UNTTC | **Transport and trade connectivity in the age of pandemics**

Reconciling a Standardized Dataset with international standards and data models, development of schemas for electronic equivalents of railway carriage documents SMGS, CIM/SMGS and CIM in XML and JSON formats

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Table of Contents

List of Annexes

Annex 1. Copies of the actual railway consignment notes

Annex 2. CIM/SMGS_Mapping.xls – comparison of CIM/SMGS fields to MMT-RDM (archived)

Annex 3. SMGS_Mapping.xls - correspondence of SMGS fields to MMT-RDM (archived)

Annex 4. CIM_Mapping.xls - correspondence of CIM fields to MMT-RDM (archived)

Annex 5. List of data for each railway document that are not matched in the MMT-RDM.

Annex 6. CIM_SMGS.json - presentation of CIM/SMGS in JSON format

Annex 7. CIM_SMGS.xml - presentation of CIM/SMGS in XML format

Annex 8. SMGS.json - representation of SMGS in JSON format

Annex 9. SMGS.xml - presentation of SMGS in XML format

Annex 10. CIM.json - CIM representation in JSON format

Annex 11. CIM.xml - presentation of CIM in XML format

Annex 12. IFTMIN_ Mapping.xls – comparison of IFTMIN and MMT RDM.

Annex 13. Presentation slides on the comparison of the consignor code and the UN code of dangerous goods. Comparison of consignment note and MMT.pptx fields

Introduction with executive brief

The current project has been initiated with the main objectives to support the development of digital multimodal transport corridors, increase the harmonization and standardization of data exchange in international transport and logistics, encourage electronic data exchange and thus to reduce people-to-people contacts during the COVID-19 crisis and in the post-pandemic recovery by using the relevant standards and Multimodal Reference Data Model (MMT RDM) of the United Nations Centre for Trade Facilitation and Electronic Business (UN/CEFACT).

This report covers the following main tasks and outputs:
1. Analysis of international trade flows passing through the Republic of Belarus, considering the use of SMGS consignment notes, CIM/SMGS and CIM consignment notes.
2. Analysis of digital interaction of participants in international freight rail and multimodal transport, including pilot projects of the EU and the EAEU.
3. Justification of the possibility and necessity of using the UN/CEFACT standard in international rail and multimodal transport.
4. Comparison of basic railway documents with the Multi-Modal Transport Reference Data Model (MMT-RDM).
5. Development of schemas of electronic equivalents of railway documents in xml and json formats.

Based on the conducted research, conclusions were drafted about the problems of direct conversion of shipping documents of different types of transport in international multimodal transportation. Options for solving these problems by freight forwarders in the framework of pilot projects are proposed. The roles and integration functions of freight forwarders in international multimodal freight transportation have been defined. Proposals have been developed to improve the Kaliningrad Transit pilot project, as well as the Zubr and Viking projects between the Baltic Sea and the Black Sea, with extension to the GUAM[1] and TRACECA[2] routes.

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[1] GUAM – Organization for Democracy and Economic Development (Azerbaijan, Georgia, Moldova and Ukraine)
[2] TRACECA – Transport Corridor Europe – Caucasus – Asia.

1. The Republic of Belarus as transit country

Belarus is situated at the crossroads of the main international transport routes as shown on Fig.1

- trans-European corridor No. 2, connecting the states of Western Europe with the East (West-East);
- trans-European corridor No. 9, with branch No. 9B, connecting the regions of the Black Sea coast with the countries of the Baltic Sea (North-South).
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FIGURE 1 : MAP OF THE MAIN TRANS-EUROPEAN TRANSPORT CORRIDORS PASSING BELARUS

Source:

Transport corridor No. 9 connects Finland, Lithuania, Russia, Belarus, Ukraine, Moldova, Romania, Bulgaria, and Greece, crosses the territory of the republic from north to south, bypassing large industrial centers - Vitebsk, Mogilev, Gomel.

The length of the Belarusian railway lines of transport corridor No. 9: the Teryukha-Gomel-Vitebsk-Ezerishche section - 489 km; section Gudogai-Molodechno-Minsk-Zhlobin - 372 km.

Transport corridor No. 2 Berlin – Warsaw – Minsk – Moscow – Nizhny Novgorod connects Germany, Poland, Belarus and Russia with extension to China. This corridor has been identified by the European Union as a priority corridor among the Cretan corridors due to the importance of trade flows passing through it in the West-East direction. Within the Republic of Belarus, the railway line runs in the direction of Brest – Minsk – Orsha – Osinovka. The length of the corridor through the territory of Belarus is 611 km.

2. Analysis of international cargo flows via Belarussian territory using SMGS, CIM/SMGS and CIM consignment notes

The Belarusian Railways (BRW) is working to increase the transit attractiveness of railway transport. At the same time, special attention is paid to the development of container transportation. Taking into account the global trend of containerization, as well as the trade and economic potential of China, Belarusian Railways, in cooperation with transport companies from Kazakhstan, China, Russia and the countries of the European Union, creates the necessary conditions for the development of cargo transportation in the framework of the Belt and Road Initiative.

