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Title: Draft BS ISO 23150-2 Road vehicles - Logical interface between sensors and data fusion unit for automated driving functions.
Part 2: Object level interfaces.

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- iii) requires additional national guidance or information

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Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

For national standards, comments will be reviewed by the relevant UK national committee and the resulting standards published as a British Standard.

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Please indicate whether you consider the UK should submit a negative (with supporting technical reasons) or positive vote on this draft. Please indicate if you are aware of any reason why this draft standard should not be published as a British Standard.

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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/ Figure/Table/Note	Type of comment	Comment (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



DRAFT International Standard

ISO/DIS 23150-2

Road vehicles — Logical interface between sensors and data fusion unit for automated driving functions —

Part 2: Object level interfaces

*Véhicules routiers — Interface logique entre capteurs et unité de
fusion de données pour les fonctions de conduite automatisée —*

Partie 2: Interfaces de niveau objet

ICS: 43.040.15

ISO/TC 22/SC 31

Secretariat: DIN

Voting begins on:
2025-08-14

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2025-11-06

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 31, *Data communication*.

A list of all parts in the ISO series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Sensors for highly automated driving according to the ISO 23150 series provide logical interfaces between a single sensor or a single-sensor cluster and the fusion unit or automated driving functions. Interfaces are defined on different levels. The interfaces on feature level, advanced detection level and detection level are technology specific and differ by each technology.

[Figure 1](#) shows the schematic and contextual relationships between the documents relating to logical interfaces of the ISO 23150 series.

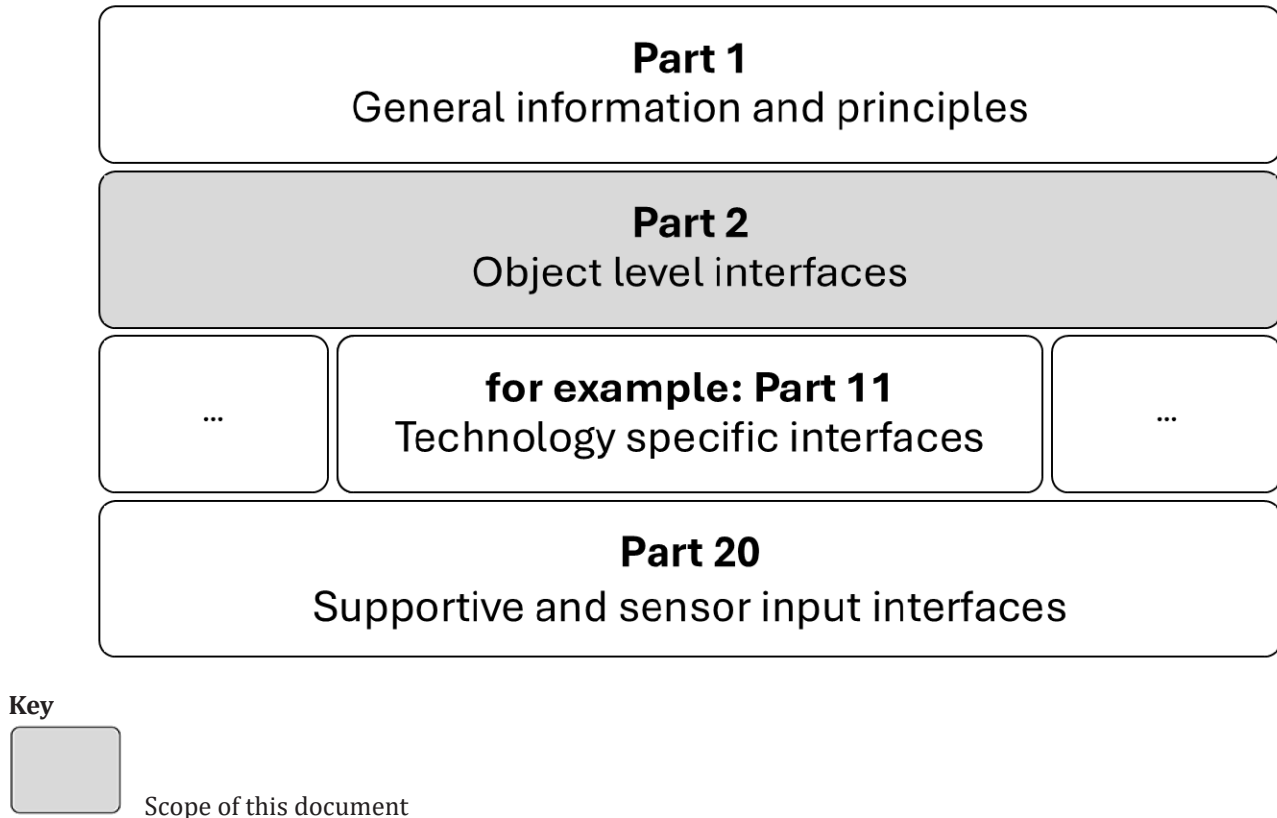


Figure 1 — Relationship of the ISO 23150 series

As a result, this document specifies the object level interfaces. Object interfaces such as the "potentially moving object interface" ([5.2.1](#)), the "road object interface" ([5.3.1](#)), the "static object interface" ([5.4.1](#)) and the "free-space object interface" ([5.5.1](#)) are part of the object level. These interfaces base on the generic specifications of the object level interface in ISO/DIS 23150-1, which are supplied by single sensors or sensor clusters. This document references to generic specifications of signals of the header and the generic interface levels.

A sensor or sensor cluster may also implement (provide or receive) logical interfaces:

- on feature, advanced detection or detection level (see technology specific parts of ISO 23150);
- for supportive and sensor input information (see ISO/CD 23150-20[\[1\]](#)).

This document is not intended to replace the logical interface specifications of other documents in the ISO 23150 series.

Road vehicles — Logical interface between sensors and data fusion unit for automated driving functions —

Part 2: Object level interfaces

1 Scope

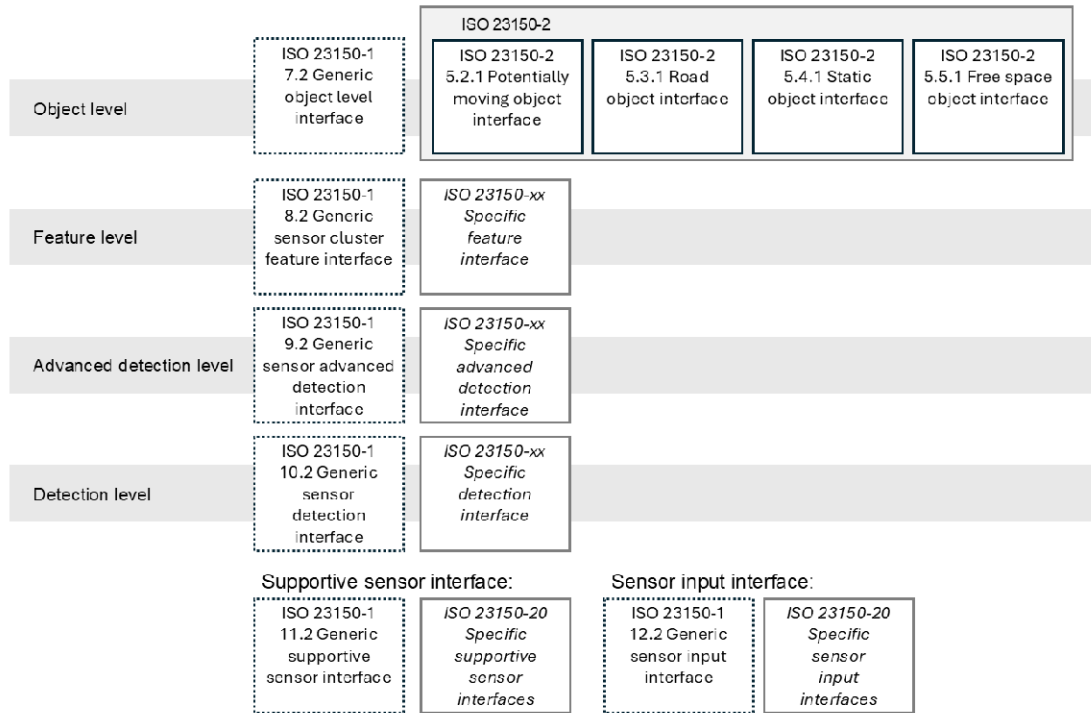
This document is applicable to road vehicles with automated driving functions. The document series specifies the logical interface between in-vehicle environmental perception sensors and the fusion unit which generates a surround model and interprets the scene around the vehicle based on the sensor data. The interface is described in a modular and semantic representation and provides information on different abstraction levels based on sensor technology specific information.

This part of the ISO 23150 document series specifies the interfaces on object level:

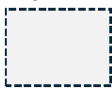
- Potentially moving object interface;
- Road object interface;
- Static object interface;
- Free-space object interface.

This document enhances the ISO/DIS 23150-1 and bases in particular on generic specifications of ISO/DIS 23150-1 (see [Figure 2](#)):

- Generic object level interface (ISO/DIS 23150-1, 7.2);
- General level-independent profiles (ISO/DIS 23150-1, 6.5).



Key



scope of the document

Figure 2 — Interfaces in the scope of this document and the related interfaces of the ISO 23150 series

This document does not provide electrical and mechanical interface specifications. Raw data interfaces are also excluded.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/DIS 23150-1, *Road vehicles — Logical interface between sensors and data fusion unit for automated driving functions — Part 1: General information and principles*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/DIS 23150-1 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/> — ISO Online browsing platform: available at <http://www.iso.org/obp> —

4 Abbreviated terms

For the purposes of this document, the abbreviated terms given in ISO/DIS 23150-1 and the following apply.

FSOI	free-space object interface
PMOI	potentially moving object interface
RDOI	road object interface
SOI	static object interface

5 Object level

5.1 General

The generic specification of the object level interfaces is defined in ISO/DIS 23150-1 clause 7. The object level interfaces base on the "Generic object level interface" (ISO/DIS 23150-1, 7.2).

On object level the following interfaces are available:

- Potentially moving object interface ([5.2.1](#));
- Road object interface ([5.3.1](#));
- Static object interface ([5.4.1](#));
- Free-space object interface ([5.5.1](#)).

5.2 Potentially moving object

5.2.1 Potentially moving object interface

At object level, the potentially moving object interface () contains the list of objects that could potentially move and are relevant for driving situations. This includes all objects that currently move, have moved (see [Figure 3](#)) and that are not definitely static three-dimensional structures. [Table 1](#) defines the general structure of the potentially moving object interface.

Table 1 — Potentially moving object interface structure

Structure	Multiplicity	Option
Potentially moving object header (5.2.2)	1	
Potentially moving objects	Multiple	Size type: dynamic/fixed

[Table 2](#) defines the logical structure of the potentially moving object interface. The object interface defines sets of signals for more detailed potentially moving object types (for example, lights, persons).

Table 2 — Potentially moving object interface

LSG	RL LSG M/C/O	Signal	RL signal M/C/O	Option
Information: interface	M	Interface version ID {major, minor, patch} (ISO/DIS 23150-1, A.1.2)	M	Profile: Uniqueness of interface versioning (ISO/DIS 23150-1, 6.5.1)
		Interface ID (ISO/DIS 23150-1, A.1.3)	O	Profile: Uniqueness of interface versioning (ISO/DIS 23150-1, 6.5.1)
		Number of valid serving sensors (ISO/DIS 23150-1, A.1.4)	M	Profile: Uniqueness of interface versioning (ISO/DIS 23150-1, 6.5.1) Optimise LL (ISO/DIS 23150-1, B.1.2) Alternative UTL (ISO/DIS 23150-1, B.1.7) Key: Sensor ID (ISO/DIS 23150-1, A.1.5)
		Size type: dynamic/fixed Size #: Number of valid serving sensors (ISO/DIS 23150-1, A.1.4)		
		Sensor ID (ISO/DIS 23150-1, A.1.5)	M	Profile: Uniqueness of interface versioning (ISO/DIS 23150-1, 6.5.1) Alternative VRO (ISO/DIS 23150-1, B.1.4)
		Time stamp – prediction (ISO/DIS 23150-1, A.1.6.1)	M	
		Cycle counter (ISO/DIS 23150-1, A.1.7.1)	O	Redundancy (ISO/DIS 23150-1, B.1.3) Signal: Time stamp – prediction (ISO/DIS 23150-1, A.1.6.1)
		Interface cycle time (ISO/DIS 23150-1, A.1.8)	O	
		Interface cycle time – variation (ISO/DIS 23150-1, A.1.9)	O	
		Data qualifier (ISO/DIS 23150-1, A.1.10)	M	Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
		Motion type (A.1.2)	M	Profile: Motion type (5.2.4.1) Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
Potentially moving objects				

Table 2 (continued)

