>
        </xsd:element>
        <xsd:element name="ID" type="udt:IDType" minOccurs="0">
            <xsd:complexType name="IDType">
               <xsd:simpleContent>
                 <xsd:extension base="xsd:token">
                   <xsd:attribute name="schemeID" type="xsd:token" />
                 <xsd:attribute name="schemeAgencyID" type="xsd:token" />
               </xsd:extension>
             </xsd:simpleContent>
            </xsd:complexType>
        </xsd:element>
        <xsd:element name="FormattedIssueDateTime"
type="qdt:FormattedDateTimeType" minOccurs="0">
            <xsd:complexType name="FormattedDateTimeType">
             <xsd:sequence>
              <xsd:element name="DateTimeString">
               <xsd:complexType>
                <xsd:simpleContent>
                 <xsd:extension base="xsd:string">
                  <xsd:attribute name="format"
type="clm62379:TimePointFormatCodeContentType" />
                 </xsd:extension>
                </xsd:simpleContent>
               </xsd:complexType>
              </xsd:element>
             </xsd:sequence>
           </xsd:complexType>
        </xsd:element>
```

IFTMIN provides for the transmission of documents attached by the sender. Documents must be described in segment IFTMIN.BGM.C002.1001. However, for each document, attached by the sender according to OSJD rules a separate message is generated, while the number of the consignment note serves as a link with the consignment note. The List of Classifiers and Codes for Data

Elements (Library of Lists of Codes for Freight Traffic on SMGS terms) (OSJD Leaflet P-444) specifies that data element 1001 has two meanings, as a coding of the document underlying the message issued the code of the title of the document attached by the sender.

Therefore, it is necessary to determine the status of BSP Master/Exchanged_ Document/Reference within MMT-RDM Master/Exchanged_ Document/Reference. Referenced_ Document - as a data element describing the transmission of electronic documents attached by the sender or as a list of documents attached by the sender to the consignment note?

6. BSP Master/Specified elements. Supply Chain_ Consignment/Total Charge. Amount and BSP Master/Specified. Supply Chain_ Consignment/Total Collect Charge. Amount describes data on payment of all charges for transportation and related services, and data on payment of all charges for transportation and related services collected from the recipient, respectively.

XSD diagram of these data elements:

```
<xsd:element name="TotalChargeAmount" type="udt:AmountType" minOccurs="0">
            <xsd:annotation>
                <xsd:documentation source="BN/BN">Total Charge
Amount</xsd:documentation>
                  <xsd:complexType name="AmountType">
                    <xsd:simpleContent>
                      <xsd:extension base="xsd:decimal">
                       <xsd:attribute name="currencyID" type="xsd:token" />
                      </xsd:extension>
                    </xsd:simpleContent>
                  </xsd:complexType>
            </xsd:annotation>
        </xsd:element>
        <xsd:element name="TotalCollectChargeAmount" type="udt:AmountType"
minOccurs="0">
            <xsd:annotation>
                <xsd:documentation source="BN/BN">Total Collect Charge
Amount</xsd:documentation>
                 <xsd:complexType name="AmountType">
                  <xsd:simpleContent>
                   <xsd:extension base="xsd:decimal">
                    <xsd:attribute name="currencyID" type="xsd:token" />
                   </xsd:extension>
                  </xsd:simpleContent>
                 </xsd:complexType>
            </xsd:annotation>
        </xsd:element>
```

IFTMIN data element for the calculation of carriage charges:

C516	**MONEY AMOUNT**	**M**		**M/U**
	The amount of cargo or transportation service in the form of an amount of money in a declared currency.			
5025	**Descriptor of the type of money amount**	**M**	**an..3**	**M/U**

Specifying the type of amount when sending.

132	***The amount of carriage charges from the consignor in the tariff currency***
133	***The amount of carriage charges from the consignor in the currency of payment***
135	***The amount of carriage charges from the consignee in the currency of the tariff***
154	***The amount of carriage charges from the consignee in the currency of payment***
151	*Declared value of cargo*

5004 Money amount C n..18 R

Number of currency units.

6345 Currency, code C an..3 O

Identification of the name or symbol of the currency unit used in the transaction.

This element may contain a currency code according to ISO-4217

6343 Currency descriptor C an..3 X

A code that assigns a specific value to the data element 6345 Currency.

4405 Status, by code C an..3 X

Provides information related to the status of the assignment.