The Belarusian Railways are successfully coping with the consequences of the global economic crisis provoked by the COVID-19 pandemic. In 2019, before the start of pandemic crisis, the total volume of containerized cargo transportation on the Belarusian Railways amounted to 732.9 thousand TEU containers, or 115.4% compared to 2018. In 2019, 338.5 thousand TEU containers were transported in transit through the territory of the Republic of Belarus along the China - Europe - China route, or 102.1% in comparison with 2018.

The international multimodal container trains "Viking" and "Zubr" have been operating for many years. The Viking train connects the infrastructure of the seaports of the Baltic and Black Sea regions (Lithuania - Belarus - Ukraine - Georgia / Azerbaijan / Moldova / Romania / Bulgaria and in the opposite direction). The Zubr container train connects the railway stations of Estonia (Tallinn - Valga), Latvia (Lugazi - Indra), Belarus (Bigosovo - Slovechno), Ukraine (Berezhest - Ilyichevsk / Ilyichevsk-Paromnaya / Odessa-Port / Mogilev-Podolsky , Fricatsey / Reni - Reni Port), and Moldova (Valcinets - Giurgiulesti / Etulia / Unghen).

The transportation of containers in the mentioned trains is carried out using the traditional paper shipping and commercial documents, which creates several well-

known problems. To eliminate them, it is advisable to take measures to transfer these trains operation to paperless technologies, using the new UN/CEFACT standards.

During the COVID-19 pandemic, there was an unprecedented jump in demand for transit container traffic between the countries of the Asia-Pacific region and the countries of the European Union using rail and multimodal routes running through the countries of the Eurasian Union (EAEU), including the Republic of Belarus. This is primarily due to the fact that the railways of these countries turned out to be the most resistant mode of transport to the negative effects of the economic crisis provoked by the COVID-19 pandemic. They kept tariffs at the pre-crisis level, while tariffs on alternative sea and air routes increased almost 10 times. This ensured a significant increase in the volume of transit container railway traffic along the EAEU routes in 2020 by more than 60%, and in 2021 - by more than 40% against the indicators of previous years. However, it should be noted that such volumes exceed the capacity of the infrastructure to ensure unhampered cargo flows. As a result, unprecedented queues of "abandoned" trains formed in the approaches to border-crossings and ports at the EAEU and European Union (EU) borders. Due to the idle time spent waiting in queues, the delivery times for containers from China to the EU countries fluctuate in the range of 30-50 days or more, while 12-15 days were promised to customers in the pre-crisis situation. Consequently, the growth in traffic volumes is matched by a sharp decline in the quality of transportation services in terms of the speed of transportation, predictability of the time of delivery, transparency of the transportation process and, in some cases, the safety of the goods being transported. The consequence is a decrease in the competitiveness of the Eurasian routes passing through the EAEU, which entails a decrease in the efficiency of the transit potential of the EAEU member states. This creates the threat of losing the achieved traffic volumes.

In 2020, 550.8 thousand TEU containers were transported along the land transit route China - EU - China, or 162.0% in comparison with 2019. From these, 177.8 thousand containers TEU were transported from EU to China, or 142.2% in comparison with 2019; and 373.0 thousand containers TEU from China to EU, or 173.6% in comparison with 2019. According to the results from 2020, the Belarus Railways transported in the following cargo: in the North-South direction: 6.4 thousand containers TEU, or 76.0% in comparison with 2019; in the South-North direction: 2.7 thousand containers TEU, or 78.1% in comparison with 2019. Besides, the Belarus Railways is working on improving the logistics of exporting products for Belarusian enterprises. Active work is underway to increase the volume of exports of Belarusian goods to China. The transportation of lumber, sugar, cellulose, milk powder, meat, etc., is growing and Belarussian enterprises receive new permits for the supply of their products. In cooperation with JSC

UTLC ERA, PJSC TransContainer and other leading participants in the container transportation market, work was carried out to develop new routes and joint digitalization projects. In addition to the main route through the Brest / Terespol border crossing, the Belarusian-Polish border crossings Bruzgi / Kuznitsa Belostokskaya and Svisloch / Semyanuvka are used to organize unhindered passage of container trains on the East-West-East route.

In 2020-2021, the Belarusian Railways, in cooperation with transport companies and shippers, organized the first container trains on the Japan/Korea - Europe route. The first full-set container trains with postal shipments between China and Europe began to run on a regular basis.

To combat the COVID-19 pandemic, the China-Europe freight trains transported a large number of medical supplies and parcels to fight the pandemic, using cross-border e-commerce. They transported goods that were previously delivered by sea or air. The organization of container trains from China to Europe has contributed to international cooperation to prevent the epidemic and helped to stabilize supply chains between countries along the Belt and Road transport corridors.

Belarusian Railways are open for the carriage of goods using the unified CIM/SMGS consignment note in all directions, work continues on the use of this consignment note at border crossings in the West-East direction and vice versa. In 2019, 42,554 containers (about 13% of the total volume of traffic) were transported with the use of the unified CIM/SMGS consignment note, in transit along the Belarus Railways. 21,950 of them were transported in the West-East direction (from the Czech Republic, France, Germany, Hungary, Slovakia, destination to the Russian Federation, Kazakhstan, China), while in the opposite ("East-West") direction 20,604 containers were transported. 4579 containers (to Slovenia, Czech Republic, Romania), as well as 3764 loaded wagons, of which 3468 to Romania, were sent from stations of Belarus Railways to European countries, using the CIM/SMGS consignment note.