LSG	RL LSG M/C/O	Signal	RL signal M/C/O	Option
Potentially moving objects information	M	Recognised objects – capability – potentially moving objects (A.1.3.1)	O	
		Recognised objects – status – potentially moving objects (A.1.4.1)	O	Redundancy (ISO/DIS 23150-1, B.1.3) Signal: Recognised objects – capability – potentially moving objects (A.1.3.1) Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
		Number of valid objects – potentially moving objects (A.1.5.1)	M	Optimise LL (ISO/DIS 23150-1, B.1.2)
		Size type: dynamic/fixed Size #: Number of valid objects – potentially moving objects (A.1.5.1)		
↔ Potentially moving object status	M	Existence probability – object level (ISO/DIS 23150-1, A.3.2)	M	
		Object ID (ISO/DIS 23150-1, A.3.3)	M	Alternative A2I (ISO/DIS 23150-1, B.3.3)
		Object grouping ID (ISO/DIS 23150-1, A.3.4)	O	
		Age (ISO/DIS 23150-1, A.2.22)	M	Profile: Observations (ISO/DIS 23150-1, 6.5.8)
		Number of valid observations (ISO/DIS 23150-1, A.2.23)	O	Profile: Observations (ISO/DIS 23150-1, 6.5.8) Optimise LL (ISO/DIS 23150-1, B.1.2) Alternative UTL (ISO/DIS 23150-1, B.1.7) Key: Time stamp reference (ISO/DIS 23150-1, A.2.24)
		Size type: dynamic/fixed Size #: Number of valid observations (ISO/DIS 23150-1, A.2.23)		
		Time stamp reference (ISO/DIS 23150-1, A.2.24)	M	Profile: Observations (ISO/DIS 23150-1, 6.5.8) Alternative VRO (ISO/DIS 23150-1, B.1.4)

Table 2 (continued)

LSG	RL LSG M/C/O	Signal		RL signal M/C/O	Option
			Observation status (ISO/DIS 23150-1, A.2.25)	M	Profile: Observations (ISO/DIS 23150-1, 6.5.8) Redundancy (ISO/DIS 23150-1, B.1.3) Signal: Object ID (ISO/DIS 23150-1, A.3.3), Time stamp – prediction (ISO/DIS 23150-1, A.1.6.1) Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
			Track quality (ISO/DIS 23150-1, A.3.5)	O	
			Measurement status (ISO/DIS 23150-1, A.2.68)	M	Profile: Measurement status (ISO/DIS 23150-1, 6.5.18) Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
↔ Potentially moving object information	M		Tracking motion model (A.2.2)	O	Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
			Number of valid recognition classifications (ISO/DIS 23150-1, A.2.61)	M	Profile: Recognition classification type (ISO/DIS 23150-1, 6.5.15) Optimise LL (ISO/DIS 23150-1, B.1.2) Alternative UTL (ISO/DIS 23150-1, B.1.7) Key: Recognition classification type (ISO/DIS 23150-1, A.2.62)
			Size type: dynamic/fixed Size #: Number of valid recognition classifications (ISO/DIS 23150-1, A.2.61)		
			Recognition classification type (ISO/DIS 23150-1, A.2.62)	M	Profile: Recognition classification type (ISO/DIS 23150-1, 6.5.15) Alternative VRO (ISO/DIS 23150-1, B.1.4) Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)

Table 2 (continued)

LSG	RL LSG M/C/O	Signal		RL signal M/C/O	Option
			Recognition classification type – confidence (ISO/DIS 23150-1, A.2.63)	M	Profile: Recognition classification type (ISO/DIS 23150-1, 6.5.15)
			Road level (A.2.3)	O	Redundancy (ISO/DIS 23150-1, B.1.3) Signal: {z} of Position {x, y, z} (ISO/DIS 23150-1, A.2.43) Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
↔ Potentially moving object position	M		Position {x, y, z} (ISO/DIS 23150-1, A.2.43)	{M, M, O}	Profile: Object pose (ISO/DIS 23150-1, 7.5.3) Profile: Motion state vector (5.2.4.2)
			Position {x, y, z} – error (ISO/DIS 23150-1, A.2.44)	C Analog: "Position {x, y, z}" (ISO/DIS 23150-1, A.2.43)	Profile: Object pose (ISO/DIS 23150-1, 7.5.3) Profile: Motion state vector (5.2.4.2) Implementation EM (ISO/DIS 23150-1, B.4.2)
			Orientation {yaw, pitch, roll} (ISO/DIS 23150-1, A.3.22)	{C (ISO/DIS 23150-1, B.2.2) Relevant: camera, O, O}	Profile: Object pose (ISO/DIS 23150-1, 7.5.3) Profile: Motion state vector (5.2.4.2)
			Orientation {yaw, pitch, roll} – error (ISO/DIS 23150-1, A.3.23)	O	Profile: Object pose (ISO/DIS 23150-1, 7.5.3) Profile: Motion state vector (5.2.4.2) Implementation EM (ISO/DIS 23150-1, B.4.2)
			Reference point {x, y, z} (ISO/DIS 23150-1, A.3.24)	O	Profile: Object pose (ISO/DIS 23150-1, 7.5.3) Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
↔ Potentially moving object bounding box	C (ISO/DIS 23150-1, B.2.2) Relevant: camera		Bounding box extent {length, width, height} (ISO/DIS 23150-1, A.3.25)	C Analog: "Position {x, y, z}" (ISO/DIS 23150-1, A.2.43)	Profile: Object pose (ISO/DIS 23150-1, 7.5.3)
			Bounding box extent {length, width, height} – error (ISO/DIS 23150-1, A.3.26)	O	Profile: Object pose (ISO/DIS 23150-1, 7.5.3) Implementation EM (ISO/DIS 23150-1, B.4.2)

Table 2 (continued)

LSG	RL LSG M/C/O	Signal	RL signal M/C/O	Option
		Clearance of the object {height} (A.2.4)	0	
		Included geometric structures (A.2.5)	0	Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
↔ Potentially moving object dynamics	M	Velocity {x, y, z} (A.2.6)	C Analog: "Position {x, y, z}" (ISO/DIS 23150-1, A.2.43)	Profile: Motion type (5.2.4.1) Profile: Motion state vector (5.2.4.2)
		Velocity {x, y, z} – error (A.2.7)	0	Profile: Motion type (5.2.4.1) Profile: Motion state vector (5.2.4.2) Implementation EM (ISO/DIS 23150-1, B.4.2)
		Acceleration {x, y, z} (A.2.8)	0	Profile: Motion type (5.2.4.1)
		Acceleration {x, y, z} – error (A.2.9)	0	Profile: Motion type (5.2.4.1) Implementation EM (ISO/DIS 23150-1, B.4.2)
		Instantaneous centre of rotation {x, y} (A.2.10)	C (ISO/DIS 23150-1, B.2.3) Signal: Rotation rate at instantaneous centre of rotation {yaw} (A.2.12)	
		Instantaneous centre of rotation {x, y} – error (A.2.11)	0	Implementation EM (ISO/DIS 23150-1, B.4.2)
		Rotation rate at instantaneous centre of rotation {yaw} (A.2.12)	0	Profile: Motion type (5.2.4.1) Profile: Motion state vector (5.2.4.2)
		Rotation rate at instantaneous centre of rotation {yaw} – error (A.2.13)	0	Profile: Motion type (5.2.4.1) Profile: Motion state vector (5.2.4.2) Implementation EM (ISO/DIS 23150-1, B.4.2)
		Movement status (A.2.14)	0	Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)

Table 2 (continued)

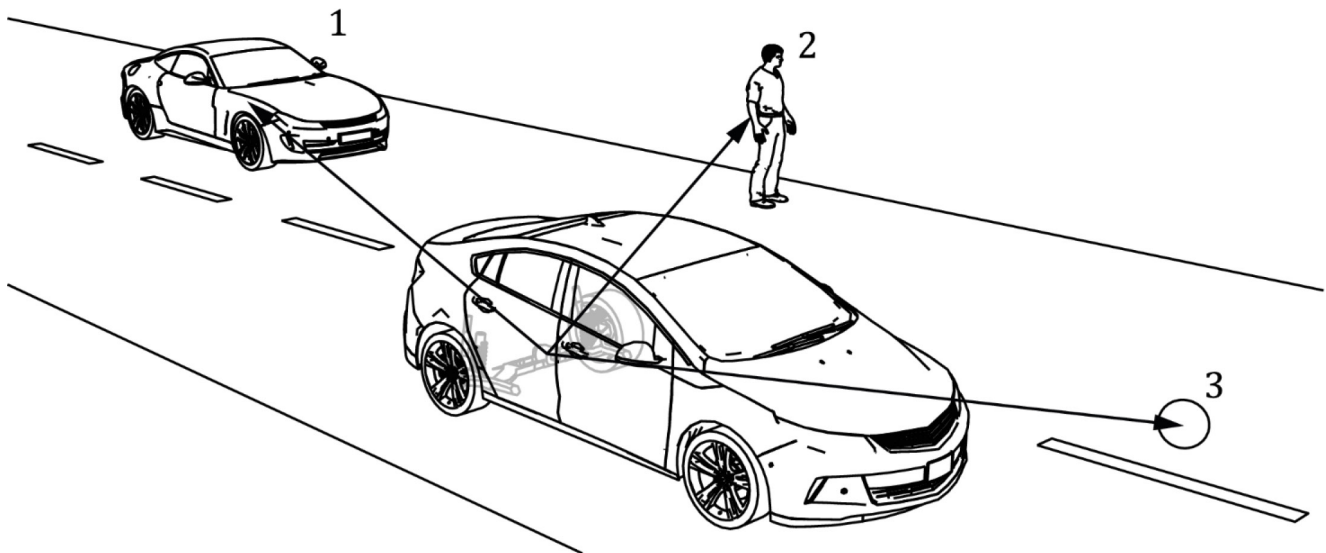
LSG	RL LSG M/C/O	Signal		RL signal M/C/O	Option
↔ Potentially moving object's lights	C (ISO/DIS 23150-1, B.2.2) Relevant: camera		Number of valid lights (A.2.15)	M	Optimise LL (ISO/DIS 23150-1, B.1.2) Alternative UTL (ISO/DIS 23150-1, B.1.7) Key: Light type (A.2.16)
			Size type: dynamic/fixed Size #: Number of valid lights (A.2.15)		
			Light type (A.2.16)	M	Alternative VRO (ISO/DIS 23150-1, B.1.4) Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
			Light status (A.2.17)	M	Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
↔ Potentially moving object: persons	O		Number of valid persons (A.2.18)	M	Optimise LL (ISO/DIS 23150-1, B.1.2)
			Size type: dynamic/fixed Size #: Number of valid persons (A.2.18)		
			Number of valid person type roles (A.2.19)	M	Optimise LL (ISO/DIS 23150-1, B.1.2) Alternative UTL (ISO/DIS 23150-1, B.1.7) Key: Person type role (A.2.20)
			Size type: dynamic/fixed Size #: Number of valid person type roles (A.2.19)		
			Person type role (A.2.20)	M	Alternative VRO (ISO/DIS 23150-1, B.1.4) Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
			Person type role – confidence (A.2.21)	M	
			Number of valid person gestures (A.2.22)	O	Optimise LL (ISO/DIS 23150-1, B.1.2) Alternative UTL (ISO/DIS 23150-1, B.1.7) Key: Person gesture indication type (A.2.23)
			Size type: dynamic/fixed Size #: Number of valid person gestures (A.2.22)		
			Person gesture indication type (A.2.23)	M	Alternative VRO (ISO/DIS 23150-1, B.1.4) Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
			Person gesture indication type – confidence (A.2.24)	O	

Table 2 (continued)

LSG	RL LSG M/C/O	Signal		RL signal M/C/O	Option
			Number of valid person's body part poses (A.2.25)	M	Optimise LL (ISO/DIS 23150-1, B.1.2) Alternative UTL (ISO/DIS 23150-1, B.1.7) Key: Person body part (A.2.26)
			Size type: dynamic/fixed Size #: Number of valid person's body part poses (A.2.25)		
			Person body part (A.2.26)	M	Alternative VRO (ISO/DIS 23150-1, B.1.4) Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
			Person body part orientation {yaw, pitch, roll} (A.2.27)	M	
			Person body part orientation {yaw, pitch, roll} – error (A.2.28)	O	Implementation EM (ISO/DIS 23150-1, B.4.2)
			Person body part origin {x, y, z} (A.2.29)	O	
			Person body part origin {x, y, z} – error (A.2.30)	O	Implementation EM (ISO/DIS 23150-1, B.4.2)
			Eye state (A.2.31)	O	Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
			Eye state – confidence (A.2.32)	O	
			Ego vehicle fixation time (A.2.33)	O	
			Ego vehicle fixation time – error (A.2.34)	O	Implementation EM (ISO/DIS 23150-1, B.4.2)
			Action type (A.2.35)	O	Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
			Action type – confidence (A.2.36)	O	
			Number of valid person accessories (A.2.37)	O	Optimise LL (ISO/DIS 23150-1, B.1.2) Alternative UTL (ISO/DIS 23150-1, B.1.7) Key: Person accessory classification type (A.2.38)

Table 2 (continued)