Examples:

MOA+132:128900:USD'
MOA+133:158800:RUB'
MOA+135:1500000:EUR'
MOA+154:2000000:BYN'

Therefore, the reference data model:

1. did not define the data element that describes payment of freight charges by the consignor (codes 132 and 133 of element IFTMIN.MOA.C516.5025). We can only assume that it is a BSP Master/Specified element. Supply Chain_ Consignment/Total Charge. Amount, but according to the description of the element it is defined as a total amount of payments;
2. There is no separation of payments by tariff currency (codes 132, 135) and payment currency (135, 154), which does not allow to unambiguously convert data from EDIFACT to XML, and, therefore, to interpret the most significant value data as financial data (only one type of payment providing association to IFTMIN data, namely BSP Master/Specified is provided. Supply Chain_ Consignment/Total Collect Charge. Amount.)

7. The MMT-RDM describes the BSP **Master/Exchanged_ Document/Reference element. Referenced_ Document**- as other documents

referenced by the electronic consignment note during the interchange. That is, we can assume that this element corresponds to the segment IFTMIN.DOC - "Details of the document. The classification of documents and their coding are outlined in leaflet P944:

Data element:	**1001**
Name:	**Name code of the document attached by the consignor**
Description:	Code describing the name of the document
UIC format:	
Agency Format	an..3
Status:	0
Note:	

Reference to the list of codes

Type:	4
Agency:	UN/EDIFACT
Document:	UNTDID/UNCL

According to the description of leaflet P944 - for OSJD conditions this segment is used for listing documents in paper or electronic form, including additional information: number of copies of the document, abbreviated name of the railroad, on which the document is withdrawn. The DOC segment lists only nine documents, in accordance with the rules for filling the segment. The rest are made in segment group 13 under the cargo consignor (NAD+CZ).

In the Reference Data Model, the attached documents in the xsd schema are represented as a complex element, with the following properties

```
<xsd:element name="ReferenceReferencedDocument"
type="ram:ReferencedDocumentType" minOccurs="0" maxOccurs="unbounded">
            <xsd:complexType name="ReferencedDocumentType">
               <xsd:annotation>
                 <xsd:documentation source="BN/BN">Referenced
Document</xsd:documentation>
               </xsd:annotation>
              <xsd:sequence>
                 <xsd:element name="StatusCode"
type="qdt:DocumentStatusCodeType" minOccurs="0">
                    <xsd:complexType name="DocumentStatusCodeType">
                      <xsd:simpleContent>
                        <xsd:extension
base="clm61373:DocumentStatusCodeContentType">
                          <xsd:attribute name="listAgencyID"
type="qdt:DocumentStatusCodeListAgencyIDContentType" fixed="6" />
                        </xsd:extension>
                      </xsd:simpleContent>
                    </xsd:complexType>
                 </xsd:element>
        <xsd:element name="TypeCode" type="qdt:DocumentCodeType"
minOccurs="0">
          <xsd:complexType name="DocumentCodeType">
           <xsd:simpleContent>
            <xsd:extension base="clm61001:DocumentNameCodeContentType">
             <xsd:attribute name="listAgencyID"
type="qdt:DocumentCodeListAgencyIDContentType" fixed="6" />
            </xsd:extension>
           </xsd:simpleContent>
```

```
          </xsd:complexType>
        </xsd:element>
        <xsd:element name="ID" type="udt:IDType" minOccurs="0">
            <xsd:complexType name="IDType">
               <xsd:simpleContent>
                 <xsd:extension base="xsd:token">
                   <xsd:attribute name="schemeID" type="xsd:token" />
                 <xsd:attribute name="schemeAgencyID" type="xsd:token" />
                </xsd:extension>
             </xsd:simpleContent>
            </xsd:complexType>
        </xsd:element>
        <xsd:element name="FormattedIssueDateTime"
type="qdt:FormattedDateTimeType" minOccurs="0">
            <xsd:complexType name="FormattedDateTimeType">
             <xsd:sequence>
              <xsd:element name="DateTimeString">
               <xsd:complexType>
                <xsd:simpleContent>
                 <xsd:extension base="xsd:string">
                  <xsd:attribute name="format"
type="clm62379:TimePointFormatCodeContentType" />
                 </xsd:extension>
                </xsd:simpleContent>
               </xsd:complexType>
              </xsd:element>
             </xsd:sequence>
          </xsd:complexType>
        </xsd:element>
```

The maxOccurs="unbounded" property indicates an unlimited number of uses for these documents, while the IFTMIN segment as such is confined to 9 documents. Therefore, when converting data, the association must be established not only between the "ReferenceReferencedDocument" element and the DOC segment, but also between the segment group 13 following the consignor information.

