Study on the Application of Telematics in Dangerous Goods Transport

Documentation of the Dangerous Goods Transport Model

Version 00-01-00

Federal Ministry
of Transport, Building
and Urban Development

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1. Document Attributes

1.1 Purpose

This is a documentation of the Dangerous Goods Transport Model within the research project “Study on the Application of Telematics in Dangerous Goods Transport” of the Federal Ministry of Transport, Building and Urban Development.

The research project is funded by means of the Federal Ministry of Transport, Building and Urban Development. The project number is 96.0950/2010.

1.2 History

Version	State	Cause	Date	Reviser
00-01-00	released	released for validation	18.04.2011	Lüpges, Kaltwasser

1.3 Contacts

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1.4 Relevant information

Interested parties, who use the tool *Enterprise Architect*, can request the UML model in the EAP format.

2. References

The following references are relevant for the comprehension of this document:

- CEN/TC 278, Road transport and traffic telematics, WI 00278225, FprCEN/TS 16157-1 *Intelligent Transport Systems — DATEX II data exchange specifications for traffic management and information — Part 1: Context and framework*
- ISO/IEC 19501:2005 *Information technology — Open Distributed Processing — Unified Modeling Language (UML) Version 1.4.2*
- W3C XML Schema
  XML Schema Part 0 Primer Second Edition
  XML Schema Part 1: Structures Second Edition
  XML Schema Part 2: Datatypes Second Edition
- WHO DOES WHAT spreadsheet Rev8 — *Joint Meeting RID/ADR/ADN (WP.15/AC.1) — Informal* documents *(Geneva, 13 - 17 September 2010)* — September 10/INF.11 — (OTIF) Report of the sixth session of the informal working group on telematics (Hamburg, 21-23 April 2010)

3. Introduction

In the recent past, a new challenge for dangerous goods transport arises from the growing relevance of telematics systems for the technical, organizational and administrative processes of these transports.

Therefore the Joint Meeting of the RID Committee of Experts and the Working Party on the Transport of Dangerous Goods established a working group (WG Telematics) on the initiative of Germany and the European Commission.

From the perspective of the Ministry of Transport, Building and Urban Development (BMVBS), such systems offer a great potential for improvement of both, safety and security of such transports.

Therefore, the BMVBS has launched a study on the application of *Telematics in Dangerous Goods Transport*. The project has started in April 2010 with scheduled project duration of 20 months.

The contractor, AlbrechtConsult GmbH, has developed a general approach (WP 100) that is intended to fuse the outcome of four dedicated work items:

- Analysis of relevant standards (WP 200)
- Identification of certification structures (WP 300)
- Approach of an IT security concept (WP 400)
- Modelling of identified data and processes (WP 500)

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Figure 1 provides an overview of the project plan and its major milestones.

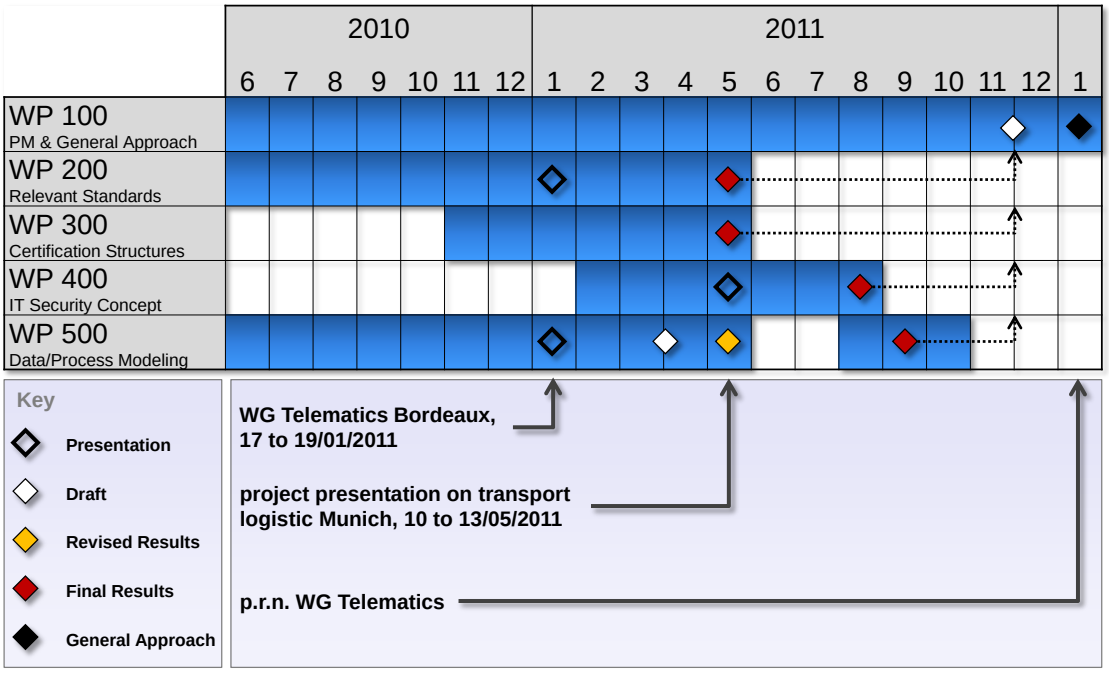

Figure 1 – Time schedule

As a result of WP 500 a data model for dangerous goods transport will be delivered that can serve as a reference model for future specifications. This reference model could either serve as a starting point for future considerations of regulations regarding telematics applications and interfaces in the ADR, ADN and RID themselves, or it could be used as means of communication with other relevant specification and standardisation processes. Such 'external' standards could potentially also become a source of reference for future versions of the regulatory frameworks, very much in the way that technical norms and standards in other domains are already quoted in them.

The proposed data modelling effort will use stat-of-the-art methods from the domain of Information and Communication Technology (ICT), in particular the Unified Modelling Language (UML). The DATEX initiative – developed for creating the CEN/TS 16157 family of Telematics standards for Traffic Management, with first three specifications expected to be published by CEN in June 2011 – provided a good starting point with the following features:

- UML profile suitable for this type of modelling effort
- Defined mapping to XML schema definitions (incl. Software Tool)
- Detailed (technical) part of the resulting model can be fed back to DATEX for CEN standardisation, providing alignment of future versions of the interface standard for traffic management

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4. From the WHO DOES WHAT table to the data model

Starting point for the aspect of data modelling (WP 500) is the WHO DOES WHAT spreadsheet (WDW table) of the WG Telematics (Figure 2). The table comprises those information elements covered by RID/ADR/ADN that are considered as relevant for the use of telematics.

For each characteristic value or each piece of information the table explains what purpose it serves, what stakeholders use them, when they are needed etc.

The table is divided into three sections:

- Section A (elements No. 1 to 32): Entry in the transport document or documents attached to the transport document
- Section B (elements No. 33 to 47): Miscellaneous
- Section C (elements No. 48 to 70): New information

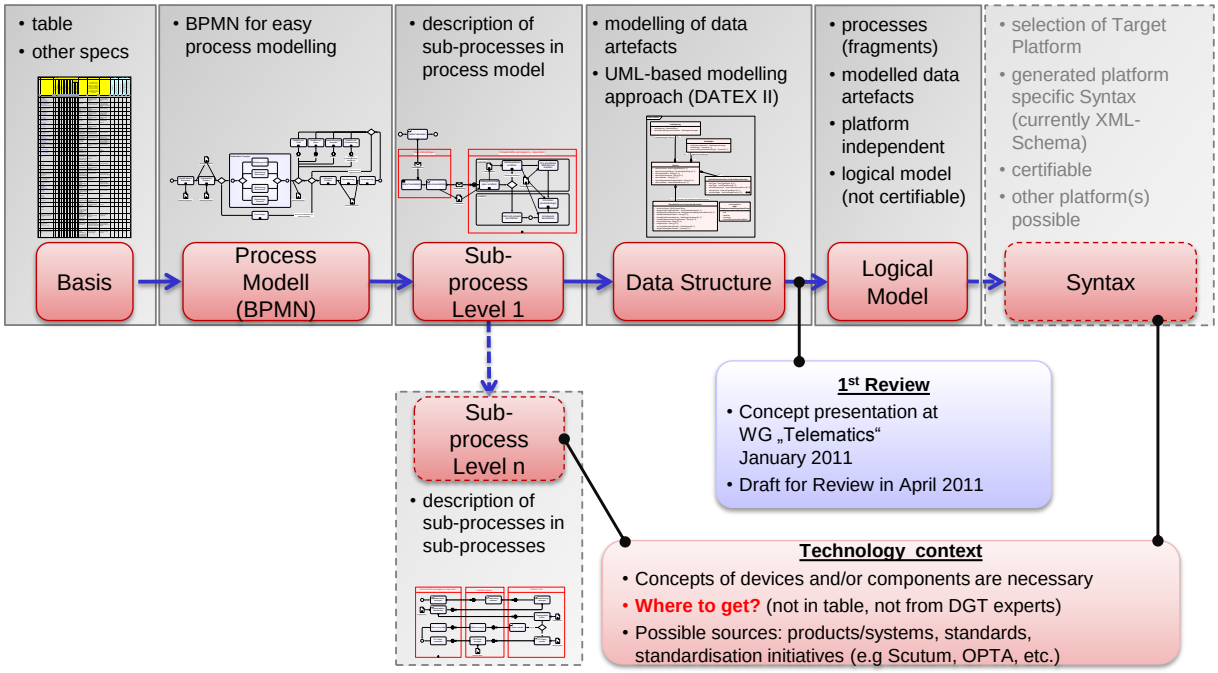

Figure 2 – From table to model

Based on the table and other external information a rudimentary process model for the transport of dangerous goods was developed by using the Business Process Modelling Notation (BPMN).