LSG	RL LSG M/C/O	Signal			RL signal M/C/O	Option
				Size type: dynamic/fixed Size #: Number of valid person accessories (A.2.37)		
				Person accessory classification type (A.2.38)	M	Alternative VRO (ISO/ DIS 23150-1, B.1.4) Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
				Person accessory classification type – confidence (A.2.39)	O	
				Accessory connec- tion to person type (A.2.40)	O	Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
				Included geometric structure of accessory (A.2.41)	O	Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
↔ Lane related information	O			Object lane association (A.2.42)	M	Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
				Angle between object edge and ego lane boundary {left edge right lane, right edge left lane} (A.2.43)	O	
				Angle between object edge and ego lane boundary {left edge right lane, right edge left lane} – error (A.2.44)	O	Implementation EM (ISO/DIS 23150-1, B.4.2)
				Object intruding ego lane {left, right} (A.2.45)	O	
				Object ego lane usage {left, right} (A.2.46)	O	
↔ Motion relat- ed information	O			Angular position {azimuth} (A.2.47)	M	
				Angular velocity {azimuth} (A.2.48)	M	
DEPRECATED: ↔ Camera sen- sor technology specific	O			DEPRECATED: Scale change – object level (A.2.49)	M	
↔ Radar sensor technology specific	C (ISO/DIS 23150-1, B.2.2) Relevant: radar			Entity radar cross section (A.2.50)	M	
↔ Lidar sensor technology specific	C (ISO/DIS 23150-1, B.2.2) Relevant: lidar			Entity lidar reflectivity (A.2.51)	M	

**Key**

- 1 vehicle
- 2 pedestrian
- 3 potentially moving object – classification unknown, for example, "Recognition classification type" (ISO/DIS 23150-1, A.2.62) with enumerator "PMOCT_Unknown"

Figure 3 — Example for potentially moving objects**5.2.2 Potentially moving object header**

[Table 3](#) defines the interface header for Potentially moving objects ([5.2.2](#)) and the changes due to the adaptation in comparison to the "Generic object level header" (ISO/DIS 23150-1, 7.3). The header of the specifies the list of valid potentially moving object entities (see [5.2.3](#))

Table 3 — Specific signal grouping: Potentially moving object header

Signal	RL signal	Option
Interface version ID {major, minor, patch} (ISO/DIS 23150-1, A.1.2)	Mandatory	Profile: Uniqueness of interface versioning (ISO/DIS 23150-1, 6.5.1)
Interface ID (ISO/DIS 23150-1, A.1.3)	Optional	Profile: Uniqueness of interface versioning (ISO/DIS 23150-1, 6.5.1)
Number of valid serving sensors (ISO/DIS 23150-1, A.1.4)	Mandatory	Profile: Uniqueness of interface versioning (ISO/DIS 23150-1, 6.5.1) Optimise LL (ISO/DIS 23150-1, B.1.2) Alternative UTL (ISO/DIS 23150-1, B.1.7) Key: Sensor ID (ISO/DIS 23150-1, A.1.5)
↔ Sensor ID (ISO/DIS 23150-1, A.1.5)	Mandatory	Profile: Uniqueness of interface versioning (ISO/DIS 23150-1, 6.5.1) Alternative VRO (ISO/DIS 23150-1, B.1.4)
Time stamp – prediction (ISO/DIS 23150-1, A.1.6.1)	Mandatory	
Cycle counter (ISO/DIS 23150-1, A.1.7.1)	Optional	Redundancy (ISO/DIS 23150-1, B.1.3) Signal: Time stamp – measurement (ISO/DIS 23150-1, A.1.6.2)
Interface cycle time (ISO/DIS 23150-1, A.1.8)	Optional	
Interface cycle time – variation (ISO/DIS 23150-1, A.1.9)	Optional	
^a Further signals of "Need of logical signal group" (ISO/DIS 23150-1, B.3.4) profiles may be added to this header (see cell "Options").		

Table 3 (continued)

Data qualifier (ISO/DIS 23150-1, A.1.10)	Mandatory	Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
Motion type (A.1.2)	Mandatory	Profile: Motion type (5.2.4.1) Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
... ^a		Need of logical signal group (ISO/DIS 23150-1, B.3.4) Profile: Vehicle coordinate system (ISO/DIS 23150-1, 6.5.4) Profile: Sensor pose (ISO/DIS 23150-1, 6.5.5) Profile: Calibration (ISO/DIS 23150-1, 6.5.6) Profile: Sensor cluster (ISO/DIS 23150-1, 6.5.7)
Potentially moving objects		
Recognised objects – capability – potentially moving objects (A.1.3.1)	Optional	
Recognised objects – status – potentially moving objects (A.1.4.1)	Optional	Redundancy (ISO/DIS 23150-1, B.1.3) Signal: Recognised objects – capability – potentially moving objects (A.1.3.1) Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
Number of valid objects – potentially moving objects (A.1.5.1)	Mandatory	Optimise LL (ISO/DIS 23150-1, B.1.2)
↪ Potentially moving entities		
^a Further signals of "Need of logical signal group" (ISO/DIS 23150-1, B.3.4) profiles may be added to this header (see cell "Options").		

5.2.3 Potentially moving object entity

Each potentially moving object describes a recognised real-world object and consists of several LSGs. Each object, which may move, even if it might have not moved yet since first recognition of the real-world object, is an entity of potentially moving objects.

A potentially moving object is described by the following LSGs for potentially moving objects with attributes for different parts (for example, vehicle, pedestrian).

- **Status:** the status describes general information of the tracked potentially moving object. This information is based on history of the object tracking. Table 4 defines the signal grouping "Potentially moving object entity status". It defines this status LSG of the potentially moving object and redefines the signal grouping "Generic object level entity status" (ISO/DIS 23150-1, 7.4).
- **Information:** the information describes properties such as the confidence of an object type.
- **Position/ Bounding box:** the object pose of a potentially moving object is defined by "Profile: Object pose" (ISO/DIS 23150-1, 7.5.3). Due to recognition capabilities, small structures shall not be included in the bounding box. The signal "Included geometric structures" (A.2.5) defines, what is included in the bounding box. There is no signal defined to determine the minimal distance up to which an information, relevant to the road user, is still recognizable.
- **Dynamics:** the dynamics describe the motion information of the tracked potentially moving object with respect to the motion type defined by the signal "Motion type" (A.1.2) [see Profile: Motion type (5.2.4.1)].
- **Lights:** the lights describe the status of the tracked potentially moving object's lights.
- **Persons:** the persons describe recognised person type, its gestures and poses of the tracked persons if the tracked potentially moving object may be a pedestrian or include persons (for example, the driver of a vehicle).

- **Lane related information:** the lane related information describes the tracked potentially moving object in relation with real-world lane boundaries.
- **Motion related information:** the motion related information describes additional motion information of the tracked potentially moving object.
- **Camera sensor technology specific¹⁾:** the camera sensor technology specific data describe dynamic information in the camera projection plane.
- **Radar sensor technology specific:** the radar sensor technology specific data describe different surface and material properties of the potentially moving object with respect to the radar.
- **Lidar sensor technology specific:** the lidar sensor technology specific data describes different surface and material properties of the potentially moving object with respect to the lidar (for example, reflection strength of a surface).

Table 4 — Specific signal grouping: Potentially moving object entity status

Signal	RL signal	Option
Existence probability – object level (ISO/DIS 23150-1, A.3.2)	Mandatory	
Object ID (ISO/DIS 23150-1, A.3.3)	Mandatory	Alternative A2I (ISO/DIS 23150-1, B.3.3)
Object grouping ID (ISO/DIS 23150-1, A.3.4)	Optional	
Age (ISO/DIS 23150-1, A.2.22)	Mandatory	Profile: Observations (ISO/DIS 23150-1, 6.5.8)
Number of valid observations (ISO/DIS 23150-1, A.2.23)	Optional	Profile: Observations (ISO/DIS 23150-1, 6.5.8) Optimise LL (ISO/DIS 23150-1, B.1.2) Alternative UTL (ISO/DIS 23150-1, B.1.7) Key: Time stamp reference (ISO/DIS 23150-1, A.2.24)
↔ Time stamp reference (ISO/DIS 23150-1, A.2.24)	Mandatory	Profile: Observations (ISO/DIS 23150-1, 6.5.8) Alternative VRO (ISO/DIS 23150-1, B.1.4)
↔ Observation status (ISO/DIS 23150-1, A.2.25)	Mandatory	Profile: Observations (ISO/DIS 23150-1, 6.5.8) Redundancy (ISO/DIS 23150-1, B.1.3) Signal: Object ID (ISO/DIS 23150-1, A.3.3), Time stamp – prediction (ISO/DIS 23150-1, A.1.6.1) Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
Track quality (ISO/DIS 23150-1, A.3.5)	Optional	
Measurement status (ISO/DIS 23150-1, A.2.68)	Mandatory	Profile: Measurement status (ISO/DIS 23150-1, 6.5.18) Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)

Potentially moving objects or other object entities on object level may be linked together (for example, a truck with a trailer or a construction site vehicle with a traffic sign at the rear of the vehicle) by using the same signal's "Object grouping ID"(ISO/DIS 23150-1, A.3.4) value in all connected objects.

1) **The LSG is DEPRECATED.**

5.2.4 Potentially moving object profiles

5.2.4.1 Profile: Motion type

The signal "Motion type" (A.1.2) defines the interpretation of the signal "Velocity {x, y, z}" (A.2.6), "Velocity {x, y, z} - error" (A.2.7), "Acceleration {x, y, z}" (A.2.8), "Acceleration {x, y, z} - error" (A.2.9), "Rotation rate at instantaneous centre of rotation {yaw}" (A.2.12) and "Rotation rate at instantaneous centre of rotation {yaw} - error" (A.2.13) values.

5.2.4.2 Profile: Motion state vector

A potentially moving object entity provides a motion state vector. The sensor may provide a full or enhanced error model according to ISO/DIS 23150-1, B.4.1.3.5. For example, the motion state vector of the sensor is provided together with an enhanced error model {"Position {x, y, z}" (ISO/DIS 23150-1, A.2.43), "Velocity {x, y, z}" (A.2.6), "Orientation {yaw, pitch, roll}" (ISO/DIS 23150-1, A.3.21) and "Rotation rate at instantaneous centre of rotation {yaw}" (A.2.12)}.

The resulting error model based on variances, covariances and cross-covariances (see ISO/DIS 23150-1, B.4.1.3.4 and ISO/DIS 23150-1, B.4.1.3.5) may provide a symmetric nD matrix:

$$\begin{pmatrix} \text{Position - error}^{(a)} & (\text{Position} \times \text{Velocity}) - \text{error} & (\text{Position} \times \text{Orientation}) - \text{error} & (\text{Position} \times \text{Rotation rate}) - \text{error} \\ (\text{Velocity} \times \text{Position}) - \text{error} & \text{Velocity - error}^{(b)} & (\text{Velocity} \times \text{Orientation}) - \text{error} & (\text{Velocity} \times \text{Rotation rate}) - \text{error} \\ (\text{Orientation} \times \text{Position}) - \text{error} & (\text{Orientation} \times \text{Velocity}) - \text{error} & \text{Orientation - error}^{(c)} & (\text{Orientation} \times \text{Rotation rate}) - \text{error} \\ (\text{Rotation rate} \times \text{Position}) - \text{error} & (\text{Rotation rate} \times \text{Velocity}) - \text{error} & (\text{Rotation rate} \times \text{Orientation}) - \text{error} & \text{Rotation rate - error}^{(d)} \end{pmatrix} \quad (1)$$

Key

- (a) "Position - error" corresponds to the signal "Position {x, y, z} - error" (ISO/DIS 23150-1, A.2.44).
- (b) "Velocity - error" corresponds to the signal "Velocity {x, y, z} - error" (A.2.7).
- (c) "Orientation - error" corresponds to the signal "Orientation {yaw, pitch, roll} - error" (ISO/DIS 23150-1, A.3.22).
- (d) "Rotation rate - error" corresponds to the signal "Rotation rate at instantaneous centre of rotation {yaw} - error" (A.2.13).

In addition to existing error signals "Position {x, y, z} - error" (ISO/DIS 23150-1, A.2.44), "Velocity {x, y, z} - error" (A.2.7), "Orientation {yaw, pitch, roll} - error" (ISO/DIS 23150-1, A.3.22) and "Rotation rate at instantaneous centre of rotation {yaw} - error" (A.2.13); the additional signals may be provided as sets of cross-covariances. All covariances of the motion state vector error model are symmetric and therefore additional optimisation methods are applicable; this means only half of non-diagonal elements need to be provided.