The following main types of cargo were transported using the CIM/SMGS consignment note: car bumpers and their parts for industrial assembly; empty railroad cars; bodies for cars and other motor vehicles; car body parts and accessories (including cabins); parts and accessories of motor vehicles; crates, boxes, packing crates and baskets, drums and similar containers, made of wood. - tanks, barrels, drums, cans, boxes; empty heavy-duty containers; crates, boxes, packing crates and baskets, drums and similar packing materials made of wood; paper and cardboard in rolls; minerals; pallets and similar platforms for the movement of ferrous goods; cellulose, etc.

A promising direction for the development of highly profitable railway transit traffic is the transportation of postal items in containers via the Eurasian corridors.

Over the past three years, there have been many pilot projects for the transportation of mail parcels by rail, but the volume has been low. Yet the COVID-19 pandemic created a situation when a huge number of mail parcels are shipped from China and, consequently, the volume of cargo increased. With the COVID-19 restrictions on air cargo transportation, the rail supply chain began to play a strategic role as a reliable mode of transport between China and Europe, ensuring smooth delivery of mail packages. According to the information obtained from the Belarussian Railways mailings in containers have become a new direction for growth of transit cargo flows from China to Europe via Belarus.

The first container trains fully loaded with postal items began operating between China and Europe on a regular basis in April 2020. In total, in 2020, more than 2.7 thousand TEU containers with postal cargo were transported by the Belarus Railways. Within two to three months, about 2000 tons of mail were delivered from China to Europe by rail. At the same time, the delivery time took on average 12-14 days. Many postal shipments by rail ended in Lithuania, while other container trains reached Poland. Further, postal items were delivered by trucks to more than 30 European countries. In March and April 2020, 2,700,000 pieces of mail cargo in 440 forty-foot containers were transported from China to Poland (to the Malashevich station) and Lithuania (to the Vaidotai station) by container trains with further dispatch to 36 European countries. The total travel time from China to Lithuania was 14 days. Postal items were sent mainly from three cities in China: Yiwu, Chongqing and Chengdu. For the carriage of postal items, the SMGS consignment note was used, and in some cases - the CIM/SMGS consignment note, and the documents provided for by the acts of the Universal Postal Union in the form of CN 37 and CN 33 were used as a transit customs declaration. These documents are drawn up in paper form, which creates significant difficulties for their transportation and use in customs clearance. Considering that more than 10 thousand postal items are transported in one 40-foot container, 500 or more paper sheets of postal documents in the form of CN 37 and CN 33 are attached to one SMGS consignment note. It is obvious that the processing of these documents needs to be digitalized. The aforementioned difficulties in working with these documents, as well as the significant increase in the delivery time of containers in the China-Europe route, caused by their long downtime at border stations, became the reasons for a significant reduction in the volume of postal shipments in 2021 (by about 70% in comparison with 2020).

3. Analysis of digital interactions among participants in international railway and multimodal freight transport, including EU and EAEU pilot projects

3.1. General overview of problems in the digital interaction of participants in international freight transportation

The main problems in the digital interaction of participants in international freight transportation are caused by the diversity and disunity of existing information support systems for international transport along the national sections of the transport routes and along sections with different transport modes. Each of these modes has its own legal framework for electronic document exchange, its own electronic transport and trade document forms, and its own technologies of electronic data exchange supporting transportation. This disunity does not allow for a transition to seamless paperless electronic document exchange along the transcontinental Eurasian transport routes. Outdated technologies for organizing shipments, based on paper shipping and commercial documents, cause numerous well-known problems. These are unproductive delays for trains, wagons and containers waiting for paperwork to be done, various impediments that emerge at the junctions between different modes in the transport chain of multimodal shipments, etc. As a result, the quality of services on the Eurasian transport corridors deteriorates and their competitiveness decreases in comparison with alternative routes that bypass the EU and EAEU countries.

The above-mentioned problems in the field of international trade and transport are not new. International organizations have been working on their solution for many years: UN/CEFACT and UNECE, EU, EAEU, OSJD[3], UIC[4] and CIT[5], as well as national government agencies and carriers. Their work is based on international standards for electronic data exchange.

The basic standard in use now is the 1987 UN/EDIFACT standard for electronic data exchange in trade and transport. It is supported and developed by UN/CEFACT, which is open to cooperation with interested international and national organizations for the implementation of the standard.

In accordance with this standard, directories and standard electronic messages have been developed, which are the equivalents of the corresponding paper documents used in various sectors of the economy, including trade and transport. In total, more than two hundred UN/EDIFACT messages have been developed. For rail transport, such messages have been developed by OSJD and UIC. The main regulatory documents describing the formats and structures of these messages and

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[3] Organization for Cooperation between Railways
[4] International Union of Railways.
[5] Comité international des transports ferroviaires (CIT)

the corresponding reference books are OSJD leaflets (specifications) and joint OSJD / UIC Leaflets. These documents also regulate the procedure for using these messages in international railway transportation. Guided by these specifications, within the framework of international and national law, the railway administrations (RWA) of the EAEU countries have concluded bilateral Agreements on the exchange of electronic data with neighboring railways, including third countries. These agreements serve as the basis for the development of projects to provide new IT and communication technological solutions. These solutions aim at creating a seamless, barrier-free environment based on electronic cross-border, legally valid document flows to ensure accelerated unhindered transportations along railway and intermodal transport corridors passing through the EAEU countries.