The aim was to get elementary data artefacts as an input for data modelling and an overview of the possible use cases. Independent from a technology context selected use cases were further modelled by sub processes to collect more knowledge about data artefacts.

A UML-based modelling approach (DATEX II) was chosen developing a data structure and modelling data artefacts based on the project's particular focus on two use cases: "accident" and "enforcement". In relation to the WDW table the relevance of the content of section A for these use cases is obvious, since this section deals with exactly the information that is needed by emergency responders appearing on the site of an accident and it is also the subject matter of enforcement.

It is much more difficult to assess the relevance of the content of section B of the table. Some entries here are similarly obvious, e.g. the tank certificate and the test report for packaging, at least for the enforcement scenario. For other entries it might however be questioned whether they need at all to be included in such a model, e.g. it is not clear whether the model actually needs to describe labels and markings. One might argue that these are only visualisation aids in the sense of non-electronic communications channels.

Especially the elements No. 36 to 42 of Part B will be discussed further in this sense with the Working Group on Telematics. They were not modelled yet.

The next sections of this document describe the details of the resulting modelling methodology and the resulting data model. To explain the model in an appropriate manner and explaining the structure, individual views of the UML model were aggregated in packages shown as class diagrams in Chapter 5. More details regarding the characteristics of the different classes, attributes and roles appearing in the data model is explained by the data dictionary located in the annex of the document.

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5. Data Modelling

5.1 Overview

With regard to the data modelling methodology a draft of the data model for dangerous goods transport has been developed. The WDW table had to be processed further to provide more suitable input into standardisation and certification processes. The following basic modelling requirements/challenges needed to be considered:

- Human language must be transformed into a formal description language
  example: (No. 1) “UN number” → *UnNumberType ::= {0001..10000}*
- Domain concepts taken from other specifications need to be obtained from the quoted source and compiled into self-sustained (IT-)definitions
  example: (No. 46) “Tunnel category (road)” → *TunCatType ::= {‘A’–‘E’} // ADR 8.6.2*
- Entities, relations and attributes need to be fully qualified. In other words it was necessary to specify which elements in which way are interrelated (e.g. *PressureSensor* related to *Tank*) and to define permissible values for (primitive) attributes.
- Domain concepts not fully specified (either inside the table or in the quoted sources) needed to be expanded and fully modelled relying on expert advice or external input from other projects (e.g. e-freight, eRailFreight, SafeSeaNet, etc.).

As part of the modelling and complying with the requirements above the following categories of data types were identified and used to transfer the domain concepts of the table into basic data model elements (data types for attributes). These attributes are then assembled to semantically coherent data structures.

5.2 Simple data types

They define the permissible value space of atomic data structures (“attributes”). Typical examples are *Boolean* (0/1), *NonNegativeInteger* (0, 1, 2, ... ∞), *String* (character sequence from given alphabet), etc.

In our modelling approach we reuse the primitive data types from the XML Schema standard (IT domain). This ensures interoperability with the potentially most important implementation platform XML / XML schema and reflects broad consensus in the EDI world, supported by many other B2B standards.

Simple data types are not canonical. The more constrained they are, the more prescriptive (= suitable for certification) is the specification. Hence, careful modelling of simple data types is important to ensure that the power of syntax checking is exploited as far as possible!

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An example is the Hazard Identification Number (HIN) in Figure 3.

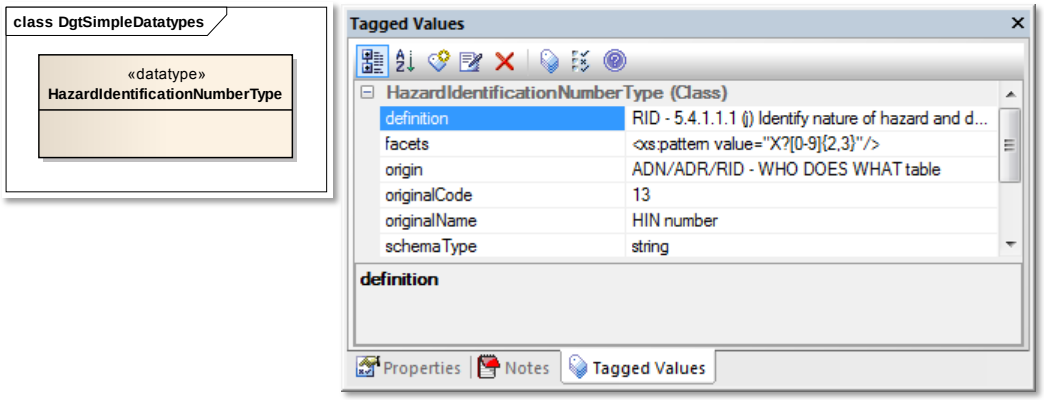

Figure 3 - Simple data type: definition of the Hazard Identification Number (HIN)

Additional metadata – especially the relation to the WDW table – is captured in *tagged values*:

- *definition* expresses the reference to regulations taken from column B of the WDW table combined with the definition taken from column R added after the "-" character.
- *origin* defines the source of the class/attribute. In the model always "AND/ADR/RID – WHO DOES WHAT table" is used.
- *originalCode* indicates the line number in the WDW table.
- *originalName* indicates the black text in column B of the WDW table
- *schemaType* is the primitive type taken from the XML Schema Definition standard (part 2). For the HIN the schema type string is used.
- *facets* is an additional mechanism from XML schema, used to further narrow down the values space or the lexical space for permissible values of the data type. In the example (Figure 3) it is used to specify an optional 'X' plus 2 to 3 digits between 0 and 9.

5.3 Enumerations

In many cases, value spaces for attributes can only take a limited number of permissible values (examples: danger labels, tunnel restriction codes, etc.) and it is advantageous to use enumerations. At first glance the values look like strings, but in reality they are (self-describing) codes. Assigning a value not found in the list of permissible literals must be avoided, because the value for the attribute is invalid and interoperability is not guaranteed.

Input documents from external sources (e.g. data models) often do not use the power of restricting the values space via enumerations and specify attribute types as string instead. Figure 4 shows the definition of the Tunnel Restriction Code.

Enumerations and Enumeration Literals are a part of the DATEX II meta-model. They are used intensively to increase the quality of syntax checking in information processing (traffic management & information model: ~1500 literals).

Enumerations use the same tagged values as for data types except for schema type, which is obvious and the same mapping from the WDW table to tagged values is proposed.

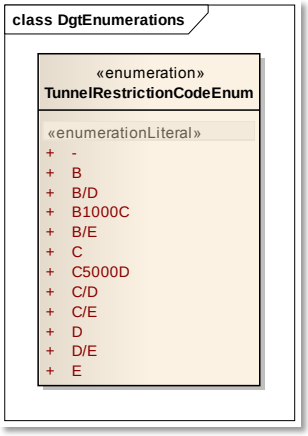

Figure 4 - Enumeration: definition of the Tunnel Restriction Code

5.4 Complex data types

Complex data types can be modelled as UML classes with attributes (e.g. Address consists of name, street, city etc.). They have their own metadata (e.g. definition) and can be re-used throughout the model.

Complex data types are recursive, e.g. they can contain other Complex data types that again contain others, etc.

Complex data types are used via class associations. In DATEX II they are named automatically if no explicit name is given. An example shows Figure 5.

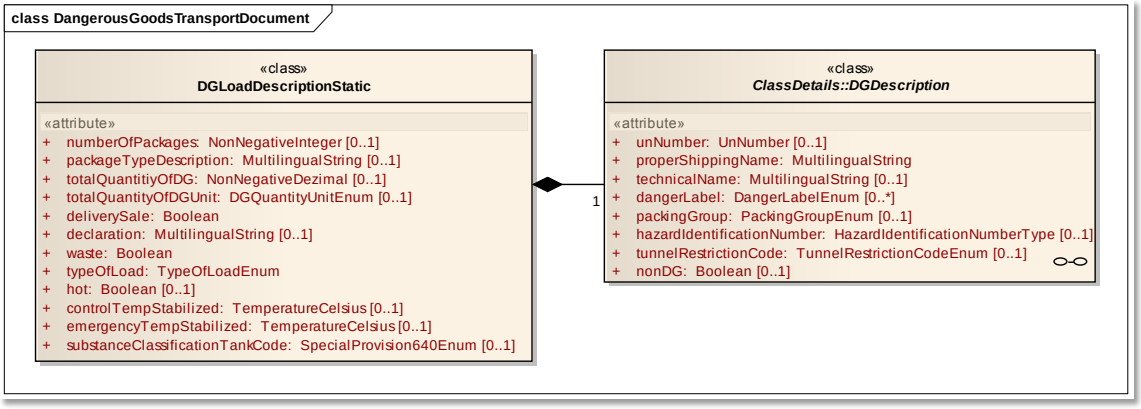

Figure 5 – Complex data types: definition of the dangerous goods load

The same set of descriptive metadata is used (Figure 6) as in the case of simple data types and enumerations. Since the data structures represented here (e.g. Figure 5) are not systematically defined, neither in ADR, ADN & RID nor in the WDW table, not all tagged values can be filled from this source. The consequence is that *originalCode* & *originalName* may be nulled, but a definition is mandatory and needs to be agreed with the Working Group on Telematics.