For example, the LSG "Potentially moving object motion state vector cross-covariances" may provide, for example, "Position {x, y, z} x Velocity {x, y, z} - error", "Position {x, y, z} x Orientation {yaw, pitch, roll} - error". The redundant symmetrical signals for the cross-covariances: "Velocity {x, y, z} x Position {x, y, z} - object level - error", "Orientation {yaw, pitch, roll} x Position {x, y, z} - object level - error" may be skipped. Similar, the symmetric covariances of the signals "Position {x, y, z} - error" (ISO/DIS 23150-1, A.2.44), "Velocity {x, y, z} - error" (A.2.7), "Orientation {yaw, pitch, roll} - error" (ISO/DIS 23150-1, A.3.22) and "Rotation rate at instantaneous centre of rotation {yaw} - error" (A.2.13) shall not transmit redundant values (see optimisation method ISO/DIS 23150-1, B.1.6).

Table 5 provides a subset of the with the relevant signals for the motion state vector of this profile and the additional signals in the LSG "Potentially moving object motion state vector cross-covariances".

Table 5 — Signal grouping: Exemplary motion state vector cross-covariances LSG

LSG	RL LSG M/C/O	Signal	RL signal M/C/O	Option
↪ Potentially moving object position	M	Position {x, y, z} (ISO/DIS 23150-1, A.2.43)	{M, M, O}	Profile: Motion state vector (5.2.4.2)
		Position {x, y, z} – error (ISO/DIS 23150-1, A.2.44)	C Analog: "Position {x, y, z}" (ISO/DIS 23150-1, A.2.43)	Profile: Motion state vector (5.2.4.2) ...
		Orientation {yaw, pitch, roll} (ISO/DIS 23150-1, A.3.21)	{C (ISO/DIS 23150-1, B.2.2) Relevant: camera, O, O}	Profile: Motion state vector (5.2.4.2)
		Orientation {yaw, pitch, roll} – error (ISO/DIS 23150-1, A.3.22)	O	Profile: Motion state vector (5.2.4.2) ...
		...	...	...
↪ Potentially moving object dynamics	M	Velocity {x, y, z} (A.2.6)	C Analog: "Position {x, y, z}" (ISO/DIS 23150-1, A.2.43)	Profile: Motion state vector (5.2.4.2) ...
		Velocity {x, y, z} – error (A.2.7)	O	Profile: Motion state vector (5.2.4.2) ...
		Rotation rate at instantaneous centre of rotation {yaw} (A.2.12)	O	Profile: Motion state vector (5.2.4.2) ...
		Rotation rate at instantaneous centre of rotation {yaw} – error (A.2.13)	O	Profile: Motion state vector (5.2.4.2) ...
		...	...	...
↪ Potentially moving object motion state vector cross-co-variances	O	Position {x, y, z} x Velocity {x, y, z} – error	O ^a	Implementation EM (ISO/DIS 23150-1, B.4.2)
		Position {x, y, z} x Orientation {yaw, pitch, roll} – error	O	Implementation EM (ISO/DIS 23150-1, B.4.2)
		Position {x, y, z} x Rotation rate at instantaneous centre of rotation {yaw} – error	O	Implementation EM (ISO/DIS 23150-1, B.4.2)
		Velocity {x, y, z} x Orientation {yaw, pitch, roll} – error	O	Implementation EM (ISO/DIS 23150-1, B.4.2)
		Velocity {x, y, z} x Rotation rate at instantaneous centre of rotation {yaw} – error	O	Implementation EM (ISO/DIS 23150-1, B.4.2)
		Orientation {yaw, pitch, roll} x Rotation rate at instantaneous centre of rotation {yaw} – error	O	Implementation EM (ISO/DIS 23150-1, B.4.2)

^a The signal’s RL is optional by definition of ISO/DIS 23150-1, B.4.1.3.5 but for this profile ([5.2.4.2](#)) it should be defined as mandatory during the system design phase so that at least one signal is mandatory in the LSG.

Additionally, in most cases the description of the signals in planar space (XY-plane) is sufficient. Therefore, below covariances may either be only 2D (position, velocity) or 1D (orientation, rotation rate).

Optimisation method may be also applied by selection of most relevant covariance matrix elements (or cross-covariance matrix elements).

Missing covariance values shall be substituted by suitable values in the fusion tracking system to guarantee a stable tracking.

5.3 Road object

5.3.1 Road object interface

The road object interface () consists of a general road surface information and two types of objects: road markings and road boundaries (see [Figure 4](#)). [Table 6](#) defines the general structure of the road object interface.

Table 6 — Road object interface structure

Structure	Multiplicity	Option
Road object header (5.3.2)	1	
Road surface	1 ^a	Size type: fixed
Road markings	Multiple	Size type: dynamic/fixed
Road boundaries	Multiple	Size type: dynamic/fixed

^a The object entity type road surface consists of only one entity, which is related to the ego vehicle.

[Table 7](#) defines the logical structure of the road object interface.

Table 7 — Road object interface

LSG	RL LSG M/C/O	Signal	RL signal M/C/O	Option
Information: interface	M	Interface version ID {major, minor, patch} (ISO/DIS 23150-1, A.1.2)	M	Profile: Unique- ness of interface versioning (ISO/DIS 23150-1, 6.5.1)
		Interface ID (ISO/DIS 23150-1, A.1.3)	O	Profile: Unique- ness of interface versioning (ISO/DIS 23150-1, 6.5.1)
		Number of valid serving sensors (ISO/ DIS 23150-1, A.1.4)	M	Profile: Unique- ness of interface versioning (ISO/DIS 23150-1, 6.5.1) Optimise LL (ISO/ DIS 23150-1, B.1.2) Alternative UTL (ISO/DIS 23150-1, B.1.7) Key: Sensor ID (ISO/DIS 23150-1, A.1.5)
		Size type: dynamic/fixed Size #: Number of valid serving sensors (ISO/DIS 23150-1, A.1.4)		

^a Road objects are described by polylines. Therefore the signal "Shape type" (ISO/DIS 23150-1, A.2.30) always has the mandatory enumeration "ST_Line". For the definition of a "ST_Line", only "ST_Line_Polyline" is used. The profile does not provide the signal "Shape type" (ISO/DIS 23150-1, A.2.30) explicitly. The signal "Extent {width, height} – vertex" ([A.2.75](#)) has attributes of the vertex at the point of the signal "Vertex point {x, y, z}" (ISO/DIS 23150-1, A.2.35). The error and confidence signals apply to this point.

Table 7 (continued)

LSG	RL LSG M/C/O	Signal	RL signal M/C/O	Option
		Sensor ID (ISO/DIS 23150-1, A.1.5)	M	Profile: Uniqueness of interface versioning (ISO/DIS 23150-1, 6.5.1) Alternative VRO (ISO/DIS 23150-1, B.1.4)
		Time stamp – prediction (ISO/DIS 23150-1, A.1.6.1)	M	
		Cycle counter (ISO/DIS 23150-1, A.1.7.1)	O	Redundancy (ISO/DIS 23150-1, B.1.3) Signal: Time stamp – prediction (ISO/DIS 23150-1, A.1.6.1)
		Interface cycle time (ISO/DIS 23150-1, A.1.8)	O	
		Interface cycle time – variation (ISO/DIS 23150-1, A.1.9)	O	
		Data qualifier (ISO/DIS 23150-1, A.1.10)	M	Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
		Colour model type (ISO/DIS 23150-1, A.1.14)	C (ISO/DIS 23150-1, B.2.2) Relevant: camera	Profile: Colour model (ISO/DIS 23150-1, 6.5.2) Alternative VRO (ISO/DIS 23150-1, B.1.4) Use enumeration to define colours by defining colour values and the applied colour model for each enumerator. Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
Road surface				

^a Road objects are described by polylines. Therefore the signal "Shape type" (ISO/DIS 23150-1, A.2.30) always has the mandatory enumeration "ST_Line". For the definition of a "ST_Line", only "ST_Line_Polyline" is used. The profile does not provide the signal "Shape type" (ISO/DIS 23150-1, A.2.30) explicitly. The signal "Extent {width, height} – vertex" (A.2.75) has attributes of the vertex at the point of the signal "Vertex point {x, y, z}" (ISO/DIS 23150-1, A.2.35). The error and confidence signals apply to this point.

Table 7 (continued)

LSG	RL LSG M/C/O	Signal	RL signal M/C/O	Option
Road surface entity	C (ISO/DIS 23150-1, B.2.4) multiple entity types	Number of valid road types (ISO/DIS 23150-1, A.3.6)	M	Profile: Road surface (ISO/DIS 23150-1, 7.5.1) Optimise LL (ISO/DIS 23150-1, B.1.2) Alternative UTL (ISO/DIS 23150-1, B.1.7) Key: Road type (ISO/DIS 23150-1, A.2.53)
		Size type: dynamic/fixed Size #: Number of valid road types (ISO/DIS 23150-1, A.3.6)		
		Road type (ISO/DIS 23150-1, A.2.53)	M	Profile: Road surface (ISO/DIS 23150-1, 7.5.1) Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
		Road type – confidence (ISO/DIS 23150-1, A.3.7)	O	Profile: Road surface (ISO/DIS 23150-1, 7.5.1)
		Number of valid road property types (ISO/DIS 23150-1, A.3.8)	M	Profile: Road surface (ISO/DIS 23150-1, 7.5.1) Optimise LL (ISO/DIS 23150-1, B.1.2) Alternative UTL (ISO/DIS 23150-1, B.1.7) Key: Road property type (ISO/DIS 23150-1, A.2.54)
		Size type: dynamic/fixed Size #: Number of valid road property types (ISO/DIS 23150-1, A.3.8)		
		Road property type (ISO/DIS 23150-1, A.2.54)	M	Profile: Road surface (ISO/DIS 23150-1, 7.5.1) Alternative VRO (ISO/DIS 23150-1, B.1.4) Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
		Road property type – confidence (ISO/DIS 23150-1, A.3.9)	M	Profile: Road surface (ISO/DIS 23150-1, 7.5.1)
^a Road objects are described by polylines. Therefore the signal "Shape type" (ISO/DIS 23150-1, A.2.30) always has the mandatory enumeration "ST_Line". For the definition of a "ST_Line", only "ST_Line_Polyline" is used. The profile does not provide the signal "Shape type" (ISO/DIS 23150-1, A.2.30) explicitly. The signal "Extent {width, height} – vertex" (A.2.75) has attributes of the vertex at the point of the signal "Vertex point {x, y, z}" (ISO/DIS 23150-1, A.2.35). The error and confidence signals apply to this point.				

Table 7 (continued)

LSG	RL LSG M/C/O	Signal	RL signal M/C/O	Option
		Number of valid road surface condition classifications (ISO/DIS 23150-1, A.3.10)	0	Profile: Road surface (ISO/DIS 23150-1, 7.5.1) Optimise LL (ISO/DIS 23150-1, B.1.2) Alternative UTL (ISO/DIS 23150-1, B.1.7) Key: Road surface condition classification type (ISO/DIS 23150-1, A.2.55)
		Size type: dynamic/fixed Size #: Number of valid road surface condition classifications (ISO/DIS 23150-1, A.3.10)		
		Road surface condition classification type (ISO/DIS 23150-1, A.2.55)	M	Profile: Road surface (ISO/DIS 23150-1, 7.5.1) Alternative VRO (ISO/DIS 23150-1, B.1.4) Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
		Road surface condition classification type – confidence (ISO/DIS 23150-1, A.3.11)	M	Profile: Road surface (ISO/DIS 23150-1, 7.5.1)
		Road surface roughness (ISO/DIS 23150-1, A.2.57)	0	Profile: Road surface (ISO/DIS 23150-1, 7.5.1)
		Road surface texture (ISO/DIS 23150-1, A.2.58)	0	Profile: Road surface (ISO/DIS 23150-1, 7.5.1)
		Track quality (ISO/DIS 23150-1, A.3.5)	0	
		Measurement status (ISO/DIS 23150-1, A.2.68)	M	Profile: Measurement status (ISO/DIS 23150-1, 6.5.18) Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
Road markings				
^a Road objects are described by polylines. Therefore the signal "Shape type" (ISO/DIS 23150-1, A.2.30) always has the mandatory enumeration "ST_Line". For the definition of a "ST_Line", only "ST_Line_Polyline" is used. The profile does not provide the signal "Shape type" (ISO/DIS 23150-1, A.2.30) explicitly. The signal "Extent {width, height} – vertex" (A.2.75) has attributes of the vertex at the point of the signal "Vertex point {x, y, z}" (ISO/DIS 23150-1, A.2.35). The error and confidence signals apply to this point.				