Based on the library of standard electronic messages for international railway freight transportation (OSJD leaflet/specification O+P 943), information exchange of data in SMGS and CIM/SMGS consignment notes takes place between railway carriers (Belarus Railways - BRW, RZD, LDZ, LTG, PKP, UZ)[6]. In this case, the IFTMIN D.97 A message is used, while the IFCSUM D.97 A message is used to transmit information about the composition of the train.

To generate the electronic SMGS consignment note in the form of a legally valid electronic document, the IFTMIN D.97 A message is used. The electronic SMGS consignment note is exchanged between the railway carriers BRW, RZD, LDZ, LTG and the Polish carrier ERC (Eurasian Railway Carrier). Between BRW and LTG, electronic commercial and legally valid documents are exchanged. These documents are presented in the form of copies (scans) signed by electronic digital signatures (EDS). Russian Railways and BRW also exchange legally valid electronic documents accompanying goods. In this case, the documents are presented in a formalized XML format approved by the Federal Customs Service of the Russian Federation and signed with a digital signature.

The most significant international pilot projects (in the chronological order of their implementation) are

- "e-rail Freight" and
- the intermodal project "Intertran".

3.2. The «e-rail Freight» project

This project has been developed since the early 1990s by three European railway associations - CIT (providing the legal framework and development of procedures); UIC (technical solutions and standards) and RailData (IT

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[6] BRW - Belarussian railways; RZD – Russian railways; LDZ – Latvian railways; LTG – Lithuanian railways; PKP – Polish railways; and UZ – Ukrainian railways.

infrastructure) - and has been based on the UN/EDIFACT standard. Most of the railway administrations of the EU and EAEU countries have joined the project. The goal of the project is to provide electronic information exchange support for international rail freight traffic.

The achieved results of the project contribute to the improvement of the quality of transportation and the development of international trade. However, the further development of the project is constrained by several factors. First, its infrastructural component, based on the corporate data transmission network INFOSET-21, provides electronic data exchange only between carriers and IT systems of the railway administrations of neighboring countries under bilateral agreements. This creates limitations for participants in multimodal transport electronic data exchange, excluding the multimodal transport operators, who participate in the supply chain. As a result, there is no possibility for a comprehensive digital transformation of the supply chain operations, which could become the source of sustainable highly profitable cargo flows. Second, the project used outdated formats and structures of electronic messages (UN/EDIFACT), as well as the old delivery apps (IBM WebSphere MQ) based on an existing connectivity scheme. This unjustifiably increases the labor intensity of the digitalization processes, prevents the introduction of new information and communication technologies and the expected effects from digitalization.

This is because the UN/EDIFACT standards (adopted more than 40 years ago) have not changed much, while the global information and communication technologies have developed rapidly in the frame of the 4th industrial revolution. Modern requirements are currently met by standards based on API (Application Programming Interface). This is a new architecture for building modern digital systems with secure (trusted) information interaction via the Internet for geographically distributed IT systems of participants in the transportation process.

In the European Union, where transit cargo flows originate and finish, passing through the EAEU countries, a new API-oriented legal framework is being created for the digital transformation of trade and movement of goods along the supply chain, including freight transportation by all modes of transport. In particular, on 22 July 2020, the European Parliament adopted the Electronic Freight Transport Information (eFTI) Regulation. In accordance with eFTI, from 2025 transport market participants in all countries of the European Union will be able to use electronic cargo documents created on the basis of the new UN/CEFACT API-based standards. This Regulation obliges all competent public authorities of the EU countries to accept electronic information through certified platforms. It is expected that the digitalization of freight transport will significantly save the operating costs of all supply chain participants and make transport more efficient and sustainable.

To ensure electronic document exchange in transit transportation through the EAEU countries, obviously there is a need to integrate projects implemented for the eFTI Regulation in the EU and EAEU projects developed within the framework of the EAEU Digital Agenda. One of the key projects is considered to be the "Creation of the Ecosystem of Digital Transport Corridors (DTCE)". At the same time, it is necessary to ensure a smooth transition from EDI, based on the UN/EDIFACT standard, to API standards with transformation of the key electronic messages to the XML format

3.3. The «Intertran» project

This project was announced in 2018 within the framework of the Asia-Pacific Regional Assembly of the International Union of Railways (UIC) and is being implemented by Russian Railways in cooperation with FESCO, the RF FCS, BRW and the State Customs Committee of the Republic of Belarus. This project is based on the idea of creating a seamless environment for information interaction between the operator of sea lines, railway carriers, customs authorities, consignors and consignees in the implementation of intermodal transportation with the processing of electronic documents. The project aims at the implementation of a fully digital door-to-door delivery technology with the participation of several transport modes and government agencies based on existing transport and commercial documents from the Japanese port of Yokohama, through the port of Vladivostok at the station of Russian Railways and the Belarusian Railways. Options for expanding the project's routes to the EU countries are being elaborated. Within the framework of the project, a package of modern information and logistics services has been created. This allows for the provision of electronic data support for the transportation of a container for any forwarder or operator, along the entire route, and to provide the necessary electronic information not only to interested business participants in supply chains, but also to meet the requirements of state regulatory authorities. This ensures a reduction in the time for Customs operations and the elimination of the subjective factor when making decisions on the release of goods and the completion of the Customs transit procedure. As a result of the implementation of this project, the total time of cargo delivery along the mentioned routes is reduced by an average of four days.