8. When the xsd schema is decomposed by the FormattedDateTimeType element, the data attributes are fixed. However, in none of the tables presented, these attributes are present.

```
<xsd:simpleType name="TimePointFormatCodeContentType">
    <xsd:restriction base="xsd:string">
        <xsd:enumeration value="102" />
        <xsd:enumeration value="203" />
        <xsd:enumeration value="205" />
        <xsd:enumeration value="209" />
        <xsd:enumeration value="502" />
        <xsd:enumeration value="602" />
    </xsd:restriction>
</xsd:simpleType>
```

Note that the ReferenceReferencedDocument tag is a compound element that contains information about document properties:

- about its status (reference **Referenced_ Document. Status. Code). It is no note that only one attribute of the directory and code set by the OSJD leaflet is associated by code 4 -** ***Document is prepared as a message for electronic interchange. It indicates that the submitted document-message will be***

transmitted by a separate electronic message. The paper media in the Reference Data Model has code 6, which does not match the IFTMIN coding.

9. IFTMIN lacks the structured data elements shown in the MMT Reference Model, such as:

- BSP Master. Specified. Supply Chain_ Consignment/ Consignor Assigned. Identifier - Unique identifier assigned by the consignor of a given shipment in the supply chain.

5. Principles of construction of data convention tool

As part of the concept of conversion of SMGS consignment note data in EDIFACT format into the XML format of the CIM/SMGS multimodal transportation data reference model, a number of questions need to be answered:

1. It is necessary to take into account what person completes these or other lines of consignment note - by the consignor, consignee or carrier. Therefore, for the purposes of conversion, it is reasonable to divide the data elements of the FTX IFTMIN segment to ensure association with the corresponding RDM-MMT data elements into data to be filled by the consignor and data to be filled by the carrier.

1. For what purposes the converted data will be used, i.e. to organize seamless interaction:

- between rail carriers,
- between carriers of different modes of transport,
- between the rail carrier and the state administrative authorities,
- between carriers and consignors/consignees?

That is, a specific solution on the amount of convertible and transmitted data must be developed for each interaction. Therefore, for rail carriers all mandatory data, as well as all data related to the security of transport and cargo safety must be converted to the format of the reference data model. The MMT CIM-SMGS Consignment Note structure should be updated to represent the identified data inconsistencies.

As an example, *Annexes 8-9* show the same SMGS consignment note involved in the transportation of goods under INTERTRAN project, in EDIFACT format (when transmitted to the Belarusian side) and in XML format for interaction with the Russian customs authorities.

2. What application rules should be developed to transfer data from one format to another or to use existing conversion tools when transferring data without loss of quality and volume of transferred data?

Therefore, when converting data from EDIFACT format to XML format no transfer of data related to the rules of generation and syntax message IFTMIN is required.

3. Displaying the key issues when correlating the structure and data formats generated in the EDIFACT and MMT-RDM standard.

4. Application and use of unified reference information related to classification and coding.

The converter as such should be an independent software designed to convert data from railway transportation documents submitted in the EDIFACT standard (IFTMIN message structure) into electronic documents in XML format in the structure of the UN CEFACT Reference Data Model for Multimodal Transport (MMT-RDM).

The basis of such a converter should be the rules of data conversion, which should provide data conversion without loss of its logical and semantic meaning. To develop such rules a comparison (mapping) of message structures IFTMIN and MMT-RDM was carried out. The table in *Annex 10* shows the mapping results. This table includes the data elements that can be contained in railroad consignment notes and, accordingly, in IFTMIN. In the course of the comparison (mapping), each data item from the IFTMIN message was trying to find the corresponding path within the MMT. It is to note that it was not always possible to find such a match.

The conversion tool will use 3 components to convert data: 1) source document (electronic consignment note) in EDIFACT format (IFTMIN message); 2) rules of data transfer from IFTMIN to message, to the developed mapping files of transportation documents with MMT-RDM and 3) specification of electronic message (electronic equivalent of SMGS, CIM or CIM/SMGS consignment note) within MMT structure.

As mentioned above, some of the data is used only on the railway transport. Therefore, it is not mandatory to incorporate them to IMT, as the MMT is designed to provide data exchange, which is used by all parties to multimodal transport process. However, within this approach it is not possible to create a conversion tool that will ensure the full conversion of data from IFTMIN to electronic messages within the MMT structure.