Table 7 (continued)

LSG	RL LSG M/C/O	Signal	RL signal M/C/O	Option
Road markings information	C (ISO/DIS 23150-1, B.2.4) multiple entity types	Recognised objects – capability – road markings (A.1.3.2)	O	
		Recognised objects – status – road markings (A.1.4.2)	O	Redundancy (ISO/DIS 23150-1, B.1.3) Signal: Recognised objects – capability – road markings (A.1.3.2) Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
		Number of valid objects – road markings (A.1.5.2)	M	Optimise LL (ISO/DIS 23150-1, B.1.2)
		Size type: dynamic/fixed Size #: Number of valid objects – road markings (A.1.5.2)		
↔ Road marking status	M	Existence probability – object level (ISO/DIS 23150-1, A.3.2)	M	
		Object ID (ISO/DIS 23150-1, A.3.3)	M	Alternative A2I (ISO/DIS 23150-1, B.3.3)
		Object grouping ID (ISO/DIS 23150-1, A.3.4)	O	
		Age (ISO/DIS 23150-1, A.2.22)	M	Profile: Observations (ISO/DIS 23150-1, 6.5.8)
		Number of valid observations (ISO/DIS 23150-1, A.2.23)	O	Profile: Observations (ISO/DIS 23150-1, 6.5.8) Optimise LL (ISO/DIS 23150-1, B.1.2) Alternative UTL (ISO/DIS 23150-1, B.1.7) Key: Time stamp reference (ISO/DIS 23150-1, A.2.24)
		Size type: dynamic/fixed Size #: Number of valid observations (ISO/DIS 23150-1, A.2.23)		
		Time stamp reference (ISO/DIS 23150-1, A.2.24)	M	Profile: Observations (ISO/DIS 23150-1, 6.5.8) Alternative VRO (ISO/DIS 23150-1, B.1.4)
^a Road objects are described by polylines. Therefore the signal "Shape type" (ISO/DIS 23150-1, A.2.30) always has the mandatory enumeration "ST_Line". For the definition of a "ST_Line", only "ST_Line_Polyline" is used. The profile does not provide the signal "Shape type" (ISO/DIS 23150-1, A.2.30) explicitly. The signal "Extent {width, height} – vertex" (A.2.75) has attributes of the vertex at the point of the signal "Vertex point {x, y, z}" (ISO/DIS 23150-1, A.2.35). The error and confidence signals apply to this point.				

Table 7 (continued)

LSG	RL LSG M/C/O	Signal		RL signal M/C/O	Option
			Observation status (ISO/DIS 23150-1, A.2.25)	M	Profile: Observations (ISO/DIS 23150-1, 6.5.8) Redundancy (ISO/DIS 23150-1, B.1.3) Signal: Object ID (ISO/DIS 23150-1, A.3.3), Time stamp – prediction (ISO/DIS 23150-1, A.1.6.1) Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
			Track quality (ISO/DIS 23150-1, A.3.5)	O	
			Measurement status (ISO/DIS 23150-1, A.2.68)	M	Profile: Measurement status (ISO/DIS 23150-1, 6.5.18) Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
↔ Road marking information	M		Number of valid road marking classifications (A.2.52)	M	Optimise LL (ISO/DIS 23150-1, B.1.2)
			Size type: dynamic/fixed Size #: Number of valid road marking classifications (A.2.52)		
			Road marking type (A.2.53)	M	Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
			Road marking type – confidence (A.2.54)	M	
			Road object lane association (A.2.55)	O	Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
			Road object lane association – confidence (A.2.56)	O	
			Arrow orientation {yaw} (A.2.57)	O	

^a Road objects are described by polylines. Therefore the signal "Shape type" (ISO/DIS 23150-1, A.2.30) always has the mandatory enumeration "ST_Line". For the definition of a "ST_Line", only "ST_Line_Polyline" is used. The profile does not provide the signal "Shape type" (ISO/DIS 23150-1, A.2.30) explicitly. The signal "Extent {width, height} – vertex" ([A.2.75](#)) has attributes of the vertex at the point of the signal "Vertex point {x, y, z}" (ISO/DIS 23150-1, A.2.35). The error and confidence signals apply to this point.

Table 7 (continued)

LSG	RL LSG M/C/O	Signal			RL signal M/C/O	Option
				Arrow direction (A.2.58)	C (ISO/DIS 23150-1, B.2.3) * The signal "Road marking type" (A.2.53) has "RMT_Sign_Arrow" or a similar enumerator defined during the system design phase.	Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
↔↔ Road marking sign information	M			Number of valid sign classifications (ISO/DIS 23150-1, A.3.12)	0	Profile: Traffic signs (ISO/DIS 23150-1, 7.5.2) Optimise LL (ISO/DIS 23150-1, B.1.2) Alternative UTL (ISO/DIS 23150-1, B.1.7) Key: Sign classification type (ISO/DIS 23150-1, A.3.13)
				Size type: dynamic/fixed Size #: Number of valid sign classifications (ISO/DIS 23150-1, A.3.12)		
				Sign classification type (ISO/DIS 23150-1, A.3.13)	M	Profile: Traffic signs (ISO/DIS 23150-1, 7.5.2) Alternative VRO (ISO/DIS 23150-1, B.1.4) Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
				Sign classification type – confidence (ISO/DIS 23150-1, A.3.14)	M	Profile: Traffic signs (ISO/DIS 23150-1, 7.5.2)
				Sign value (ISO/DIS 23150-1, A.3.15)	0	Profile: Traffic signs (ISO/DIS 23150-1, 7.5.2)
				Sign value unit (ISO/DIS 23150-1, A.3.16)	0	Profile: Traffic signs (ISO/DIS 23150-1, 7.5.2) Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
^a Road objects are described by polylines. Therefore the signal "Shape type" (ISO/DIS 23150-1, A.2.30) always has the mandatory enumeration "ST_Line". For the definition of a "ST_Line", only "ST_Line_Polyline" is used. The profile does not provide the signal "Shape type" (ISO/DIS 23150-1, A.2.30) explicitly. The signal "Extent {width, height} – vertex" (A.2.75) has attributes of the vertex at the point of the signal "Vertex point {x, y, z}" (ISO/DIS 23150-1, A.2.35). The error and confidence signals apply to this point.						

Table 7 (continued)

LSG	RL LSG M/C/O	Signal			RL signal M/C/O	Option
				Sign text content (ISO/DIS 23150-1, A.3.17)	0	Profile: Traffic signs (ISO/DIS 23150-1, 7.5.2)
				Sign text font (ISO/DIS 23150-1, A.3.18)	0	Profile: Traffic signs (ISO/DIS 23150-1, 7.5.2) Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
				Sign text – confidence (ISO/DIS 23150-1, A.3.19)	0	Profile: Traffic signs (ISO/DIS 23150-1, 7.5.2)
				Number of valid entity states (ISO/DIS 23150-1, A.3.20)	0	Profile: Traffic signs (ISO/DIS 23150-1, 7.5.2) Optimise LL (ISO/DIS 23150-1, B.1.2) Alternative UTL (ISO/DIS 23150-1, B.1.7) Key: Entity state (ISO/DIS 23150-1, A.3.21)
				Size type: dynamic/fixed Size #: Number of valid entity states (ISO/DIS 23150-1, A.3.20)		
				Entity state (ISO/DIS 23150-1, A.3.21)	M	Profile: Traffic signs (ISO/DIS 23150-1, 7.5.2) Alternative VRO (ISO/DIS 23150-1, B.1.4) Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
↔↔↔ Road marking message colour tone	0			Size type: dynamic/fixed Size # * Implicit list length – Optimise LL (ISO/DIS 23150-1, B.1.2): depends on Colour model type (ISO/DIS 23150-1, A.1.14)		
				Colour value (ISO/DIS 23150-1, A.2.18)	M	Profile: Colour model (ISO/DIS 23150-1, 6.5.2)
				Colour tone – confidence (ISO/DIS 23150-1, A.2.19)	0	Profile: Colour model (ISO/DIS 23150-1, 6.5.2)
^a Road objects are described by polylines. Therefore the signal "Shape type" (ISO/DIS 23150-1, A.2.30) always has the mandatory enumeration "ST_Line". For the definition of a "ST_Line", only "ST_Line_Polyline" is used. The profile does not provide the signal "Shape type" (ISO/DIS 23150-1, A.2.30) explicitly. The signal "Extent {width, height} – vertex" (A.2.75) has attributes of the vertex at the point of the signal "Vertex point {x, y, z}" (ISO/DIS 23150-1, A.2.35). The error and confidence signals apply to this point.						

Table 7 (continued)

LSG	RL LSG M/C/O	Signal		RL signal M/C/O	Option
↔↔ Road marking additional area colour tone	O		Number of valid additional colour tones (ISO/DIS 23150-1, A.2.20)	M	Profile: Additional colours (ISO/DIS 23150-1, 6.5.3) Optimise LL (ISO/DIS 23150-1, B.1.2) Alternative UTL (ISO/DIS 23150-1, B.1.7) Key: Colour tone type (ISO/DIS 23150-1, A.2.21)
			Size type: dynamic/fixed Size #: Number of valid additional colour tones (ISO/DIS 23150-1, A.2.20)		
			Colour tone type (ISO/DIS 23150-1, A.2.21)	M	Profile: Additional colours (ISO/DIS 23150-1, 6.5.3) Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
			Size type: dynamic/fixed Size # * Implicit list length – Optimise LL (ISO/DIS 23150-1, B.1.2): depends on Colour model type (ISO/DIS 23150-1, A.1.14)		
			Colour value (ISO/DIS 23150-1, A.2.18)	M	Profile: Additional colours (ISO/DIS 23150-1, 6.5.3)
			Colour tone – confidence (ISO/DIS 23150-1, A.2.19)	O	Profile: Additional colours (ISO/DIS 23150-1, 6.5.3)
↔ Road marking connections	C (ISO/DIS 23150-1, B.2.2) Relevant: camera, lidar		Number of valid connections (A.2.59)	M	Optimise LL (ISO/DIS 23150-1, B.1.2) Alternative UTL (ISO/DIS 23150-1, B.1.7) Key: Connection type (A.2.60)
			Size type: dynamic/fixed Size #: Number of valid connections (A.2.59)		
			Connection type (A.2.60)	M	Alternative VRO (ISO/DIS 23150-1, B.1.4) Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
			Connection grouping ID (A.2.61)	M	
			Vertex point {x, y, z} (ISO/DIS 23150-1, A.2.35)	{M, M, O}	
^a Road objects are described by polylines. Therefore the signal "Shape type" (ISO/DIS 23150-1, A.2.30) always has the mandatory enumeration "ST_Line". For the definition of a "ST_Line", only "ST_Line_Polyline" is used. The profile does not provide the signal "Shape type" (ISO/DIS 23150-1, A.2.30) explicitly. The signal "Extent {width, height} – vertex" (A.2.75) has attributes of the vertex at the point of the signal "Vertex point {x, y, z}" (ISO/DIS 23150-1, A.2.35). The error and confidence signals apply to this point.					

Table 7 (continued)

LSG	RL LSG M/C/O	Signal		RL signal M/C/O	Option
			Vertex point {x, y, z} – error (ISO/DIS 23150-1, A.2.36)	C Analog: "Vertex point {x, y, z}" (ISO/DIS 23150-1, A.2.35)	Implementation EM (ISO/DIS 23150-1, B.4.2)
			Vertex point {x, y, z} – confidence (ISO/DIS 23150-1, A.2.37)	O	
↔ Road marking polynomials	C (ISO/DIS 23150-1, B.2.2) Relevant: cam- era, lidar		Number of valid polynomials (A.2.62)	M	Optimise LL (ISO/ DIS 23150-1, B.1.2)
			Size type: dynamic/fixed Size #: Number of valid polynomials (A.2.62)		
			Polynomial coefficient y {c0, c1, c2, c3} (A.2.63)	M	
			Polynomial coefficient z {c0, c1, c2, c3} (A.2.64)	O	
			Polynomial y – error (A.2.65)	O	Implementation EM (ISO/DIS 23150-1, B.4.2)
			Polynomial z – error (A.2.66)	O	Implementation EM (ISO/DIS 23150-1, B.4.2)
			Polynomial range x {begin, end} (A.2.67)	M	
			Extent {width, height} – polyno- mial (A.2.68)	O	
			Extent {width, height} – polyno- mial – error (A.2.69)	O	Implementation EM (ISO/DIS 23150-1, B.4.2)
			Extent {width, height} – polyno- mial – confidence (A.2.70)	O	
			Number of valid data ranges (A.2.71)	O	Optimise LL (ISO/ DIS 23150-1, B.1.2)
			Size type: dynamic/fixed Size #: Number of valid data ranges (A.2.71)		
			Supported data range x {begin, end} (A.2.72)	M	
			Supported axis (A.2.73)	M	Optimise DE (ISO/ DIS 23150-1, B.1.8) Optimise EES (ISO/ DIS 23150-1, B.1.9)
↔ Road marking polylines	C (ISO/DIS 23150-1, B.2.2) Relevant: cam- era, lidar		Polyline interpolation method (ISO/ DIS 23150-1, A.2.29)	M	Profile: Shape type {x, y, z} (ISO/DIS 23150-1, 6.5.10.2) ^a Optimise DE (ISO/ DIS 23150-1, B.1.8) Optimise EES (ISO/ DIS 23150-1, B.1.9)

^a Road objects are described by polylines. Therefore the signal "Shape type" (ISO/DIS 23150-1, A.2.30) always has the mandatory enumeration "ST_Line". For the definition of a "ST_Line", only "ST_Line_Polyline" is used. The profile does not provide the signal "Shape type" (ISO/DIS 23150-1, A.2.30) explicitly. The signal "Extent {width, height} – vertex" (A.2.75) has attributes of the vertex at the point of the signal "Vertex point {x, y, z}" (ISO/DIS 23150-1, A.2.35). The error and confidence signals apply to this point.