The UN/EDIFACT standard is used in the Intertran project only when issuing electronic SMGS consignment notes for transferring them between the IT systems of Russian and Belarussian railways. Accompanying documents are digitized in the form of XML messages that are developed based on national agency standards.

The limited use of the UN/EDIFACT standard in the mentioned international projects is explained by the following:

• UN/EDIFACT standards are very complex and time consuming for practical use,

• They are based on older data formats and protocols for their transmission,

• Their use is restricted only to the railway agency data transmission network INFOSET 21.

These shortcomings of the UN/EDIFACT standard, along with its clear merits, are recognized not only by national transport operators, relevant OSJD structures, but also by UN/CEFACT as the depository of this standard. At the same time, these actors recommend switching to a new generation of UN standards. This approach will ensure interoperability between documents, modes of transport and national segments within the digital multimodal corridors.

3.4. Implementation of electronic document exchange by Belarussian Railways

To improve Customs procedures, the Belarus Railways and the State Customs Committee of the Republic of Belarus (hereinafter referred to as the SCC) have created a digital technology for organizing information interaction between the Customs authorities of the Republic of Belarus and the Belarusian Railway regarding Customs operations for goods transported by rail across the Customs border of the EAEU, using electronic SMGS consignment notes. This technology regulates the transfer of information in electronic format to notify Customs authorities on the arrival (departure) of cargo to (from) the Customs territory of the EAEU. This technology ensures the development of paperless technologies based on the use of UN/EDIFACT standards and national standards for the carriage of goods by rail.

In 2020, Belarusian Railways switched to the use of electronic consignment notes for the carriage of goods in intra-republican traffic. The transportation of goods under electronic SMGS consignment notes in bilateral traffic with Latvia and Lithuania has been implemented, with the development of all Customs procedures using paperless technologies. In 2021, paperless technologies were used to support the transportation of empty wagons in bilateral cargo traffic with Poland, as well as empty containers in transit along the route Poland - Belarus - Russia - Kazakhstan.

One of the main directions of current development for Belarussian Railways is the transition to electronic consignment notes for export, import and transit. The necessary conditions for this have already been created and the corresponding information systems have been developed.

Belarussian Railways are making a significant effort to implement the provisions of the *UN International Convention on the Harmonization of Frontier Controls of*

Goods (Annex 9).[7] One of the trade facilitation measures and basis for paperless trade is the implementation of a Single Window facility. The establishment of such a mechanism in practice makes it possible to simplify the movement of goods across borders, shorten the time required for carrying out administrative procedures, and to reduce the costs for participants in foreign economic activities.

The Belarussian Railways supports the promotion of UN/CEFACT ideas on the use of XML or JSON formats within the OSJD and EAEU projects aimed at the transition to paperless technologies in international freight transport.

3.5. Integration and information functions of freight forwarders in international multimodal cargo transport

The analysis of international multimodal transport operations along the 2nd (West-East) and 9th (North-South) transport corridors (passing through Belarus), conducted in the framework of this study, showed that cargo owners (sellers and buyers of goods) do not undertake the organization of the process of transportation (i.e., do not use the 1-PL scheme), but outsource this process. The outsourcing companies are freight forwarders who act as 3-PL, 4-PL or 5-PL transport operators along the entire route. The national legislation of the countries through which the 2nd and 9th transport corridors pass and the contracts for the provision of transport and forwarding services determine the legal status of these operators. The subject of these agreements is the delivery of a certain set of goods "from door to door" at the agreed period of time by different modes of transport across the territories of several states. To fulfill the obligations under these contracts, the Carriage Operators enter into relevant contracts with service providers. Service providers are classified as direct and indirect suppliers. Direct suppliers are the direct executors of work on the provision of relevant services, i.e. service providers. These are carriers and owners (operators) of infrastructure and vehicles of various types of transport modes, Customs brokers, as well as other entities that provide services in the process of transportation. Service providers can also be other forwarders who, in turn, have contractual relationships with direct service providers.

The national legislation regulates the procedure of formalizing these relations, including the forms of contracts, establishing liability for violation of contractual obligations, etc. An exception are contracts with carriers for the organization of international transportation of goods. The procedure for the conclusion and execution of contracts for the carriage of goods in international traffic (including the forms of these contracts and forms of transport documents) are established by the international transport law of the respective modes of transport: road, river, sea,

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[7] https://unece.org/DAM/trans/conventn/ECE-TRANS-55r2e.pdf

air, and rail. The international multimodal transportation of a consignment (in its entirety or parts of it), the following documents are drawn up in a specific sequence: road consignment notes, maritime and inland water transport bills of lading, air waybill, railway consignment note. At the same time, there is no interoperability between the legal regulations for different modes of transport, hence, there is no interoperability for the corresponding transport documents.