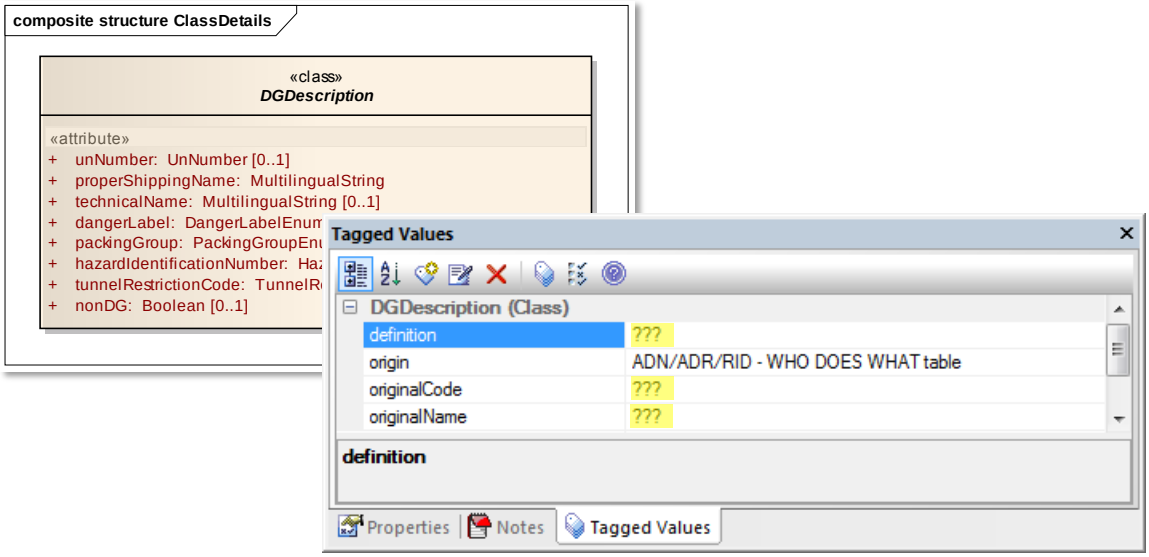

Figure 6 – Complex data types: problem of the metadata set

6. The Dangerous Goods Transport Model

6.1 The package “DangerousGoodsTransportArtefacts”

6.1.1 The class model

The package “DangerousGoodsTransportArtefacts” supplies classes and attributes defining the artefacts of a dangerous goods transport. It is depicted – including the relationships between classes – in Figure 7.

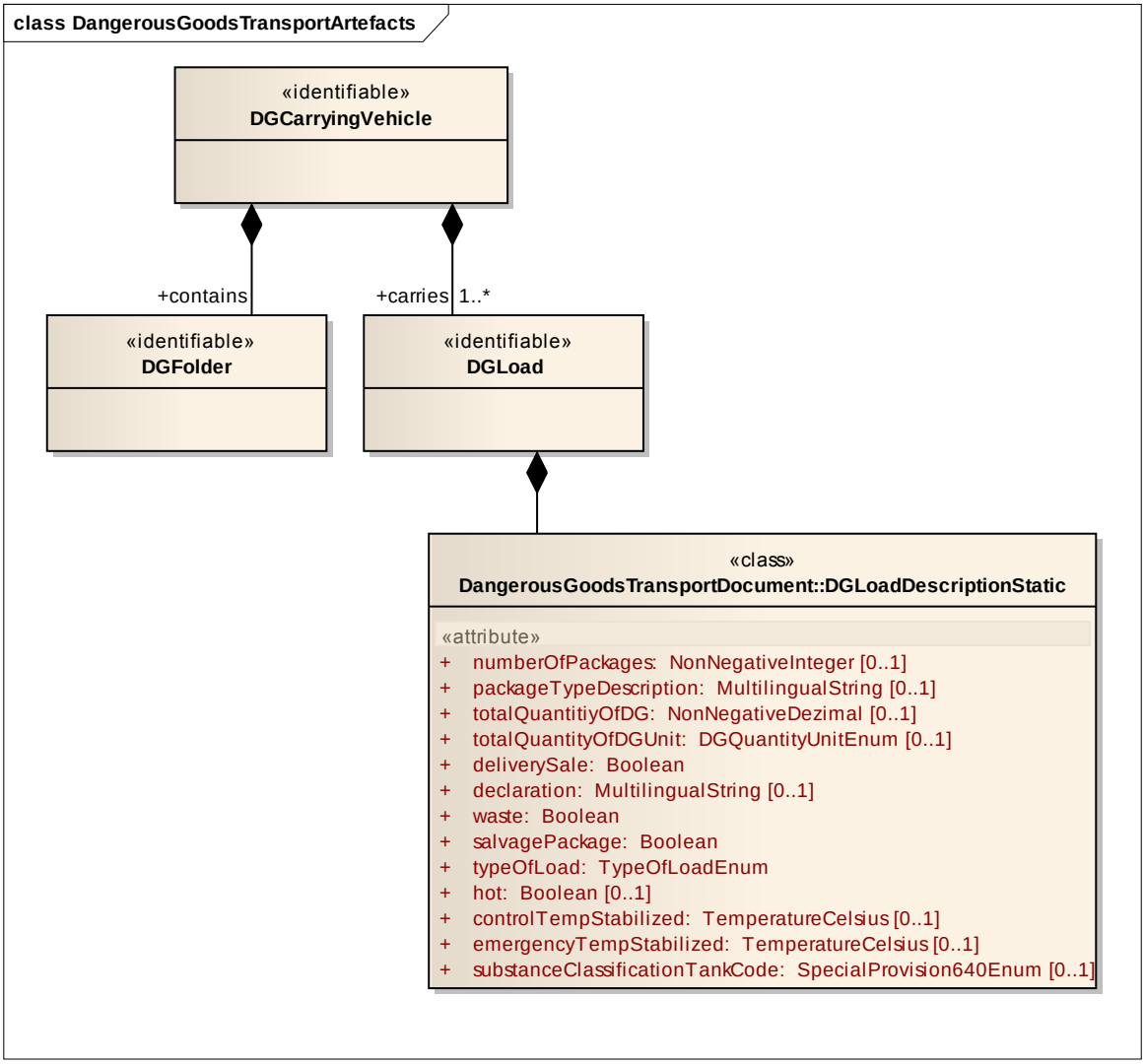

Figure 7 – The DangerousGoodsTransportArtefacts class model

6.1.2 Semantics

Beyond the WDW table the assumption was made that there is a vehicle (*identifiable DGCarryingVehicle*), which carries the dangerous goods. The vehicle contains a dangerous goods folder (*identifiable DGFolder*), which include all documents necessary for the transport (certificates, transport document, instructions in writing, etc.).

In addition, it carries one or more dangerous goods loads (*identifiable DGLoad*). For each of these dangerous goods loads, a description of the properties must be available (*class DGLoadDescriptionStatic*). These were taken from the WDW table part A.

The model emphasises the distinction between the *load* itself and the *description* of each dangerous good load. This aspect is further explained in Chapter 5.3. All attributes marked with “[0..1]” or “[0..*]” are optional. In case no multiplicity or a “[1..*]” has been specified, the corresponding attribute is implicitly mandatory.

6.2 The package “DangerousGoodsDocuments”

6.2.1 The class model

The package “DangerousGoodsDocuments” supplies classes and attributes defining the dangerous goods documents in the dangerous goods folder. It is depicted – including the relationships between classes – in Figure 8.