Table 7 (continued)

LSG	RL LSG M/C/O	Signal			RL signal M/C/O	Option	
			Number of valid polylines (A.2.74)			M	Optimise LL (ISO/ DIS 23150-1, B.1.2)
			Size type: dynamic/fixed Size #: Number of valid polylines (A.2.74)				
				Number of valid vertices (ISO/ DIS 23150-1, A.2.31)		M	Profile: Shape type {x, y, z} (ISO/DIS 23150-1, 6.5.10.2) ^a Optimise LL (ISO/ DIS 23150-1, B.1.2)
				Size type: dynamic/fixed Size #: Number of valid vertices (ISO/DIS 23150-1, A.2.31)			
				Vertex point {x, y, z} (ISO/DIS 23150-1, A.2.35)		{M, M, O}	Profile: Shape type {x, y, z} (ISO/DIS 23150-1, 6.5.10.2) ^a
				Vertex point {x, y, z} – error (ISO/DIS 23150-1, A.2.36)		C Analog: Vertex point {x, y, z} (ISO/DIS 23150-1, A.2.35)	Profile: Shape type {x, y, z} (ISO/DIS 23150-1, 6.5.10.2) ^a Implementation EM (ISO/DIS 23150-1, B.4.2)
				Vertex point {x, y, z} – con- fidence (ISO/DIS 23150-1, A.2.37)		O	Profile: Shape type {x, y, z} (ISO/DIS 23150-1, 6.5.10.2) ^a
				Extent {width, height} – ver- tex (A.2.75)		O	
				Extent {width, height} – ver- tex – error (A.2.76)		O	Implementation EM (ISO/DIS 23150-1, B.4.2)
				Extent {width, height} – ver- tex – confidence (A.2.77)		O	
Road bounda- ries							
Road bounda- ries information	C (ISO/DIS 23150-1, B.2.4) multiple entity types	Recognised objects – capability – road boundaries (A.1.3.3)				O	
		Recognised objects – status – road boundaries (A.1.4.3)				O	Redundancy (ISO/ DIS 23150-1, B.1.3) Signal: Recognised objects – capability – road boundaries (A.1.3.3) Optimise DE (ISO/ DIS 23150-1, B.1.8) Optimise EES (ISO/ DIS 23150-1, B.1.9)
^a Road objects are described by polylines. Therefore the signal "Shape type" (ISO/DIS 23150-1, A.2.30) always has the mandatory enumeration "ST_Line". For the definition of a "ST_Line", only "ST_Line_Polyline" is used. The profile does not provide the signal "Shape type" (ISO/DIS 23150-1, A.2.30) explicitly. The signal "Extent {width, height} – vertex" (A.2.75) has attributes of the vertex at the point of the signal "Vertex point {x, y, z}" (ISO/DIS 23150-1, A.2.35). The error and confidence signals apply to this point.							

Table 7 (continued)

LSG	RL LSG M/C/O	Signal	RL signal M/C/O	Option
		Number of valid objects – road boundaries (A.1.5.3)	M	Optimise LL (ISO/DIS 23150-1, B.1.2)
		Size type: dynamic/fixed Size #: Number of valid objects – road boundaries (A.1.5.3)		
↔ Road boundary status	M	Existence probability – object level (ISO/DIS 23150-1, A.3.2)	M	
		Object ID (ISO/DIS 23150-1, A.3.3)	M	Alternative A2I (ISO/DIS 23150-1, B.3.3)
		Object grouping ID (ISO/DIS 23150-1, A.3.4)	O	
		Age (ISO/DIS 23150-1, A.2.22)	M	Profile: Observations (ISO/DIS 23150-1, 6.5.8)
		Number of valid observations (ISO/DIS 23150-1, A.2.23)	O	Profile: Observations (ISO/DIS 23150-1, 6.5.8) Optimise LL (ISO/DIS 23150-1, B.1.2) Alternative UTL (ISO/DIS 23150-1, B.1.7) Key: Time stamp reference (ISO/DIS 23150-1, A.2.24)
		Size type: dynamic/fixed Size #: Number of valid observations (ISO/DIS 23150-1, A.2.23)		
		Time stamp reference (ISO/DIS 23150-1, A.2.24)	M	Profile: Observations (ISO/DIS 23150-1, 6.5.8) Alternative VRO (ISO/DIS 23150-1, B.1.4)
		Observation status (ISO/DIS 23150-1, A.2.25)	M	Profile: Observations (ISO/DIS 23150-1, 6.5.8) Redundancy (ISO/DIS 23150-1, B.1.3) Signal: Object ID (ISO/DIS 23150-1, A.3.3), Time stamp – prediction (ISO/DIS 23150-1, A.1.6.1) Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
		Track quality (ISO/DIS 23150-1, A.3.5)	O	

^a Road objects are described by polylines. Therefore the signal "Shape type" (ISO/DIS 23150-1, A.2.30) always has the mandatory enumeration "ST_Line". For the definition of a "ST_Line", only "ST_Line_Polyline" is used. The profile does not provide the signal "Shape type" (ISO/DIS 23150-1, A.2.30) explicitly. The signal "Extent {width, height} – vertex" ([A.2.75](#)) has attributes of the vertex at the point of the signal "Vertex point {x, y, z}" (ISO/DIS 23150-1, A.2.35). The error and confidence signals apply to this point.

Table 7 (continued)

LSG	RL LSG M/C/O	Signal		RL signal M/C/O	Option
			Measurement status (ISO/DIS 23150-1, A.2.68)	M	Profile: Measurement status (ISO/DIS 23150-1, 6.5.18) Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
↔ Road boundary information	M		Number of valid road boundary classifications (A.2.78)	M	Optimise LL (ISO/DIS 23150-1, B.1.2) Alternative UTL (ISO/DIS 23150-1, B.1.7) Key: Road boundary type (A.2.79)
			Size type: dynamic/fixed Size #: Number of valid road boundary classifications (A.2.78)		
			Road boundary type (A.2.79)	M	Alternative VRO (ISO/DIS 23150-1, B.1.4) Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
			Road boundary type – confidence (A.2.80)	M	
			Road object lane association (A.2.55)	O	Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
			Road object lane association – confidence (A.2.56)	O	
↔↔ Road boundary colour tone	C (ISO/DIS 23150-1, B.2.2) Relevant: camera		Size type: dynamic/fixed Size # * Implicit list length – Optimise LL (ISO/DIS 23150-1, B.1.2): depends on Colour model type (ISO/DIS 23150-1, A.1.14)		
			Colour value (ISO/DIS 23150-1, A.2.18)	M	Profile: Colour model (ISO/DIS 23150-1, 6.5.2)
			Colour tone – confidence (ISO/DIS 23150-1, A.2.19)	O	Profile: Colour model (ISO/DIS 23150-1, 6.5.2)
↔ Road boundary polynomials	C (ISO/DIS 23150-1, B.2.2) Relevant: camera, lidar, radar		Number of valid polynomials (A.2.62)	M	Optimise LL (ISO/DIS 23150-1, B.1.2)
			Size type: dynamic/fixed Size #: Number of valid polynomials (A.2.62)		
			Polynomial coefficient y {c0, c1, c2, c3} (A.2.63)	M	
			Polynomial coefficient z {c0, c1, c2, c3} (A.2.64)	O	

^a Road objects are described by polylines. Therefore the signal "Shape type" (ISO/DIS 23150-1, A.2.30) always has the mandatory enumeration "ST_Line". For the definition of a "ST_Line", only "ST_Line_Polyline" is used. The profile does not provide the signal "Shape type" (ISO/DIS 23150-1, A.2.30) explicitly. The signal "Extent {width, height} – vertex" ([A.2.75](#)) has attributes of the vertex at the point of the signal "Vertex point {x, y, z}" (ISO/DIS 23150-1, A.2.35). The error and confidence signals apply to this point.

Table 7 (continued)

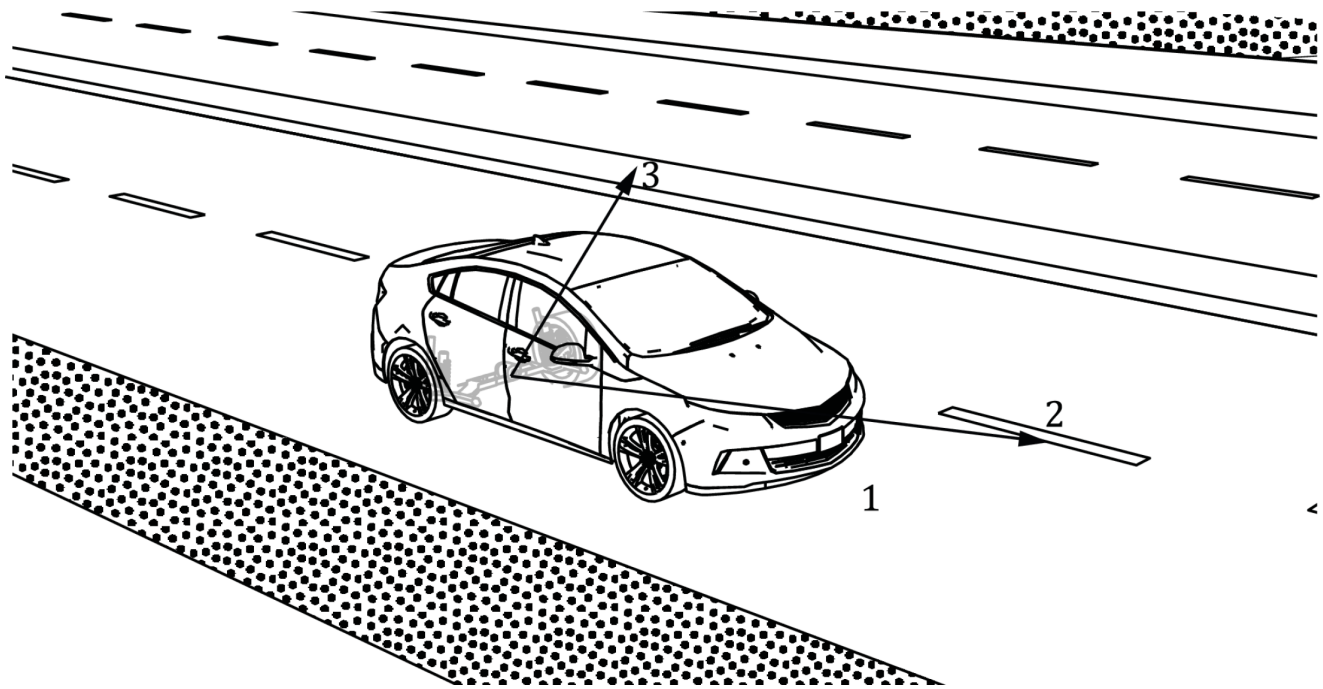
LSG	RL LSG M/C/O	Signal		RL signal M/C/O	Option
			Polynomial y – error (A.2.65)	0	Implementation EM (ISO/DIS 23150-1, B.4.2)
			Polynomial z – error (A.2.66)	0	Implementation EM (ISO/DIS 23150-1, B.4.2)
			Polynomial range x {begin, end} (A.2.67)	M	
			Extent {width, height} – polynomial (A.2.68)	0	
			Extent {width, height} – polynomial – error (A.2.69)	0	Implementation EM (ISO/DIS 23150-1, B.4.2)
			Extent {width, height} – polynomial – confidence (A.2.70)	0	
			Number of valid data ranges (A.2.71)	0	Optimise LL (ISO/DIS 23150-1, B.1.2)
			Size type: dynamic/fixed Size #: Number of valid data ranges (A.2.71)		
			Supported data range x {begin, end} (A.2.72)	M	
			Supported axis (A.2.73)	M	
↔ Road boundary polylines	C (ISO/DIS 23150-1, B.2.2) Relevant: camera, lidar, radar		Polyline interpolation method (ISO/DIS 23150-1, A.2.29)	M	Profile: Shape type {x, y, z} (ISO/DIS 23150-1, 6.5.10.2) ^a Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
			Number of valid polylines (A.2.74)	M	Optimise LL (ISO/DIS 23150-1, B.1.2)
			Size type: dynamic/fixed Size #: Number of valid polylines (A.2.74)		
			Number of valid vertices (ISO/DIS 23150-1, A.2.31)	M	Profile: Shape type {x, y, z} (ISO/DIS 23150-1, 6.5.10.2) ^a Optimise LL (ISO/DIS 23150-1, B.1.2)
			Size type: dynamic/fixed Size #: Number of valid vertices (ISO/DIS 23150-1, A.2.31)		
			Vertex point {x, y, z} (ISO/DIS 23150-1, A.2.35)	{M, M, O}	Profile: Shape type {x, y, z} (ISO/DIS 23150-1, 6.5.10.2) ^a

^a Road objects are described by polylines. Therefore the signal "Shape type" (ISO/DIS 23150-1, A.2.30) always has the mandatory enumeration "ST_Line". For the definition of a "ST_Line", only "ST_Line_Polyline" is used. The profile does not provide the signal "Shape type" (ISO/DIS 23150-1, A.2.30) explicitly. The signal "Extent {width, height} – vertex" ([A.2.75](#)) has attributes of the vertex at the point of the signal "Vertex point {x, y, z}" (ISO/DIS 23150-1, A.2.35). The error and confidence signals apply to this point.