As result it is not possible to reissue one type of transport mode document into another by simply transferring details from one form to another, since these documents have different requisite composition. The reason is that a certain amount (volume) of goods transported along international multimodal routes is processed in each mode of transport in a different way, within the framework of this transport mode regulations. For maritime transport, this volume is drawn up as a consignment of goods transported under one bill of lading, which is a contract of carriage by sea. The bill of lading is not only a transport document, but also a document of title. When transferring to rail transport, the concept of "consignment of goods" is not used, since it is absent in rail transport regulations. The maritime consignment of goods is divided into parts with reference to the infrastructure for loading or carrying goods on railway vehicles (wagons or containers). Each of these parts is drawn up according to specific railway regulations (SMGS or CIM) as a consignment consisting of one or more wagons or containers. For each of these consignments a railway consignment note (SMGS, CIM or CIM/SMGS) is issued. In this case, the data in the bill of lading is usually not used, since the data elements for consignors and consignees, points of departure and destination, as well as the characteristics of the transported goods, in the maritime bill of lading and the railway consignment notes are different. In addition, unlike the maritime bill of lading, railway consignment notes are only transport documents. This suggests significant differences in the legal status of maritime and and railway consignors and consignees. The latter are not considered as cargo owners, so forwarders (transport operators) can more freely choose them from among the certified rail carriers.

When cargo is transferred from rail to road transport, the cargo shipment is divided into parts in proportion to the carrying capacity of road vehicles. For the carriage of each of these parts a road consignment note (CMR) is issued. At the same time, only a small part of the data elements can be transferred from the SMGS to the CMR, for example, since the main railway and road data (consignees and consignors, points of departure and destination, as well as the characteristics of the transported cargo), as a rule, do not coincide, except for some data regarding the transported goods. The detailed consideration of this problem using specific examples of comparison for railway bills of lading with sea bills of lading and road waybills was carried out by the author of this report together with Dmitry

Iakymenkov (Ukraine) and Sergey Tumel (Belarus) - experts working on UN/CEFACT solutions.

At the points of intersection of the CIM and SMGS railway transport regulation zones (along the 2nd transport corridor these are the Malaszewicz and Semenowka stations of the Polish Railways), the corresponding re-issue of consignment notes is carried out. The multimodal operators assign these duties to re-forwarders, who are formal consignees under the CIM consignment notes and consignors under the SMGS consignment note for carriage in the West-East direction and vice versa in the opposite direction. When re-issuing waybills, re-forwarders can transfer from one waybill to another only data about the cargo and the vehicle. Re-forwarders usually receive data on the railway station and route, consignees and payers (forwarders) in transit railway operations, as well as on the specifics of transportation, from multimodal operators.

4. Substantiation of the possibility and necessity of using the UN/CEFACT standard in international rail and multimodal freight transportation

4.1. Regulatory framework for using the UN/EDIFACT standard and transition to the new UN CEFACT standards for international rail transportation

For more than 20 years, in order to provide information support for international freight traffic, the railways members of OSJD have been carrying out electronic data exchange using electronic messages based on the structure of the UN/EDIFACT international standard.

For the uniform application of electronic communications standards, the OSJD developed and recommended for use the following specifications/leaflets:

- P942 "Technology of information support of cargo transportation by SMGS with electronic data exchange using the UN/EDIFACT standard",

- P943 "Library of standard electronic messages for international freight traffic under the terms of the SMGS using the UN/EDIFACT standard".

- P944 "List of classifiers and codes of data elements. Library of lists of codes for freight traffic on the terms of SMGS".

The UN/EDIFACT standards have been surpassed by technological development. Therefore, at the initiative of UN/CEFACT, OSJD is working on the transition to new UN/CEFACT standards using the Multi-Modal Transport Reference Data Model (MMT RDM). To prepare such a transition a mapping was carried out

under this study of segments of typical messages containing composite data types in SMGS, CIM/SMGS, and CIM consignment notes in UN/EDIFACT format and composite data types MMT RDM. Besides, a decomposition of the constituent elements of the SMGS, CIM/SMGS, and CIM consignment notes into basic types was done for interconnection with basic types of MMT RDM data.

These activities took place based on the mentioned OSJD specifications/leaflets and other regulatory documents:

- CIM-SMGS Consignment Note.xls;
- CIM/SMGS Consignment Note Manual (GLV-CIM/SMGS) (Applicable with effect from 1 January 2019);
- CIM Consignment Note Manual (GLV-CIM) (Edition 1 January 2021);
- Agreement on International Goods Transport by Rail (SMGS Agreement) (Effective from 1 November 1951, with amendments and additions as of 1 July 2015);
- Technical specification IFTMIN.docx (Descriptions of electronic messages IFTMIN 97.A (SMGS consignment note and wagon list (additional copy), CIM/SMGS consignment note and wagon list / accompanying document) are presented in OSJD specification/leaflet O+P 943;
- Description of MMT RDM from the UN/CEFACT website (BRS_T_L-MMTDataElements.xls);
- real-world copies of invoices with data (Appendix 1 to the report).

4.2. Comparison of the main railway transport documents with the Multi-Modal Transport Reference Data Model (MMT-RDM)

The comparison and mapping results with and XML and JSON files are presented in the following attachments:

 Annex 2. CIMSMGS_Mapping.xls - correspondence of CIM/SMGS fields to MMT RDM
 Annex 3. SMGS_Mapping.xls - correspondence of SMGS fields to MMT RDM
 Annex 4. CIM_Mapping.xls - correspondence of CIM fields to MMT RDM

In these mappings, some of the data contained in the original documents were not found in the MMT RDM. The lines with these data are highlighted in red in the tables in Annexes 2-4. A list of these data for each railway document in English and Russian (as in the original forms of the corresponding railway documents) is given in Annex 5.