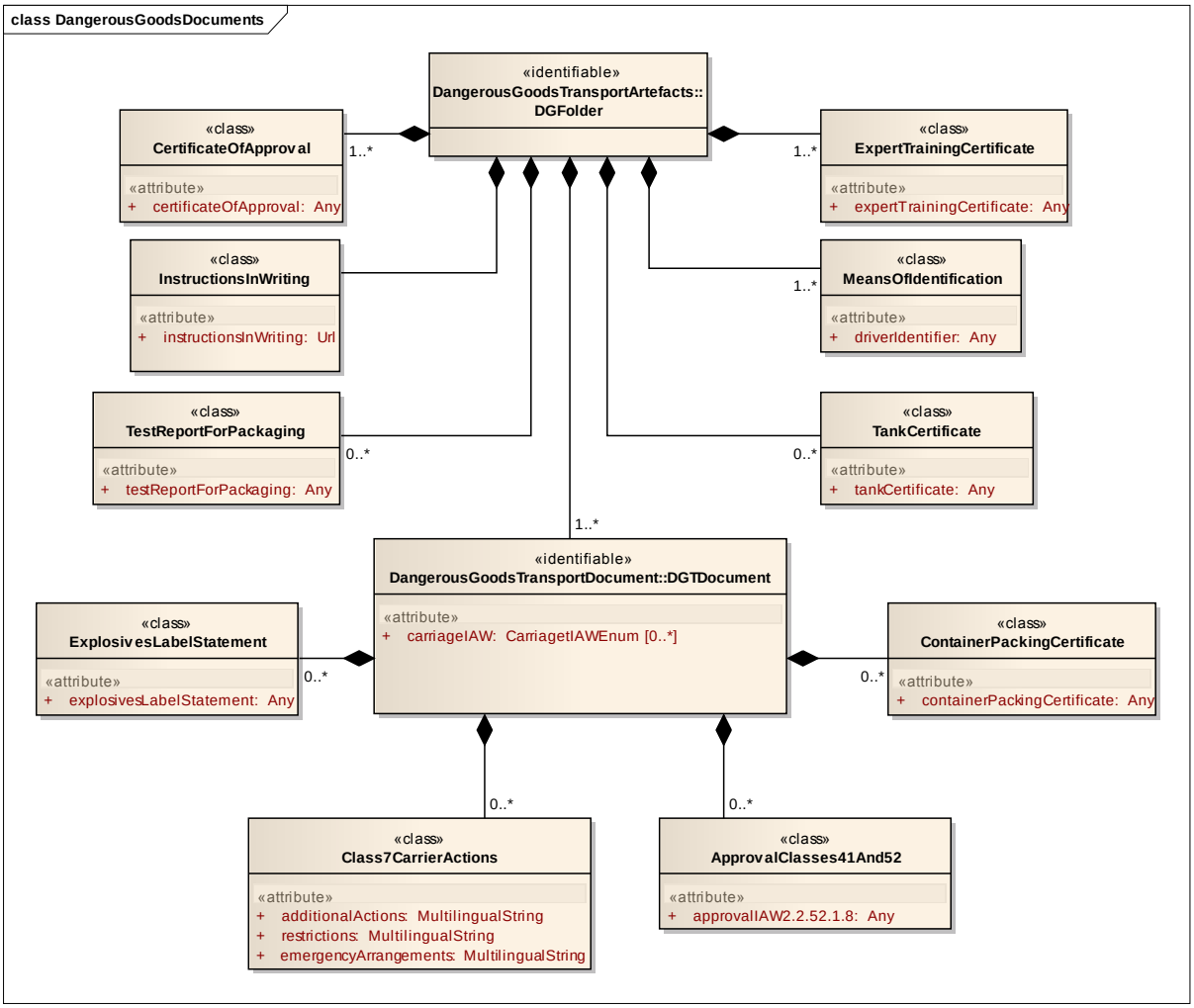

Figure 8 – The DangerousGoodsDocuments class model

6.2.2 Semantics

The dangerous goods folder (*identifiable DGFolder*) contains all the necessary documents for the transport of dangerous goods (certificates, transport document, instructions in writing, etc.). The assignment of documents bases on the WDW table. Hence, documents that are defined in part A of the table (explosive label statement, container packing certificate etc.) were associated with the transport document. Documents that were listed in part B (tank certificate, test report for packagings, etc.) are associated with the *class DGFolder*.

Because the structure of the certificates in terms of the WDW table is indefinite, no more precise information were made in the data model. Therefore the data type *Any* was assigned to the appropriate attributes.

6.3 The package “DangerousGoodsTransportDocument”

6.3.1 The class model

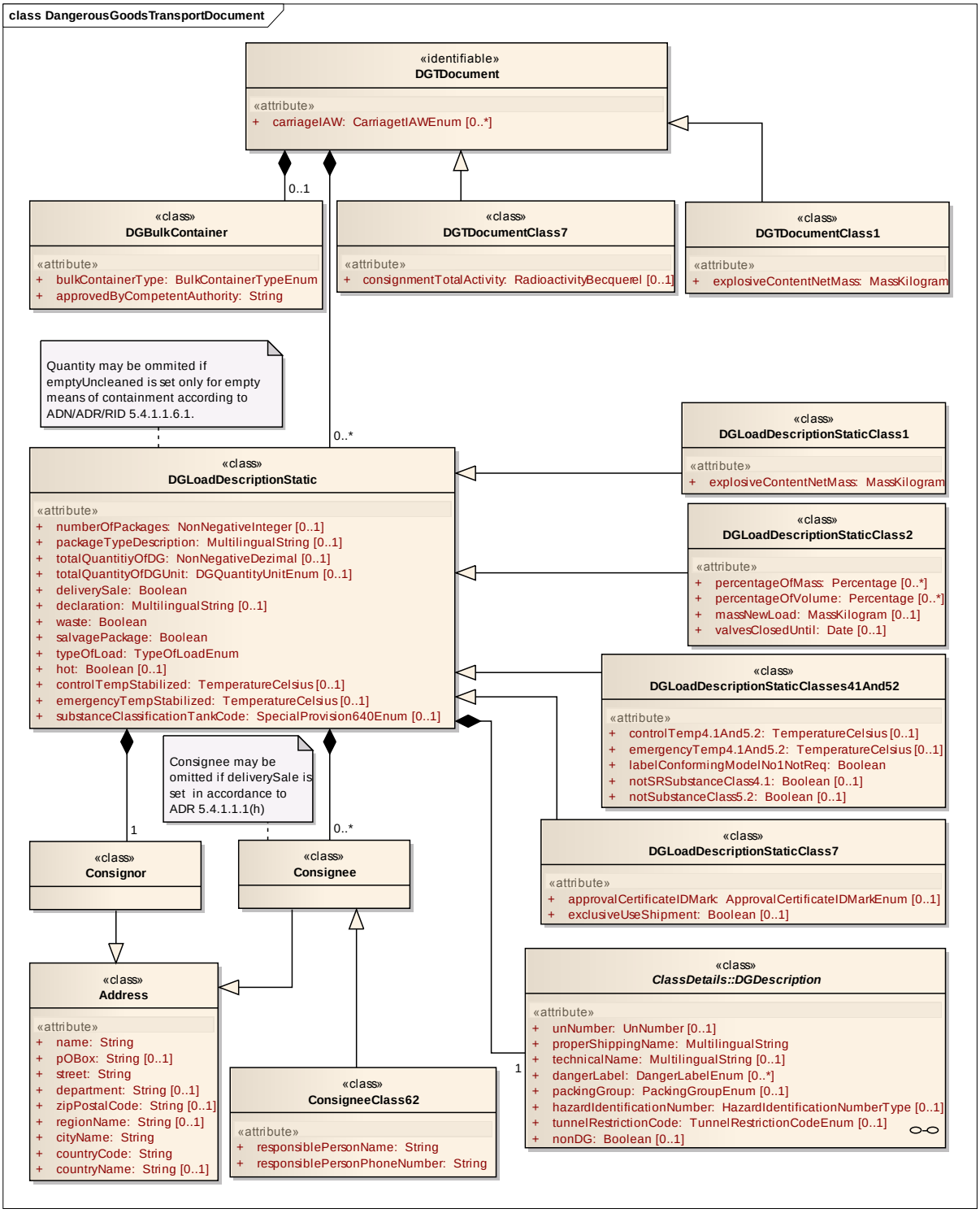

Figure 9 – The DangerousGoodsTransportDocument class model

The package “DangerousGoodsTransportDocument” supplies classes and attributes to the definition of the dangerous goods transport document and its specializations. It is pictured including the relationships between the classes in Figure 9.

6.3.2 Semantics

According to classes of dangerous goods the transport document (*class DGTDocument*) has different specializations. This aspect is considered by the *class DGTDockumentClass1* and the *class DGTDockumentClass1*.

At the level of the transport document references to the transport by chapters of ADN/ADR/RID (e.g. "carriage in accordance with 7.5.8.1") were summarized in an enumeration.

In the model, the transport document represents a reflection of the load. It includes a description of the load with all dangerous goods (*class DGLoadDescriptionStatic*). The description of the components of the load refers to this to just one description of a dangerous good (*class DGDescrition*, see also chapter 6.4.).

For the element No. 20 of the WDW table (Multi-compartment tank) no explicit attributes/classes are needed; these are considered by a *1..** multiplicity between the classes *DangerousGoodsTransportDocument* and *DangeousGoodsLoadDescriptionStatic*.

The description of the components of a load has the specializations necessary for the dangerous goods class 1 (*DGLoadDescriptionStaticClass1*), 2 (*DGLoadDescriptionStaticClass2*), 4.1 and 5.2 (*DGLoadDescriptionStaticClasses41And52*) and class 7 (*DGLoadDescriptionStaticClass7*).

Any dangerous goods load has a consignor and no, one or more consignees. The address properties are derived from the class LegalEntity. Regulations concerning the class 6.2 were considered by the corresponding specialization (class *ConsigneeClass62)* of the *class Consignee*.