Table 7 (continued)

LSG	RL LSG M/C/O	Signal			RL signal M/C/O	Option
				Vertex point {x, y, z} – error (ISO/DIS 23150-1, A.2.36)	C Analog: Vertex point {x, y, z} (ISO/DIS 23150-1, A.2.35)	Profile: Shape type {x, y, z} (ISO/DIS 23150-1, 6.5.10.2) ^a Implementation EM (ISO/DIS 23150-1, B.4.2)
				Vertex point {x, y, z} – con- fidence (ISO/DIS 23150-1, A.2.37)	0	Profile: Shape type {x, y, z} (ISO/DIS 23150-1, 6.5.10.2) ^a
				Extent {width, height} – ver- tex (A.2.75)	0	
				Extent {width, height} – ver- tex – error (A.2.76)	0	Implementation EM (ISO/DIS 23150-1, B.4.2)
				Extent {width, height} – ver- tex – confidence (A.2.77)	0	

^a Road objects are described by polylines. Therefore the signal "Shape type" (ISO/DIS 23150-1, A.2.30) always has the mandatory enumeration "ST_Line". For the definition of a "ST_Line", only "ST_Line_Polyline" is used. The profile does not provide the signal "Shape type" (ISO/DIS 23150-1, A.2.30) explicitly. The signal "Extent {width, height} – vertex" (A.2.75) has attributes of the vertex at the point of the signal "Vertex point {x, y, z}" (ISO/DIS 23150-1, A.2.35). The error and confidence signals apply to this point.



Key

- 1 road surface; relevant for the ego-vehicle
- 2 road marking
- 3 road boundary

Figure 4 — Example for road objects

5.3.2 Road object header

Table 8 defines the interface header for road objects (5.3.2) and the changes due to the adaptation in comparison to the "Generic object level header" (ISO/DIS 23150-1, 7.3). The header of the specifies the list of valid road marking entities and/or the list of valid road boundary entities (see 5.3.3).

Table 8 — Specific signal grouping: Road object header

Signal	RL signal	Option
Interface version ID {major, minor, patch} (ISO/DIS 23150-1, A.1.2)	Mandatory	Profile: Uniqueness of interface versioning (ISO/DIS 23150-1, 6.5.1)
Interface ID (ISO/DIS 23150-1, A.1.3)	Optional	Profile: Uniqueness of interface versioning (ISO/DIS 23150-1, 6.5.1)
Number of valid serving sensors (ISO/DIS 23150-1, A.1.4)	Mandatory	Profile: Uniqueness of interface versioning (ISO/DIS 23150-1, 6.5.1) Optimise LL (ISO/DIS 23150-1, B.1.2) Alternative UTL (ISO/DIS 23150-1, B.1.7) Key: Sensor ID (ISO/DIS 23150-1, A.1.5)
↔ Sensor ID (ISO/DIS 23150-1, A.1.5)	Mandatory	Profile: Uniqueness of interface versioning (ISO/DIS 23150-1, 6.5.1) Alternative VRO (ISO/DIS 23150-1, B.1.4)
Time stamp – prediction (ISO/DIS 23150-1, A.1.6.1)	Mandatory	
Cycle counter (ISO/DIS 23150-1, A.1.7.1)	Optional	Redundancy (ISO/DIS 23150-1, B.1.3) Signal: Time stamp – measurement (ISO/DIS 23150-1, A.1.6.2)
Interface cycle time (ISO/DIS 23150-1, A.1.8)	Optional	
Interface cycle time – variation (ISO/DIS 23150-1, A.1.9)	Optional	
Data qualifier (ISO/DIS 23150-1, A.1.10)	Mandatory	Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
Colour model type (ISO/DIS 23150-1, A.1.14)	Conditional (ISO/DIS 23150-1, B.2.2) Relevant: camera	Profile: Colour model (ISO/DIS 23150-1, 6.5.2) Alternative VRO (ISO/DIS 23150-1, B.1.4) Use enumeration to define colours by defining colour values and the applied colour model for each enumerator. Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
^a Further signals of "Need of logical signal group" (ISO/DIS 23150-1, B.3.4) profiles may be added to this header (see cell "Options").		

Table 8 (continued)

... ^a			Need of logical signal group (ISO/DIS 23150-1, B.3.4) Profile: Vehicle coordinate system (ISO/DIS 23150-1, 6.5.4) Profile: Sensor pose (ISO/DIS 23150-1, 6.5.5) Profile: Calibration (ISO/DIS 23150-1, 6.5.6) Profile: Sensor cluster (ISO/DIS 23150-1, 6.5.7)
Road surface			
Road markings			
Recognised objects – capability – road markings (A.1.3.2)	RL LSG conditional (ISO/DIS 23150-1, B.2.4) multiple entity types	Optional	
Recognised objects – status – road markings (A.1.4.2)		Optional	Redundancy (ISO/DIS 23150-1, B.1.3) Signal: Recognised objects – capability – road markings (A.1.3.2) Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
Number of valid objects – road markings (A.1.5.2)		Mandatory	Optimise LL (ISO/DIS 23150-1, B.1.2)
↪ Road marking entities			
Road boundaries			
Recognised objects – capability – road boundaries (A.1.3.3)		Optional	
Recognised objects – status – road boundaries (A.1.4.3)		Optional	Redundancy (ISO/DIS 23150-1, B.1.3) Signal: Recognised objects – capability – road boundaries (A.1.3.3) Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
Number of valid objects – road boundaries (A.1.5.3)		Mandatory	Optimise LL (ISO/DIS 23150-1, B.1.2)
↪ Road boundary entities			
^a Further signals of "Need of logical signal group" (ISO/DIS 23150-1, B.3.4) profiles may be added to this header (see cell "Options").			

5.3.3 Road object entity

Each road object describes a recognised real-world road limitation (road marking or road boundary) or the relevant road surface for the ego-vehicle. They consist of several LSGs.

The road surface is described by the road surface entity LSG. The road surface provides no LSG "Status".

A road marking is described by the following LSGs for road marking.

- **Status:** the status describes the general information of a tracked road marking. This information is based on history of the object tracking. Table 9 defines the signal grouping "Road object entity status". It defines this status LSG of the road marking and redefines the signal grouping "Generic object level entity status" (ISO/DIS 23150-1, 7.4).

- **Information:** the information describes the road marking type and different visual properties related to the road marking.
- **Sign information:** the sign information describes optional the sign symbol of the road marking, which may be equivalent to a traffic sign as traffic main sign.
- **Colour tone:** the colour tone describes the main colour of the message text and the background of the road marking.
- The contour of a road marking could be described by polynomials and/or polylines and connections:
 - **Connections:** the contour can be connected with other road markings contours of the road and each connection has a common vertex point at the connection of the road markings.
 - **Polynomials:** the polynomials of a road marking describe the detailed shape and bounds in a 3D vector space with polynomial lines. Different polynomials describe the y and z values of the contour independently.
 - **Polylines:** the polylines of a road marking describe the detailed shape and bounds in a 3D vector space with multiple line segments and a defined interpolation method.

A road boundary is described by the following LSGs for road boundary:

- **Status:** the status describes the general information of a tracked road boundary. This information is based on history of the object tracking. [Table 9](#) defines the signal grouping "Road object entity status". It defines this status LSG of the road boundary and redefines the signal grouping "Generic object level entity status" (ISO/DIS 23150-1, 7.4).
- **Information:** the information describes the road boundary type and different visual properties related to the road boundary.
- **Colour tone:** the colour tone describes the main colour of the road boundary.
- The contour could be described by polynomials and/or polylines:
 - **Polynomials:** the polynomials of a road boundary describe the detailed shape and bounds in a 3D vector space with polynomial lines. Different polynomials describe the y and z values of the contour independently.
 - **Polylines:** the polylines of a road boundary describe the detailed shape and bounds in a 3D vector space with multiple line segments and a defined interpolation method.

Table 9 — Specific signal grouping: Road object entity status

Signal	RL signal	Option
Existence probability – object level (ISO/DIS 23150-1, A.3.2)	Mandatory	
Object ID (ISO/DIS 23150-1, A.3.3)	Mandatory	Alternative A2I (ISO/DIS 23150-1, B.3.3)
Object grouping ID (ISO/DIS 23150-1, A.3.4)	Optional	
Age (ISO/DIS 23150-1, A.2.22)	Mandatory	Profile: Observations (ISO/DIS 23150-1, 6.5.8)
Number of valid observations (ISO/DIS 23150-1, A.2.23)	Optional	Profile: Observations (ISO/DIS 23150-1, 6.5.8) Optimise LL (ISO/DIS 23150-1, B.1.2) Alternative UTL (ISO/DIS 23150-1, B.1.7) Key: Time stamp reference (ISO/DIS 23150-1, A.2.24)

Table 9 (continued)

↪ Time stamp reference (ISO/DIS 23150-1, A.2.24)	Mandatory	Profile: Observations (ISO/DIS 23150-1, 6.5.8) Alternative VRO (ISO/DIS 23150-1, B.1.4)
↪ Observation status (ISO/DIS 23150-1, A.2.25)	Mandatory	Profile: Observations (ISO/DIS 23150-1, 6.5.8) Redundancy (ISO/DIS 23150-1, B.1.3) Signal: Object ID (ISO/DIS 23150-1, A.3.3), Time stamp – prediction (ISO/DIS 23150-1, A.1.6.1) Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
Track quality (ISO/DIS 23150-1, A.3.5)	Optional	
Measurement status (ISO/DIS 23150-1, A.2.68)	Mandatory	Profile: Measurement status (ISO/DIS 23150-1, 6.5.18) Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)

Road markings and road boundaries can be represented either by polynomials of degree 3 or by polylines consisting of one or more segments merged at the vertex points (see [Figure 5](#) and see informative figures in [Annex A](#) for details: [Figure A.11](#) and [Figure A.14](#)).

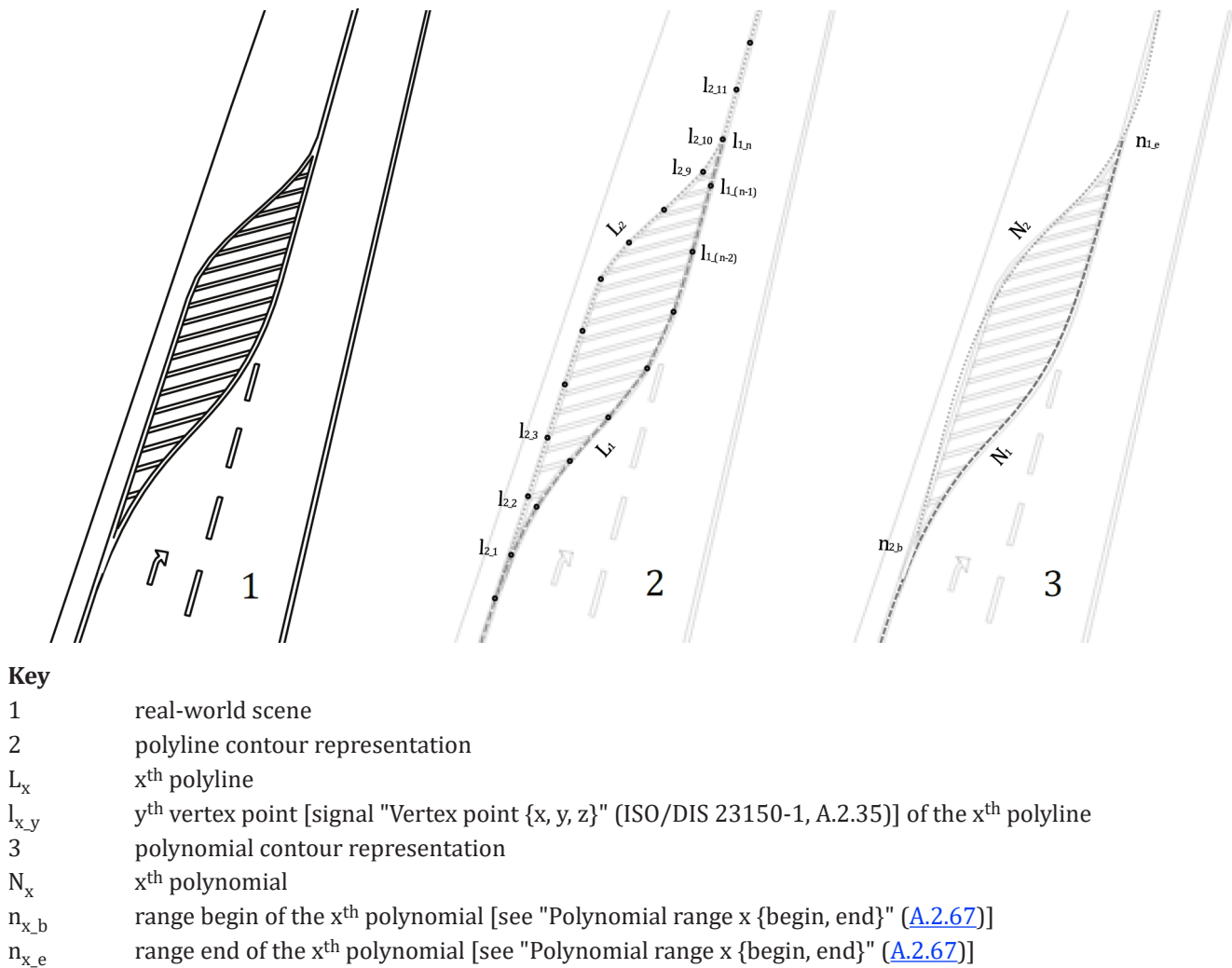


Figure 5 — Example for alternative contour representations

The road marking contours are specified with road marking polynomials and/or road marking polylines and refer to connections of road markings by the signal "Connection type" (A.2.60) and the signal "Connection grouping ID" (A.2.61). Each road marking connection is defined by a unique signal "Connection grouping ID" (A.2.61) value and connects two or more road marking contours.