Therefore, it is necessary to supplement the RDM-MMT with all the missing data. This will allow the development of specifications of electronic messages as full-format equivalents of SMGS, CIM/SMGS and CIM consignment notes in XML format within the MMT structure. Based on these specifications and IFTMIN and MMT mapping files, it will be possible to develop a fully functional conversion tool that provides unambiguous conversion of IFTMIN to electronic

equivalents of SMGS, CIM/SMGS and CIM consignment notes) in JSON and XML formats within the MMT structure. This option would allow creating a data pipeline on the basis of MMT, sufficient for all parties to multimodal transportation process. Concurrently, each of the parties will be able to receive and use only the list of data from the MMT that it needs for their own needs, as well as for exchange with their multimodal transport partners. For this purpose, a number of appropriate special electronic messages in JSON and XML formats can be developed in the MMT structure.

6. Practical implementation

In 2022, the Eurasian Economic Commission intends to conduct an experiment on rail freight transportation in containers along the route between the terminal and logistics centers "East-West" (Kaliningrad region, railway station Chernyakhovsk) and "Bely Rast" (Moscow region, railway station Bely Rast) using electronic transportation data and digital services.

Transportation between the specified terminal and logistics centers must be carried out on the territory of Russia, the Republic of Lithuania and the Republic of Belarus.

In the course of the experiment it is intended to forgo the use of paper railway consignment note and transit declaration (customs declaration). It is envisaged to harmonize the data of electronic transport documents and electronic shipping documents.

This experiment is based on the experience of the INTERTRAN project and is implemented from December 2021, starting from the Bely Rast terminal under the following scheme: SMGS consignment notes for container shipments are issued electronically according to the UN/EDIFACT standard in the form of IFTMIN messages; forwarding documents are also issued electronically in the form of XML messages, which are based on national departmental standards of the Russian Federal Customs Service. The electronic documents shall become legally binding if signed by RF Electronic Digital Signatures (EDS RF) of the corresponding officers of the Bely Rast terminal. These electronic documents are used for customs clearance of goods exported from Russia. The transfer of container shipments to the Belarusian Railway is carried out by electronic shipping and accompanying documents. Recognition of the legal value of these electronic documents in Belarus is provided by the Trusted Third Party System (TTS), which automatically verifies and signs them with Electronic Digital Signatures of Belarus (EDS RB). It makes possible to ensure transit transportation of containers on the Belarusian Railway by electronic shipping and accompanying documents,

including Customs clearance for transit at the exit station of the Belarusian Railway in digital format.

Transfer of containers from the Belarusian Railway to the Lithuanian Railway is carried out with the use of electronic documents according to a similar scheme using the EDS system. However, there is a problem in such case associated with the Lithuanian Customs requirement to provide supporting documents in paper form. The experiment stipulates an interchange of shipping documents generated in accordance with the structure and format of the Reference Data Model.

Transfer of containers from the Lithuanian railroad to the Kaliningrad railroad of the Russian Federation is carried out with the use of electronic documents using the EDS system. Subsequent transportation and reception of the container at the destination station (Chernyakhovsk) is also made with the use of electronic shipping documents.

In this experiment, rail transport of a container between Bely Rast and Vostok-West terminals in transit through Belarus and Lithuania is considered to be a part of the multimodal routes between the countries of the Eurasian Economic Union and the European Union. The starting and end section of these routes will be covered by road transport. Further transportation from Kaliningrad region to EU countries and back is possible both by rail with transshipment to European gauge rolling stock (1435 mm), and by sea and road transport.

Conclusion.

1. The reference data model as a whole can be used to enable interaction between all stakeholders in the supply chain, including government agencies. Concurrently, the interchange is ensured not by the transfer of electronic documents, but a set of data needed to perform actions and operations in the transport of goods within the supply chain.

2. Harmonization and alignment of reference libraries on coding and classification of OSJD and CEFACT data elements is required to ensure correct identification of transmitted information.

3. As the practice of interaction with the state regulatory authorities shows, the application of unified rules for the conversion and generation of electronic transport documents using RDM-MMT will simplify procedures for the goods transfer across borders. The application of books of different formats by customs authorities, as well as the requirements for filling out electronic forms of transport documents as set out by transport and customs legislation results in delays at the border and in the customs declaration of goods, the application of risk management

systems by government agencies to minimize violations of legislation governing the international economic activity.

4. With consideration of the increasing use of XML, JSON formats, it is advisable within the OSJD to consider the issue of generation of reference data on data conversion between EDIFACT and RDM-MMT to ensure the creation of a "pipeline" of data in the application of seamless technologies.