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6.4 The package “ClassDetails”

6.4.1 The class model

The package “DangerousGoodsTransportDocument” supplies classes and attributes to the definition of the dangerous goods description and its specializations. It is pictured including the relationships between the classes in Figure 10.

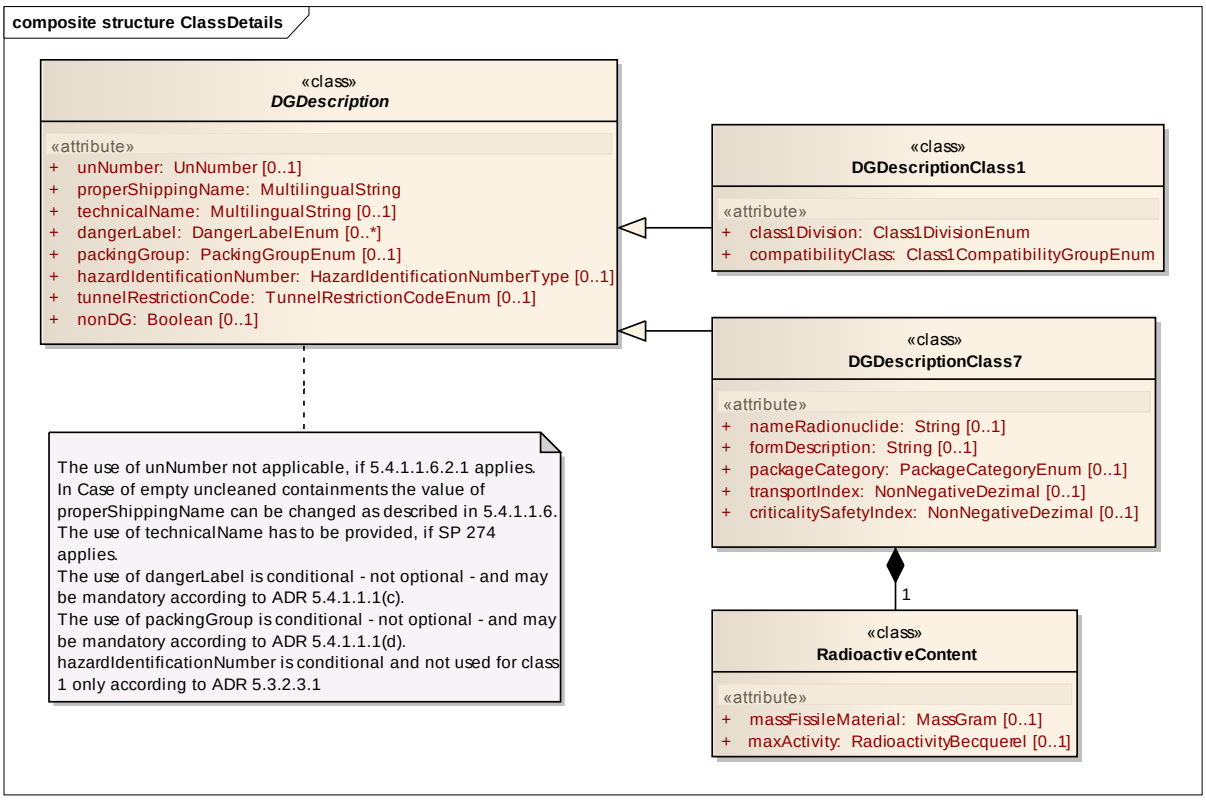

Figure 10 – The ClassDetails class model

6.4.2 Semantics

The *class DGDescription* describes a single dangerous good. For dangerous goods of the classes 1 and 7 is this based on a specialization (DGDescriptionClass1, DGDescriptionClass7).

By specializing in the class 7 a modeling of the attribute *class* (WDW table no. 4) for class 7 is obsolete, because the relation is unique.

Annex A

A.1 Overview

This data dictionary describes the characteristics of the different classes, attributes and roles appearing in the data model defined in Chapter 6. The dictionary is specified as a set of tables grouping classes, attributes and roles for each package as they are defined in Chapter 6.

For each package are successively provided:

- The class table,
- The association role table.
- The attribute table,

Each table of a given type has the same structure.

The data dictionary is categorised into sections following the different UML model packages as mentioned above. It defines for every package the entities and elements corresponding.

The table columns have the following meaning:

- Columns Name: they provide the symbolic name (either in Lower or Upper Camel Case) given to the corresponding class, attribute or association role.
- Column Definition: it provides a comprehensive definition detailing this class, attribute or association role.

Some columns are specific for one or two tables. The class tables include the following two columns:

- Column Identifiable: it indicates if the corresponding class is identifiable (value “yes”) or not (value “no”).
- Column Abstract: it indicates if the corresponding class is abstract (value “yes”) or concrete (value “no”). Abstract classes are defined in ISO/IEC 1501.

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The attribute tables and the association tables include the following column:

- Column Multiplicity: it provides the number of occurrences a class may have when instantiating this association (resp. a class attribute may have when instantiating this class). The adopted syntax is the following: m..n where ‘m’ and ‘n’ respectively represent the minimum the maximum value of multiplicity.

For association roles, the possible value for *m* are:

- 0 in case of an optional participation of the corresponding class when instantiating the association;
- 1 in case of a mandatory participation of the corresponding class when instantiating the association;
- 2, 3, … in case a minimum number of participations of the corresponding class is explicitly defined when instantiating the association.

For association roles, the possible value for *n* are:

- 1 in case only one class instance is at most participating at the association instantiation;
- * in case several instances are allowed participating at the association instantiation;
- 2, 3, .. in case a maximum number participations of the corresponding class is explicitly defined when instantiating the association.

For attributes, the possible value for *m* are:

- 0 in case of an optional attribute;
- 1 in case of a mandatory association / attribute;
- 2, 3, … in case a minimum number of occurrences is explicitly defined.

For attributes, the possible value for *n* are:

- 1 in case only one attribute instance is allowed;
- * in case several instances are allowed for this attribute without being precised;
- 2, 3, .. in case a maximum number of occurrences is explicitly defined.

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For the attribute tables, the following column has been added:

- Column Type: it provides the class name used as data type. It is only provided for elements corresponding to class attributes. When the type name ends with 'Enum' this means it corresponds to an enumeration of accepted values.

For the association table, the following column has been added:

- Column Target: it provides the class name appearing at the second end of the relationship, i.e. linked through the corresponding association.

A.2 Data Dictionary for "DangerousGoodsTransport"

A.2.1 "ClassDetails" package

A.2.1.1 "ClassDetails" package classes

Class name	Definition	Stereotype	Abstract
DGDescription	???		yes
DGDescriptionClass1	ADN/ADR/RID 5.4.1.1.1 (c) - Identify nature of hazard		no
DGDescriptionClass7	ADN/ADR/RID 5.4.1.2.5.1 (d) - Identify detailed RAM hazard		no
RadioactiveContent	ADN/ADR/RID 5.4.1.2.5.1 (c) - Identify detailed RAM hazard		no

Table 1— Classes of the "ClassDetails" package

A.2.1.2 "ClassDetails" package association roles

There are no defined association roles in the "ClassDetails" package.

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A.2.1.3 "ClassDetails" package attributes

Class name	Attribute name	Definition	Multiplicity	Type
DGDescription	dangerLabel	ADN/ADR/RID 5.4.1.1.1 (c) - Identify additional hazard(s)	0..*	DangerLabelEnum
	hazardIdentificationNumber	RID 5.4.1.1.1 (j) - Identify nature of hazard and degree of danger	0..1	HazardIdentificationNumberType
	nonDG	ADN/ADR/RID 5.4.1.5 - Indicates not subject to ADR/RID	0..1	Boolean
	packingGroup	ADN/ADR/RID 5.4.1.1.1 (d) - Identify degree of danger	0..1	PackingGroupEnum
	properShippingName	ADN/ADR/RID 5.4.1.1.1 (b) - Identify DG	1..1	MultilingualString
	technicalName	ADN/ADR/RID 5.4.1.1.1 (c) - Further characterize generic or N.O.S PSNs	0..1	MultilingualString
	tunnelRestrictionCode	ADR 5.4.1.1.1 - To select a route in consideration of tunnel restrictions	0..1	TunnelRestrictionCodeEnum
	unNumber	ADN/ADR/RID 5.4.1.1.1 (a) - Identify DG	0..1	UnNumber
DGDescriptionClass1	class1Division	ADN/ADR/RID 5.4.1.1.1 (c) - Identify nature of hazard	1..1	Class1DivisionEnum
	compatibilityClass	ADN/ADR/RID 5.4.1.1.1 (c) - Identify nature of hazard	1..1	Class1CompatibilityGroupEnum
DGDescriptionClass7	criticalitySafetyIndex	ADN/ADR/RID 5.4.1.2.5.1 (f) - Identify detailed RAM hazard	0..1	NonNegativeDecimal
	formDescription	ADN/ADR/RID 5.4.1.2.5.1 (b) - Identify detailed RAM hazard	0..1	String
	nameRadionuclide	ADN/ADR/RID 5.4.1.2.5.1 (a) - Identify detailed RAM hazard	0..1	String