4.3. Development of schemas for electronic equivalents of rail transport documents in XML and JSON formats

Schemas for electronic equivalents of railway documents in XML and JSON formats are represented in the following Annexes:

Annex 6. CIM_SMGS.json - presentation of CIM/SMGS in JSON format

Annex 7. CIM_SMGS.xml - presentation of CIM/SMGS in XML format

Annex 8. SMGS.json - representation of SMGS in JSON format

Annex 9. SMGS.xml - presentation of SMGS in XML format

Annex 10. CIM.json - CIM representation in JSON format

Annex 11. CIM.xml - presentation of CIM in XML format

Based on OSJD specification/memo O+P 943 and technical specification IFTMIN.docx, we created document IFTMIN_Mapping.xls regarding the alignment of IFTMIN data to CIM/SMGS, SMGS, and CIM. Based on this document and the existing MMT mappings to all railway transportation documents, an IFTMIN mapping to MMT was made. The mapping results are presented in Annex 12. IFTMIN_ Mapping.xls - description of the mapping of IFTMIN to MMT

A brief description of the mapping procedure is given in the presentation added to the report using the example of mapping some fields of the SMGS consignment note: consignor code and UN code of dangerous goods (Annex 13. Presentation slides on the comparison of the consignor code and the UN code of dangerous goods. Comparison of the invoice and MMT.pptx fields).

5. Conclusions and proposals

5.1. On the issue of direct conversion between documents accompanying goods in different types of transport in international multimodal transportation

The analysis of multimodal transport information exchange indicated that direct conversion of shipping documents of different modes of transport in the chain acceptance - transfer of transported cargo is practically impossible. The reason is that carriers of different modes of transport practically do not interact with each other either at the point of re-issuing shipping documents during the acceptance and transfer of goods, or at the point of settling financial payments with each other. Freight forwarders, who have contractual relationships with the carriers in the different modes of transport and with the end-to-end transport operators that liaise between the main participants in the transportation process, perform these functions. The freight forwarders receive data for re-issuance of shipping documents from the sources noted above. The legal status of the multimodal

transport operators is determined in theory by the United Nations Convention on International Multimodal Transport of Goods (Geneva, 24 May 1980), which has not been ratified by most countries in the world. Still, this convention is used as a theoretical basis for the establishment of international private law for cross-border multimodal transport, i.e., it provides options for concluding contracts between participants in multimodal transport to optimize them in the international supply chains. The specific forms of these contracts have been developed by the International Federation of Freight Forwarders Associations (FIATA). FIATA documents (usually titled freight forwarder's documents) regulate the business relationship between the forwarder and the cargo owner. These documents do not apply to the relationship of the forwarder with the carriers, i.e., they are not considered as documents of carriage. The relationship of the forwarder with the carriers is governed by the relevant transport documents stipulated by national and international transport conventions, laws, statutes, and regulations within the respective modes of transport.

5.2. Digital transformation of the integration functions of freight forwarders in international multimodal freight transportation

The copyright for FIATA forwarding documents belongs to the FIATA Secretariat. For many years (since the last century) they have been used in paper form, which no longer meets the requirements of our time. Therefore, FIATA "digitalized" one of its main documents "FIATA Multimodal Transport Bill of Lading" as part of the Electronic FIATA Multimodal Transport Bill of Lading (eFBL) pilot project.

FIATA forwarding documents contain full information about the transported goods, its owners (seller and buyer), their postal and bank details, the route of transportation, as well as the operator of multimodal international transportation, including its legal status in relation to the transported goods. These documents are the main legal and informational source, based on which the multimodal transportation operator concludes relevant agreements with carriers of different transport modes and other service providers. Therefore, it is useful to align these FIATA forwarding documents with the UN/CEFACT MMT RDM. Such mapping and alignment have already been made with the FIATA Multimodal Transport Bill of Lading as part of the FIATA project for Electronic FIATA Multimodal Transport Bill of Lading (eFBL).

The means of data exchange have evolved. Data is no longer shared on a bilateral basis but is now made available through ecosystems to trusted parties, who proactively retrieve data from its original issuer. This means that a secure identification of the ecosystems participants is key to ensuring trust in both issuers and receivers of data.

The eFBL solution focuses on guaranteeing the integrity and traceability of the documents, based on their digitalization. FIATA will make its bill of lading standard available to software providers to enable its members to issue eFBLs through their everyday tools. Each document will be 'stamped' with a unique FIATA tracking QR code and number which will certify the validity of the document, the integrity of its content, and the identity of its issuer (as it will be linked to the digital identity profile of the FIATA member issuing the document). The tracking QR code and number will also allow all stakeholders interacting with the document to have access to a full audit trail for each document.

To facilitate interoperability with all actors of the supply chain, the eFBL standard is aligned with the UN/CEFACT (United Nations Centre for Trade Facilitation and Electronic Business) Multimodal Transport Reference Data Model.

5.3. Issues of electronic document exchange in the project «Kaliningrad Transit»

In 2022, the Eurasian Economic Commission plans to conduct an experiment on the railway transportation of goods 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 takes place through the territory of Russia, the Republic of Lithuania, and the Republic of Belarus.