5.3.4 Road object interface profiles

For RDOI, no specific profiles are defined.

5.4 Static object

5.4.1 Static object interface

The static object interface () consists of four types of entities: general landmarks, traffic signs (traffic main sign and additional supplementary signs), traffic sign boards and traffic lights (see Figure 6). Table 10 defines the general structure of the static object interface.

Table 10 — Static object interface structure

Structure	Multiplicity	Option
Static object header (5.4.2)	1	
General landmarks	Multiple	Size type: dynamic/fixed
Traffic signs	Multiple	Size type: dynamic/fixed
Traffic sign boards	Multiple	Size type: dynamic/fixed
Traffic lights	Multiple	Size type: dynamic/fixed

Table 11 defines the logical structure of the static object interface.

Table 11 — Static object interface

LSG	RL LSG M/C/O	Signal	RL signal M/C/O	Option
Information: interface	M	Interface version ID {major, minor, patch} (ISO/DIS 23150-1, A.1.2)	M	Profile: Unique- ness of interface versioning (ISO/ DIS 23150-1, 6.5.1)
		Interface ID (ISO/DIS 23150-1, A.1.3)	O	Profile: Unique- ness of interface versioning (ISO/ DIS 23150-1, 6.5.1)
		Number of valid serving sensors (ISO/ DIS 23150-1, A.1.4)	M	Profile: Unique- ness of interface versioning (ISO/ DIS 23150-1, 6.5.1) Optimise LL (ISO/ DIS 23150-1, B.1.2) Alternative UTL (ISO/DIS 23150-1, B.1.7) Key: Sensor ID (ISO/DIS 23150-1, A.1.5)
		Size type: dynamic/fixed Size #: Number of valid serving sensors (ISO/DIS 23150-1, A.1.4)		
		Sensor ID (ISO/DIS 23150-1, A.1.5)	M	Profile: Unique- ness of interface versioning (ISO/ DIS 23150-1, 6.5.1) Alternative VRO (ISO/DIS 23150-1, B.1.4)
		Time stamp – prediction (ISO/DIS 23150-1, A.1.6.1)	M	
		Cycle counter (ISO/DIS 23150-1, A.1.7.1)	O	Redundancy (ISO/ DIS 23150-1, B.1.3) Signal: Time stamp – prediction (ISO/DIS 23150-1, A.1.6.1)

^a Reference only traffic sign or traffic light with the highest probability for the association.

Table 11 (continued)

LSG	RL LSG M/C/O	Signal	RL signal M/C/O	Option
		Interface cycle time (ISO/DIS 23150-1, A.1.8)	O	
		Interface cycle time – variation (ISO/DIS 23150-1, A.1.9)	O	
		Data qualifier (ISO/DIS 23150-1, A.1.10)	M	Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
		Colour model type (ISO/DIS 23150-1, A.1.14)	C (ISO/DIS 23150-1, B.2.2) Relevant: camera	Profile: Colour model (ISO/DIS 23150-1, 6.5.2) Alternative VRO (ISO/DIS 23150-1, B.1.4) Use enumeration to define colours by defining colour values and the applied colour model for each enumerator. Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
General landmarks				
General landmarks information	C (ISO/DIS 23150-1, B.2.4) multiple entity types	Recognised objects – capability – general landmarks (A.1.3.4)	O	
		Recognised objects – status – general landmarks (A.1.4.4)	O	Redundancy (ISO/DIS 23150-1, B.1.3) Signal: Recognised objects – capability – general landmarks (A.1.3.4) Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
		Number of valid objects – general landmarks (A.1.5.4)	M	Optimise LL (ISO/DIS 23150-1, B.1.2)
		Size type: dynamic/fixed Size #: Number of valid objects – general landmarks (A.1.5.4)		
↔ General landmark status	M	Existence probability – object level (ISO/DIS 23150-1, A.3.2)	M	
		Object ID (ISO/DIS 23150-1, A.3.3)	M	Alternative A2I (ISO/DIS 23150-1, B.3.3)
^a Reference only traffic sign or traffic light with the highest probability for the association.				

Table 11 (continued)

LSG	RL LSG M/C/O	Signal	RL signal M/C/O	Option
		Object grouping ID (ISO/DIS 23150-1, A.3.4)	O	
		Age (ISO/DIS 23150-1, A.2.22)	M	Profile: Observations (ISO/DIS 23150-1, 6.5.8)
		Number of valid observations (ISO/DIS 23150-1, A.2.23)	O	Profile: Observations (ISO/DIS 23150-1, 6.5.8) Optimise LL (ISO/DIS 23150-1, B.1.2) Alternative UTL (ISO/DIS 23150-1, B.1.7) Key: Time stamp reference (ISO/DIS 23150-1, A.2.24)
		Size type: dynamic/fixed Size #: Number of valid observations (ISO/DIS 23150-1, A.2.23)		
		Time stamp reference (ISO/DIS 23150-1, A.2.24)	M	Profile: Observations (ISO/DIS 23150-1, 6.5.8) Alternative VRO (ISO/DIS 23150-1, B.1.4)
		Observation status (ISO/DIS 23150-1, A.2.25)	M	Profile: Observations (ISO/DIS 23150-1, 6.5.8) Redundancy (ISO/DIS 23150-1, B.1.3) Signal: Object ID (ISO/DIS 23150-1, A.3.3), Time stamp – prediction (ISO/DIS 23150-1, A.1.6.1) Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
		Track quality (ISO/DIS 23150-1, A.3.5)	O	
		Measurement status (ISO/DIS 23150-1, A.2.68)	M	Profile: Measurement status (ISO/DIS 23150-1, 6.5.18) Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
^a Reference only traffic sign or traffic light with the highest probability for the association.				

Table 11 (continued)

LSG	RL LSG M/C/O	Signal	RL signal M/C/O	Option
↔ General landmark information	M	Number of valid general landmark classifications (A.2.81)	M	Optimise LL (ISO/DIS 23150-1, B.1.2) Alternative UTL (ISO/DIS 23150-1, B.1.7) Key: General landmark classification type (A.2.82)
		Size type: dynamic/fixed Size #: Number of valid general landmark classifications (A.2.81)		
		General landmark classification type (A.2.82)	M	Alternative VRO (ISO/DIS 23150-1, B.1.4) Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
		General landmark classification type – confidence (A.2.83)	M	
↔ General landmark position	M	Position {x, y, z} (ISO/DIS 23150-1, A.2.43)	{M, M, O}	Profile: Object pose (ISO/DIS 23150-1, 7.5.3)
		Position {x, y, z} – error (ISO/DIS 23150-1, A.2.44)	C Analog: "Position {x, y, z}" (ISO/DIS 23150-1, A.2.43)	Profile: Object pose (ISO/DIS 23150-1, 7.5.3) Implementation EM (ISO/DIS 23150-1, B.4.2)
		Orientation {yaw, pitch, roll} (ISO/DIS 23150-1, A.3.22)	{C (ISO/DIS 23150-1, B.2.2) Relevant: camera, O, O}	Profile: Object pose (ISO/DIS 23150-1, 7.5.3)
		Orientation {yaw, pitch, roll} – error (ISO/DIS 23150-1, A.3.23)	O	Profile: Object pose (ISO/DIS 23150-1, 7.5.3) Implementation EM (ISO/DIS 23150-1, B.4.2)
		Reference point {x, y, z} (ISO/DIS 23150-1, A.3.24)	O	Profile: Object pose (ISO/DIS 23150-1, 7.5.3) Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
↔ General landmark bounding box	C (ISO/DIS 23150-1, B.2.2) Relevant: camera	Bounding box extent {length, width, height} (ISO/DIS 23150-1, A.3.24)	C Analog: "Position {x, y, z}" (ISO/DIS 23150-1, A.2.43)	Profile: Object pose (ISO/DIS 23150-1, 7.5.3)
^a Reference only traffic sign or traffic light with the highest probability for the association.				

Table 11 (continued)

LSG	RL LSG M/C/O	Signal		RL signal M/C/O	Option
			Bounding box extent {length, width, height} – error (ISO/DIS 23150-1, A.3.26)	0	Profile: Object pose (ISO/DIS 23150-1, 7.5.3) Implementation EM (ISO/DIS 23150-1, B.4.2)
Traffic signs					
Traffic signs information	C (ISO/DIS 23150-1, B.2.4) multiple entity types	Recognised objects – capability – traffic signs (A.1.3.5)		0	
		Recognised objects – status – traffic signs (A.1.4.5)		0	Redundancy (ISO/DIS 23150-1, B.1.3) Signal: Recognised objects – capability – traffic signs (A.1.3.5) Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
		Number of valid objects – traffic signs (A.1.5.5)		M	Optimise LL (ISO/DIS 23150-1, B.1.2)
			Size type: dynamic/fixed Size #: Number of valid objects – traffic signs (A.1.5.5)		
↪ Traffic main sign status	M		Existence probability – object level (ISO/DIS 23150-1, A.3.2)	M	
			Object ID (ISO/DIS 23150-1, A.3.3)	M	Alternative A2I (ISO/DIS 23150-1, B.3.3)
			Object grouping ID (ISO/DIS 23150-1, A.3.4)	0	
			Age (ISO/DIS 23150-1, A.2.22)	M	
			Number of valid observations (ISO/DIS 23150-1, A.2.23)	0	Profile: Observations (ISO/DIS 23150-1, 6.5.8) Optimise LL (ISO/DIS 23150-1, B.1.2) Alternative UTL (ISO/DIS 23150-1, B.1.7) Key: Time stamp reference (ISO/DIS 23150-1, A.2.24)
			Size type: dynamic/fixed Size #: Number of valid observations (ISO/DIS 23150-1, A.2.23)		
			Time stamp reference (ISO/DIS 23150-1, A.2.24)	M	Profile: Observations (ISO/DIS 23150-1, 6.5.8) Alternative VRO (ISO/DIS 23150-1, B.1.4)
^a Reference only traffic sign or traffic light with the highest probability for the association.					

Table 11 (continued)

LSG	RL LSG M/C/O	Signal		RL signal M/C/O	Option
			Observation status (ISO/DIS 23150-1, A.2.25)	M	Profile: Observations (ISO/DIS 23150-1, 6.5.8) Redundancy (ISO/DIS 23150-1, B.1.3) Signal: Object ID (ISO/DIS 23150-1, A.3.3), Time stamp – prediction (ISO/DIS 23150-1, A.1.6.1) Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
			Track quality (ISO/DIS 23150-1, A.3.5)	O	
			Measurement status (ISO/DIS 23150-1, A.2.68)	M	Profile: Measurement status (ISO/DIS 23150-1, 6.5.18) Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
↔ Traffic main sign information	M		Number of valid sign classifications (ISO/DIS 23150-1, A.3.11)	M	ISO/DIS 23150-1 Profile: Traffic signs (ISO/DIS 23150-1, 7.5.2) Optimise LL (ISO/DIS 23150-1, B.1.2) Alternative UTL (ISO/DIS 23150-1, B.1.7) Key: Sign classification type (ISO/DIS 23150-1, A.3.12)
			Size type: dynamic/fixed Size #: Number of valid sign classifications (ISO/DIS 23150-1, A.3.11)		
			Sign classification type (ISO/DIS 23150-1, A.3.12)	M	Profile: Traffic signs (ISO/DIS 23150-1, 7.5.2) Alternative VRO (ISO/DIS 23150-1, B.1.4) Optimise DE (ISO/DIS 23150-1, B.1.8) Optimise EES (ISO/DIS 23150-1, B.1.9)
^a Reference only traffic sign or traffic light with the highest probability for the association.					