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Class name	Attribute name	Definition	Multiplicity	Type
	packageCategory	ADN/ADR/RID 5.4.1.2.5.1 (d) - Identify detailed RAM hazard	0..1	PackageCategoryEnum
	transportIndex	ADN/ADR/RID 5.4.1.2.5.1 (e) - Identify detailed RAM hazard	0..1	NonNegativeDecimal
RadioactiveContent	massFissileMaterial	ADN/ADR/RID 5.4.1.2.5.1 (c) - Identify detailed RAM hazard	0..1	MassGram
	maxActivity	ADN/ADR/RID 5.4.1.2.5.1 (c) - Identify detailed RAM hazard	0..1	RadioactivityBecquerel

Table 2— Attributes of the "ClassDetails" package

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A.2.2 "DangerousGoodsDocuments" package

A.2.2.1 "DangerousGoodsDocuments" package classes

Class name	Definition	Stereotype	Abstract
ApprovalClasses41And52	ADN/ADR/RID 5.4.1.2.3 - Indicates possible explosive hazard and specific conditions of transport		no
CertificateOfApproval	ADR 9.1.3.5, ADN 8.1.8 - Indicates suitability for carrying dangerous goods		no
Class7CarrierActions	ADN/ADR/RID 5.4.1.2.5.2 - Identify detailed RAM hazard		no
ContainerPackingCertificate	ADN/ADR/RID 5.4.2 - Certifies loading/filling of container/vehicle in accordance with 5.4.2 IMDG Code		no
ExpertTrainingCertificate	ADN/ADR 7.5.1.2 and 8.2.1 - Indicates qualification for carrying dangerous goods		no
ExplosivesLabelStatement	ADN/ADR/RID 5.4.1.2.1 (c) - Clarify for enforcement purposes		no
InstructionsInWriting	ADN/ADR/RID 5.4.3 - Emergency information for the vehicle crew		no
MeansOfIdentification	ADN/ADR/RID 1.10.1.4 - Security purposes		no
TankCertificate	ADN/ADR/RID 6.8.2.3.1 - Suitability for the intended purpose		no
TestReportForPackaging	ADN/ADR/RID 6.1.5.8 - Suitability for the intended purpose		no

Table 3— Classes of the "DangerousGoodsDocuments" package

A.2.2.2 "DangerousGoodsDocuments" package association roles

There are no defined association roles in the "DangerousGoodsDocuments" package.

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A.2.2.3 "DangerousGoodsDocuments" package attributes

Class name	Attribute name	Definition	Multiplicity	Type
ApprovalClasses41And52	approvalIAW2.2.52.1.8	ADN/ADR/RID 5.4.1.2.3 - Indicates possible explosive hazard and specific conditions of transport	1..1	Any
CertificateOfApproval	certificateOfApproval	ADR 9.1.3.5, ADN 8.1.8 - Indicates suitability for carrying dangerous goods	1..1	Any
Class7CarrierActions	additionalActions	ADN/ADR/RID 5.4.1.2.5.2 (a) - Identify detailed RAM hazard	1..1	MultilingualString
	emergencyArrangements	ADN/ADR/RID 5.4.1.2.5.2 (c) - Identify detailed RAM hazard	1..1	MultilingualString
	restrictions	ADN/ADR/RID 5.4.1.2.5.2 (b) - Identify detailed RAM hazard	1..1	MultilingualString
ContainerPackingCertificate	containerPackingCertificate	ADN/ADR/RID 5.4.2 - Certifies loading/filling of container/vehicle in accordance with 5.4.2 IMDG Code	1..1	Any
ExpertTrainingCertificate	expertTrainingCertificate	ADN/ADR 7.5.1.2 and 8.2.1 - Indicates qualification for carrying dangerous goods	1..1	Any
ExplosivesLabelStatement	explosivesLabelStatement	ADN/ADR/RID 5.4.1.2.1 (c) - Clarify for enforcement purposes	1..1	Any
InstructionsInWriting	instructionsInWriting	ADN/ADR/RID 5.4.3 - Emergency information for the vehicle crew	1..1	Url
MeansOfIdentification	driverIdentifier	ADN/ADR/RID 1.10.1.4 - Security purposes	1..1	Any
TankCertificate	tankCertificate	ADN/ADR/RID 6.8.2.3.1 - Suitability for the intended purpose	1..1	Any

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Class name	Attribute name	Definition	Multiplicity	Type
TestReportForPackaging	testReportForPackaging	ADN/ADR/RID 6.1.5.8 - Suitability for the intended purpose	1..1	Any

Table 4— Attributes of the "DangerousGoodsDocuments" package

A.2.3 "DangerousGoodsTransportArtefacts" package

A.2.3.1 "DangerousGoodsTransportArtefacts" package classes

Class name	Definition	Stereotype	Abstract
DGCarryingVehicle	???	identifiable	no
DGFolder	???	identifiable	no
DGLoad	???	identifiable	no

Table 5— Classes of the "DangerousGoodsTransportArtefacts" package

A.2.3.2 "DangerousGoodsTransportArtefacts" package association roles

Class name	Role name	Definition	Multiplicity	Target
DGCarryingVehicle	carries		1..*	DGLoad
	contains		1..1	DGFolder

Table 6— Associations of the "DangerousGoodsTransportArtefacts" package

A.2.3.3 "DangerousGoodsTransportArtefacts" package attributes

There are no defined attributes in the "DangerousGoodsTransportArtefacts" package.

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A.2.4 "DangerousGoodsTransportDocument" package

A.2.4.1 "DangerousGoodsTransportDocument" package classes

Class name	Definition	Stereotype	Abstract
Address	???		no
Consignee	ADN/ADR/RID 5.4.1.1.1 (f) - To identify destination		no
ConsigneeClass62	ADN/ADR/RID 5.4.1.2.4 - Identifies source of expert advice		no
Consignor	ADN/ADR/RID 5.4.1.1.1 (g) - To identify the person who initiated the transport		no
DGBulkContainer	ADN/ADR/RID 5.4.1.1.17 - Indicates approved containment		no
DGLoadDescriptionStatic	???		no
DGLoadDescriptionStaticClass1	ADN/ADR/RID 5.4.1.2.1 (a) - Indicates quantity of explosives in article		no
DGLoadDescriptionStaticClass2	ADN/ADR/RID 5.4.1.2.2 (a) - Identify degree of danger; RID (b), (c) and (d) - Indicates specific conditions of transport		no
DGLoadDescriptionStaticClass7	ADN/ADR/RID 5.4.1.2.5 - Identify detailed RAM hazard		no
DGLoadDescriptionStaticClasses41And52	ADN/ADR/RID 5.4.1.2.3 - Indicates possible explosive hazard and specific conditions of transport		no
DGTDocument	???	identifiable	no
DGTDocumentClass1	ADN/ADR/RID 5.4.1.2.1 (a) - Indicates quantity of explosives in article		no
DGTDocumentClass7	ADN/ADR/RID 5.4.1.2.5.1 (j) - Identify detailed RAM hazard		no

Table 7— Classes of the "DangerousGoodsTransportDocument" package

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A.2.4.2 "DangerousGoodsTransportDocument" package association roles

There are no defined association roles in the "DangerousGoodsTransportDocument" package.

A.2.4.3 "DangerousGoodsTransportDocument" package attributes

Class name	Attribute name	Definition	Multiplicity	Type
Address	cityName	???	1..1	String
	countryCode	???	1..1	String
	countryName	???	0..1	String
	department	???	0..1	String
	name	???	1..1	String
	pOBox	???	0..1	String
	regionName	???	0..1	String
	street	???	1..1	String
	zipPostalCode	???	0..1	String
ConsigneeClass62	responsiblePersonName	ADN/ADR/RID 5.4.1.2.4 - Identifies source of expert advice	1..1	String
	responsiblePersonPhoneNumber	ADN/ADR/RID 5.4.1.2.4 - Identifies source of expert advice	1..1	String
DGBulkContainer	approvedByCompetentAuthority	ADN/ADR/RID 5.4.1.1.17 - Indicates approved containment	1..1	String
	bulkContainerType	ADN/ADR/RID 5.4.1.1.17 - Indicates approved containment	1..1	BulkContainerTypeEnum
DGLoadDescriptionStatic	controlTempStabilized	ADR 5.4.1.1.15 - Need to maintain conditions	0..1	TemperatureCelsius