At the request of the United Nations Economic Commission for Europe, studies are being carried out on the application of international standards for electronic data interchange for multimodal transport corridors.

By order of the Eurasian Intergovernmental Council dated 20 August 2021, an Action Plan (roadmap) on the implementation of the main directions and stages of a coordinated transport policy of the member States of the Eurasian Economic Union for 2021-2023 was approved (hereinafter - the Action Plan).

The Action Plan provides for the:
- identification and elimination of obstacles (barriers, exemptions, restrictions) affecting the functioning of the market for railway transport services (paragraph 41),
- implementation of pilot (test) projects (including in a bilateral format) for the implementation of electronic documents used in transport activities (paragraph 4),
- realization of proposals on common approaches to digital logistics in the Union (paragraph 10),

- implementation of projects related to the transition and usage of an electronic railway consignment note in the transportation of goods within the Eurasian Union (paragraph 41),
- development of proposals for a phased transition to the use of electronic documents for international road transport of goods (paragraph 30).

An experiment in this framework indicated the way to abandoning the use of paper-based railway consignment notes and transit (Customs) declarations. It is envisaged to harmonize the data in electronic transport documents and electronic documents accompanying goods.

This experiment is based on the results of the INTERTRAN project and has been implemented since December 2021, starting from the Bely Rast terminal according to the following scheme: SMGS consignment notes for container shipments are issued electronically using the UN/EDIFACT standard in the form of IFTMIN messages; shipping documents accompanying goods are also issued in electronic format in the form of XML messages, which are developed on the basis of national standards of the Federal Customs Service of the Russian Federation. Russian Federation Electronic Digital Signatures (EDS) of the relevant officials of the "Bely Rast" terminal provide proof of the legal validity of these electronic documents. Based on these electronic documents, Customs clears goods exported from the Russian Federation. The transfer of container shipments to Belarusian Railway is processed according to electronic transport and accompanying documents. The proof of the legal validity of these electronic documents is provided in Belarus by a system of a Trusted Third Party (TTP), which automatically verifies and signs them with Electronic Digital Signatures of Belarus (EDS RB). This provides the possibility for transit transportation of containers by Belarusian Railways using electronic transport and accompanying documents. This covers also Customs clearance procedures of transit at the exit station of Belarusian Railways in digital format.

The transfer of containers from the Belarusian to Lithuanian railways takes place using electronic documents according to a similar scheme using the TTP system. However, there is a complication related to the requirements of Lithuanian Customs to provide accompanying documents in paper form. So, the freight forwarder must print out the accompanying electronic documents. This requirement creates additional difficulties and significantly slows down the process of container clearance at Lithuanian border stations.

The transfer of containers from Lithuanian railways to the Kaliningrad railway of the Russian Federation is carried out using electronic documents and the TTP system. Further transportation and acceptance of the container at the destination

station (Chernyakhovsk) is also carried out using electronic transportation and accompanying documents.

In this experiment, the railway transportation of a container between the terminals "Bely Rast" and "Chernyakhovsk", transiting Belarus and Lithuania, is considered as part of the multimodal routes between the countries of the Eurasian Economic Union and the European Union. The initial and final sections of these routes are planned to be made by road transport. The continuation of transportation from the Kaliningrad region to EU countries and back is possible both by rail with reloading onto the rolling stock of the European gauge (1435 mm), and by sea and road transport. This will require an appropriate re-issuing of the shipping documents.

5.4. Proposals to improve the Kaliningrad Transit project, as well as the Zubr and Viking projects between the Baltic Sea and the Black Sea with extension to the GUAM and TRACECA corridors

To improve the implementation of the above projects, we propose to:

5.4.1. Develop a software converter that provides the ability to unambiguously convert (recode) messages from UN/EDIFACT to UN/CEFACT standards-based XML messages and back to be used by participants in the transportation process, including multimodal transportation. Such a converter should be based on the UN/CEFACT MMT RDM as well as the schemas of the consignment note electronic document equivalents developed under this study (Annexes 6-11).

5.4.2. Using a software converter, develop "digital twins" of transport and accompanying documents for container shipments transported within the framework of these projects:

5.4.2.1. Together with the issuance of SMGS consignment notes in accordance with the UN/EDIFACT standard in the form of IFTMIN messages, formalize these consignment notes in the form of a UN/CEFACT XML message.

5.4.2.2. Together with the execution of accompanying documents in the form of XML messages, based on the national agency standards of the Federal Customs Service of the Russian Federation, these documents should be drawn up in XML format aligned with the UN/CEFACT standards.

5.4.3. Compare the eight key FIATA forwarding documents with the UN/CEFACT Reference Data Model and develop electronic equivalents of these documents in the form of UN/CEFACT-aligned XML messages. Organize cooperation with FIATA, starting with participation in the pilot project "Electronic FIATA Multimodal Transport Bill of Lading" (eFBL).

5.4.4. Involve in the proposed experiment the maximum number of key participants in multimodal transport, including end-to-end operators and regional (national) forwarders, on the routes along the transport corridors Baltic Sea -

Black Sea, GUAM and TRACECA. This will require the development and implementation, under the auspices of UN/CEFACT, of appropriate experimental integration platforms which shall be e-FTI certified.