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Class name	Attribute name	Definition	Multiplicity	Type
	declaration	ADN/ADR/RID 5.4.1.1.1 (i) - Declaration required by multilateral agreement	0..1	MultilingualString
	deliverySale	ADN/ADR/RID 5.4.1.1.1 (h) - To identify destination	1..1	Boolean
	emergencyTempStabilized	ADR 5.4.1.1.15 - Need to maintain conditions	0..1	TemperatureCelsius
	hot	ADN/ADR/RID 5.4.1.1.14 - Identify scalding/burning hazard	0..1	Boolean
	numberOfPackages	ADN/ADR/RID 5.4.1.1.1 (e) - Indicate what DGs are contained	0..1	NonNegativeInteger
	packageTypeDescription	ADN/ADR/RID 5.4.1.1.1 (e) - Indicate what DGs are contained	0..1	MultilingualString
	salvagePackage	ADN/ADR/RID 5.4.1.1.5 - Indicates a special packaging situation	1..1	Boolean
	substanceClassificationTankCode	ADN/ADR/RID 5.4.1.1.16 - Indicates substance classification tank code	0..1	SpecialProvision640Enum
	totalQuantitiyOfDG	ADN/ADR/RID 5.4.1.1.1 (f) - Indicate quantity of individual DGs	0..1	NonNegativeDecimal
	totalQuantityOfDGUnit	ADN/ADR/RID 5.4.1.1.1 (f) - Indicate quantity of individual DGs	0..1	DGQuantityUnitEnum
	typeOfLoad	ADN/ADR/RID 5.4.1.1.6 - Identify risks from fumes/residues	1..1	TypeOfLoadEnum
	waste	ADN/ADR/RID 5.4.1.1.3 - To identify simplified classification of wastes and interface with waste regs	1..1	Boolean

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Class name	Attribute name	Definition	Multiplicity	Type
DGLoadDescriptionStaticClass1	explosiveContentNetMass	ADN/ADR/RID 5.4.1.2.1 (a) - Indicates quantity of explosives in article	1..1	MassKilogram
DGLoadDescriptionStaticClass2	massNewLoad	RID 5.4.1.2.2 (c) - Indicates specific conditions of transport	0..1	MassKilogram
	percentageOfMass	ADN/ADR/RID 5.4.1.2.2 (a) - Identify degree of danger	0..*	Percentage
	percentageOfVolume	ADN/ADR/RID 5.4.1.2.2 (a) - Identify degree of danger	0..*	Percentage
	valvesClosedUntil	RID 5.4.1.2.2 (d) - Indicates specific conditions of transport	0..1	Date
DGLoadDescriptionStaticClass7	approvalCertificateIDMark	ADN/ADR/RID 5.4.1.2.5.1 (g) - Identify detailed RAM hazard	0..1	ApprovalCertificateIDMarkEnum
	exclusiveUseShipment	ADN/ADR/RID 5.4.1.2.5.1 (i) - Identify detailed RAM hazard	0..1	Boolean
DGLoadDescriptionStaticClasses41And52	controlTemp4.1And5.2	ADN/ADR/RID 5.4.1.2.3.1 - Indicates possible explosive hazard and specific conditions of transport	0..1	TemperatureCelsius
	emergencyTemp4.1And5.2	ADN/ADR/RID 5.4.1.2.3.1 - Indicates possible explosive hazard and specific conditions of transport	0..1	TemperatureCelsius
	labelConformingModelNo1NotReq	ADN/ADR/RID 5.4.1.2.3.2 - Indicates possible explosive hazard and specific conditions of transport	1..1	Boolean
	notSRSubstanceClass4.1	ADN/ADR/RID 5.4.1.2.3.5 - Indicates possible explosive hazard and specific conditions of transport	0..1	Boolean

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Class name	Attribute name	Definition	Multiplicity	Type
	notSubstanceClass5.2	ADN/ADR/RID 5.4.1.2.3.5 - Indicates possible explosive hazard and specific conditions of transport	0..1	Boolean
DGTDocument	carriageIAW	???	0..*	CarriagetIAWEnum
DGTDocumentClass1	explosiveContentNetMass	ADN/ADR/RID 5.4.1.2.1 (a) - Indicates quantity of explosives in article	1..1	MassKilogram
DGTDocumentClass7	consignmentTotalActivity	ADN/ADR/RID 5.4.1.2.5 (j) - Identify detailed RAM hazard	0..1	RadioactivityBecquerel

Table 8— Attributes of the "DangerousGoodsTransportDocument" package

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A.3 Data Dictionary of <<datatypes>> for "DangerousGoodsTransport"

This clause contains the definitions of all data types which are used in the "DangerousGoodsTransport".

A.3.1 The <<datatype>> "Any"

ADN/ADR/RID 1, 5, 6, 7, 8, 9 - Any does not constrain its content in any way

A.3.2 The <<datatype>> "HazardIdentificationNumberType"

RID 5.4.1.1.1 (j) - Identify nature of hazard and degree of danger

A.3.3 The <<datatype>> "MassGram"

ADN/ADR/RID 5.4.1.2.5.1 (c) - Mass in Gram

A.3.4 The <<datatype>> "MassKilogram"

ADN/ADR/RID 5.4.1.2.1 (a), 5.4.1.2.2 (a) - Mass in Kilogram

A.3.5 The <<datatype>> "NonNegativeDezimal"

The value space of decimal is the set of numbers that can be obtained by multiplying an positive integer by a non-positive power of ten

A.3.6 The <<datatype>> "Percentage"

A measure of percentage.

A.3.7 The <<datatype>> "RadioactivityBecquerel"

ADN/ADR/RID 5.4.1.2.5.1 - Radioactivity in Becquerel

A.3.8 The <<datatype>> "TemperatureCelsius"

A measure of temperature defined in degrees Celsius.

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A.3.9 The <<datatype>> "UnNumber"

ADN/ADR/RID 2.1.1.2 - Identify DG

A.4 Data Dictionary of <<enumerations>> for "DangerousGoodsTransport"

This clause contains the definitions of all enumerations which are used in the "DangerousGoodsTransport".

A.4.1 The <<enumeration>> "ApprovalCertificateIDMarkEnum"

ADN/ADR/RID 5.4.1.2.5.1 (g) - Identify detailed RAM hazard

Enumerated value name	Definition
lowDispersibleRadioactiveMaterial	ADN/ADR/RID 5.4.1.2.5.1 (g) - Identify detailed RAM hazard
packageDesign	ADN/ADR/RID 5.4.1.2.5.1 (g) - Identify detailed RAM hazard
shipment	ADN/ADR/RID 5.4.1.2.5.1 (g) - Identify detailed RAM hazard
specialArrangement	ADN/ADR/RID 5.4.1.2.5.1 (g) - Identify detailed RAM hazard
specialFormRadioactiveMaterial	ADN/ADR/RID 5.4.1.2.5.1 (g) - Identify detailed RAM hazard

Table 9— Values contained in the enumeration "ApprovalCertificateIDMarkEnum"

A.4.2 The <<enumeration>> "BulkContainerTypeEnum"

ADN/ADR/RID 5.4.1.1.17 - Indicates approved containment

Enumerated value name	Definition
BK1	ADN/ADR/RID 5.4.1.1.17 - Indicates approved containment
BK2	ADN/ADR/RID 5.4.1.1.17 - Indicates approved containment

Table 10— Values contained in the enumeration "BulkContainerTypeEnum"

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A.4.3 The <<enumeration>> "CarriagetIAWEnum"

???

Enumerated value name	Definition
1.1.4.2.1	ADN/ADR/RID 5.4.1.1.7 - Indicates sea or air requirements apply
2.2.52.1.8	ADN/ADR/RID 5.4.1.2.3.3 - Indicates possible explosive hazard and specific conditions of transport
2.2.52.1.9	ADN/ADR/RID 5.4.1.2.3.4 - Indicates possible explosive hazard and specific conditions of transport
4.1.2.2b	ADN/ADR/RID 5.4.1.1.11 - Indicates that journey must be to inspection/disposal facility
4.1.6.10	ADN/ADR/RID 5.4.1.2.2 (b) - Indicates specific conditions of transport
4.3.2.4.3	ADN/ADR/RID 5.4.1.1.6.3 (a) - Identify risks from fumes/residues
4.3.2.4.4	ADN/ADR/RID 5.4.1.1.6.4 - Identify risks from fumes/residues
6.7.2.19.6b	ADN/ADR/RID 5.4.1.1.11 - Indicates that journey must be to inspection/disposal facility
6.7.3.15.6b	ADN/ADR/RID 5.4.1.1.11 - Indicates that journey must be to inspection/disposal facility
6.7.4.14.6b	ADN/ADR/RID 5.4.1.1.11 - Indicates that journey must be to inspection/disposal facility
7.5.8.1	ADN/ADR/RID 5.4.1.1.6.3 (b) - Identify risks from fumes/residues

Table 11— Values contained in the enumeration "CarriagetIAWEnum"

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A.4.4 The <<enumeration>> "Class1CompatibilityGroupEnum"

ADN/ADR/RID 5.4.1.1.1 (c) - Identify nature of hazard

Enumerated value name	Definition
A	ADN/ADR/RID 5.4.1.1.1 (c) - Identify nature of hazard
B	ADN/ADR/RID 5.4.1.1.1 (c) - Identify nature of hazard
C	ADN/ADR/RID 5.4.1.1.1 (c) - Identify nature of hazard
D	ADN/ADR/RID 5.4.1.1.1 (c) - Identify nature of hazard
E	ADN/ADR/RID 5.4.1.1.1 (c) - Identify nature of hazard
F	ADN/ADR/RID 5.4.1.1.1 (c) - Identify nature of hazard
G	ADN/ADR/RID 5.4.1.1.1 (c) - Identify nature of hazard
H	ADN/ADR/RID 5.4.1.1.1 (c) - Identify nature of hazard
J	ADN/ADR/RID 5.4.1.1.1 (c) - Identify nature of hazard
K	ADN/ADR/RID 5.4.1.1.1 (c) - Identify nature of hazard
L	ADN/ADR/RID 5.4.1.1.1 (c) - Identify nature of hazard
N	ADN/ADR/RID 5.4.1.1.1 (c) - Identify nature of hazard
S	ADN/ADR/RID 5.4.1.1.1 (c) - Identify nature of hazard

Table 12— Values contained in the enumeration "Class1CompatibilityGroupEnum"

A.4.5 The <<enumeration>> "Class1DivisionEnum"

ADN/ADR/RID 5.4.1.1.1 (c) - Identify nature of hazard

Enumerated value name	Definition
1.1	ADN/ADR/RID 5.4.1.1.1 (c) - Identify nature of hazard
1.2	ADN/ADR/RID 5.4.1.1.1 (c) - Identify nature of hazard

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Enumerated value name	Definition
1.3	ADN/ADR/RID 5.4.1.1.1 (c) - Identify nature of hazard
1.4	ADN/ADR/RID 5.4.1.1.1 (c) - Identify nature of hazard
1.5	ADN/ADR/RID 5.4.1.1.1 (c) - Identify nature of hazard
1.6	ADN/ADR/RID 5.4.1.1.1 (c) - Identify nature of hazard

Table 13— Values contained in the enumeration "Class1DivisionEnum"

A.4.6 The <<enumeration>> "DangerLabelEnum"

ADN/ADR/RID 5.4.1.1.1 (c) - Identify additional hazard(s)

Enumerated value name	Definition
1	ADN/ADR/RID 5.4.1.1.1 (c) - Identify additional hazard(s)
1.4	ADN/ADR/RID 5.4.1.1.1 (c) - Identify additional hazard(s)
1.5	ADN/ADR/RID 5.4.1.1.1 (c) - Identify additional hazard(s)
1.6	ADN/ADR/RID 5.4.1.1.1 (c) - Identify additional hazard(s)
15	ADN/ADR/RID 5.4.1.1.1 (c) - Identify additional hazard(s)
2.1	ADN/ADR/RID 5.4.1.1.1 (c) - Identify additional hazard(s)
2.2	ADN/ADR/RID 5.4.1.1.1 (c) - Identify additional hazard(s)
2.3	ADN/ADR/RID 5.4.1.1.1 (c) - Identify additional hazard(s)
3	ADN/ADR/RID 5.4.1.1.1 (c) - Identify additional hazard(s)
4.1	ADN/ADR/RID 5.4.1.1.1 (c) - Identify additional hazard(s)
4.2	ADN/ADR/RID 5.4.1.1.1 (c) - Identify additional hazard(s)
4.3	ADN/ADR/RID 5.4.1.1.1 (c) - Identify additional hazard(s)
5.1	ADN/ADR/RID 5.4.1.1.1 (c) - Identify additional hazard(s)
5.2	ADN/ADR/RID 5.4.1.1.1 (c) - Identify additional hazard(s)

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Enumerated value name	Definition
6.1	ADN/ADR/RID 5.4.1.1.1 (c) - Identify additional hazard(s)
6.2	ADN/ADR/RID 5.4.1.1.1 (c) - Identify additional hazard(s)
7A	ADN/ADR/RID 5.4.1.1.1 (c) - Identify additional hazard(s)
7B	ADN/ADR/RID 5.4.1.1.1 (c) - Identify additional hazard(s)
7C	ADN/ADR/RID 5.4.1.1.1 (c) - Identify additional hazard(s)
7D	ADN/ADR/RID 5.4.1.1.1 (c) - Identify additional hazard(s)
7E	ADN/ADR/RID 5.4.1.1.1 (c) - Identify additional hazard(s)
8	ADN/ADR/RID 5.4.1.1.1 (c) - Identify additional hazard(s)
9	ADN/ADR/RID 5.4.1.1.1 (c) - Identify additional hazard(s)

Table 14— Values contained in the enumeration "DangerLabelEnum"

A.4.7 The <<enumeration>> "DGQuantityUnitEnum"

ADN/ADR/RID 5.4.1.1.1 (f) - Indicate quantity of individual DGs

Enumerated value name	Definition
grossMass	ADN/ADR/RID 5.4.1.1.1 (f) - Indicate quantity of individual DGs
netMass	ADN/ADR/RID 5.4.1.1.1 (f) - Indicate quantity of individual DGs
volume	ADN/ADR/RID 5.4.1.1.1 (f) - Indicate quantity of individual DGs

Table 15— Values contained in the enumeration "DGQuantityUnitEnum"

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A.4.8 The <<enumeration>> "PackageCategoryEnum"

ADN/ADR/RID 5.4.1.2.5.1 (d) - Identify detailed RAM hazard

Enumerated value name	Definition
III-YELLOW	ADN/ADR/RID 5.4.1.2.5.1 (d) - Identify detailed RAM hazard
II-YELLOW	ADN/ADR/RID 5.4.1.2.5.1 (d) - Identify detailed RAM hazard
I-WHITE	ADN/ADR/RID 5.4.1.2.5.1 (d) - Identify detailed RAM hazard

Table 16— Values contained in the enumeration "PackageCategoryEnum"

A.4.9 The <<enumeration>> "PackingGroupEnum"

ADN/ADR/RID 5.4.1.1.1 (d) - Identify degree of danger

Enumerated value name	Definition
I	ADN/ADR/RID 5.4.1.1.1 (d) - Identify degree of danger
II	ADN/ADR/RID 5.4.1.1.1 (d) - Identify degree of danger
III	ADN/ADR/RID 5.4.1.1.1 (d) - Identify degree of danger

Table 17— Values contained in the enumeration "PackingGroupEnum"

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A.4.10 The <<enumeration>> "SpecialProvision640Enum"

ADN/ADR/RID 5.4.1.1.16 - Indicates substance classification tank code

Enumerated value name	Definition
C	ADN/ADR/RID 5.4.1.1.16 - Indicates substance classification tank code
D	ADN/ADR/RID 5.4.1.1.16 - Indicates substance classification tank code
E	ADN/ADR/RID 5.4.1.1.16 - Indicates substance classification tank code
F	ADN/ADR/RID 5.4.1.1.16 - Indicates substance classification tank code
G	ADN/ADR/RID 5.4.1.1.16 - Indicates substance classification tank code
H	ADN/ADR/RID 5.4.1.1.16 - Indicates substance classification tank code
I	ADN/ADR/RID 5.4.1.1.16 - Indicates substance classification tank code
J	ADN/ADR/RID 5.4.1.1.16 - Indicates substance classification tank code
K	ADN/ADR/RID 5.4.1.1.16 - Indicates substance classification tank code
L	ADN/ADR/RID 5.4.1.1.16 - Indicates substance classification tank code
M	ADN/ADR/RID 5.4.1.1.16 - Indicates substance classification tank code
N	ADN/ADR/RID 5.4.1.1.16 - Indicates substance classification tank code
O	ADN/ADR/RID 5.4.1.1.16 - Indicates substance classification tank code

Table 18— Values contained in the enumeration "SpecialProvision640Enum"

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A.4.11 The <<enumeration>> "TunnelRestrictionCodeEnum"

ADR 1.9.5.3.1 - Indicates tunnel restrictions

Enumerated value name	Definition
-	ADR 1.9.5.3.1 - Indicates tunnel restrictions
B	ADR 1.9.5.3.1 - Indicates tunnel restrictions
B/D	ADR 1.9.5.3.1 - Indicates tunnel restrictions
B/E	ADR 1.9.5.3.1 - Indicates tunnel restrictions
B1000C	ADR 1.9.5.3.1 - Indicates tunnel restrictions
C	ADR 1.9.5.3.1 - Indicates tunnel restrictions
C/D	ADR 1.9.5.3.1 - Indicates tunnel restrictions
C/E	ADR 1.9.5.3.1 - Indicates tunnel restrictions
C5000D	ADR 1.9.5.3.1 - Indicates tunnel restrictions
D	ADR 1.9.5.3.1 - Indicates tunnel restrictions
D/E	ADR 1.9.5.3.1 - Indicates tunnel restrictions
E	ADR 1.9.5.3.1 - Indicates tunnel restrictions

Table 19— Values contained in the enumeration "TunnelRestrictionCodeEnum"

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A.4.12 The <<enumeration>> "TypeOfLoadEnum"

ADN/ADR/RID 5.4.1.1.6 - Identify risks from fumes/residues

Enumerated value name	Definition
emptyNonPackaging	ADN/ADR/RID 5.4.1.1.6.2.2 - Identify risks from fumes/residues
emptyPackaging	ADN/ADR/RID 5.4.1.1.6.2.1 - Identify risks from fumes/residues
emptyUncleaned	ADN/ADR/RID 5.4.1.1.6.1 - Identify risks from fumes/residues
emptyUncleanedReturn	ADN/ADR/RID 5.4.1.1.6.2.3 - Identify risks from fumes/residues
regularLoad	ADN/ADR/RID 5.4.1.1.6 - Identify risks from fumes/residues

Table 20— Values contained in the enumeration "TypeOfLoadEnum"

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