Data Specification for Autonomous Driving Support Facilities

Version 1.0

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National Institute for Land and Infrastructure Management

Ministry of Land, Infrastructure, Transport and Tourism, Government of Japan

Contents

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Introduction

Ministry of Land, Infrastructure, Transport and Tourism (MLIT), government of Japan had defined "Autonomous Driving Support Facilities" in the Road Act[1] in 2020.

Before the distribution of related data, National Institute for Land and Infrastructure Management (NILIM) and MLIT had decided to define data specification.

The specification is compiled to the following international standards.

- ISO19107:2003 Geographic Information - Spatial Schema
- ISO19131:2022 Geographic information – Data product specifications
- ISO20524-2:2022 Intelligent Transport Systems - Geographic Data Files (GDF) GDF5.1 - Part 2: Map Data Used in Automated Driving Systems, Cooperative ITS, And Multi-Modal Transport

This is the first version of the specification.

The data product specification will be updated depending on the progress of related technologies in the future.

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National Institute for Land and Infrastructure Management

Data Specification for Autonomous Driving Support Facilities

1   Scope

This specification defines the data structure for delivery Autonomous Driving Support Facilities (ADSF) related data between contents providers and service centres. The contents provider specified in this specification represents the supplier of map related contents data and the service centre provides data and services to user devices.

This specification does not define application-oriented data structure in a vehicle or a user device.
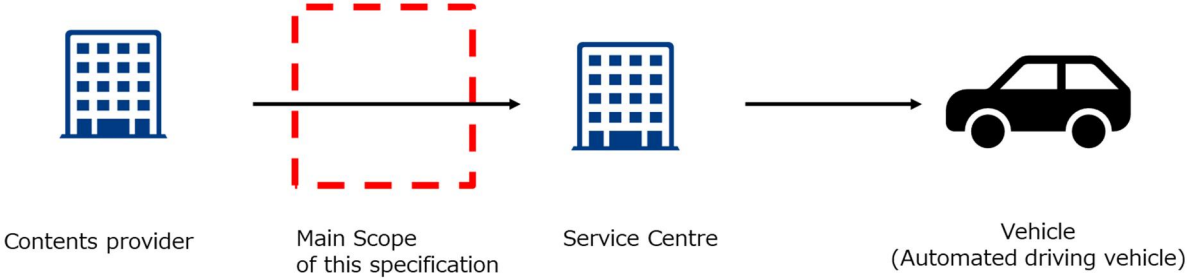

Figure 1 — Scope of this specification

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.

ISO19107:2003 Geographic Information - Spatial Schema

ISO19131:2022 Geographic information – Data product specifications

ISO20524-2:2022 Intelligent Transport Systems - Geographic Data Files (GDF) GDF5.1 - Part 2: Map Data Used in Automated Driving Systems, Cooperative ITS, And Multi-Modal Transport

3   Terms and definitions

3.1
Autonomous Driving Support Facilities (ADSF)
The facilities defined as roadside facilities and are under the control of road administrators.

[SOURCE: the Road Act in Japan[1] (2020)]

3.2
sharable feature
[SOURCE: ISO20524:2022-2]

3.3
Contents Provider
The supplier of map related contents data.

3.4
Service Centre
The centre which provides data and services to user devices.

3.5
GM_Point
[SOURCE: ISO19107]

3.6
GM_Curve
[SOURCE: ISO19107]

3.7
GM_Surface
[SOURCE: ISO19107]

3.8
TP_Node
[SOURCE: ISO19107]

3.9
TP_Edge
[SOURCE: ISO19107]

3.10
TP_Face
[SOURCE: ISO19107]

4   Abbreviated terms

ADSF	**Autonomous Driving Support Facilities**
GDF	**Geographic Data Files**
ITS	**Intelligent Transport Systems**
JGD2011	**Japanese Geographic Datum 2011**
MLIT	**Ministry of Land, Infrastructure, Transport and Tourism**
NILIM	**National Institute for Land and Infrastructure Management**
UTC	**Universal Time, Coordinated**

5   Data content and structure

5.1   Introduction

The data exchange between a contents provider and a service centre is structured by three types of ADSFs and six types of spatial representations. The data of ADSF is possible to treat as a SharableFeature, defined in GDF5.1 through Anchor Point. The relationship between them is shown in Figure 2. The multiplicity appearing at each end of a relationship explains whether a parameter is optional or not, and whether it may appear several times.
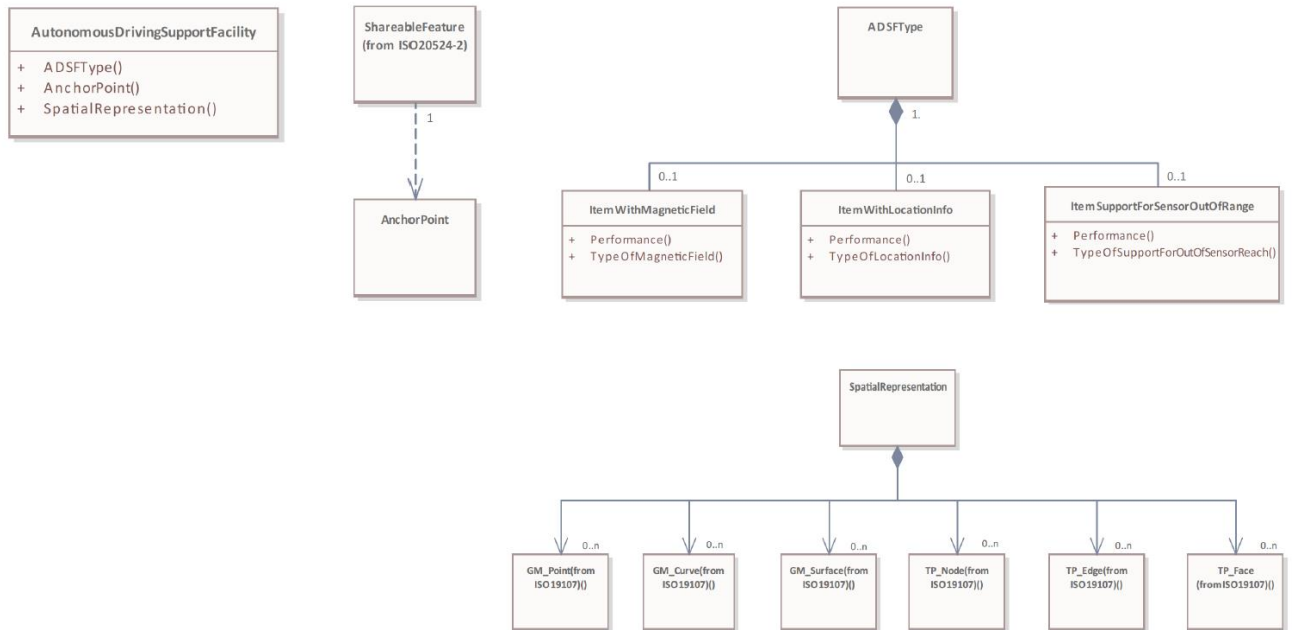

Figure 2 — Overall data model

5.2   Class ShareableFeature

See ISO20524-2:2022.

5.3   Class: Anchor Point

Anchor Point is a class used to integrate ADSF with GDF using Sharable Features defined by ISO20524-2:2022 (GDF5.1 part2)

Figure 3 — Class: AnchorPoint

5.4 Class: ADSFType

ADSFType is a class that represents the type of ADSF, and it includes ItemWithMagneticField, ItemWithLocationInfo, and ItemSupportForSensorOutOfRange.
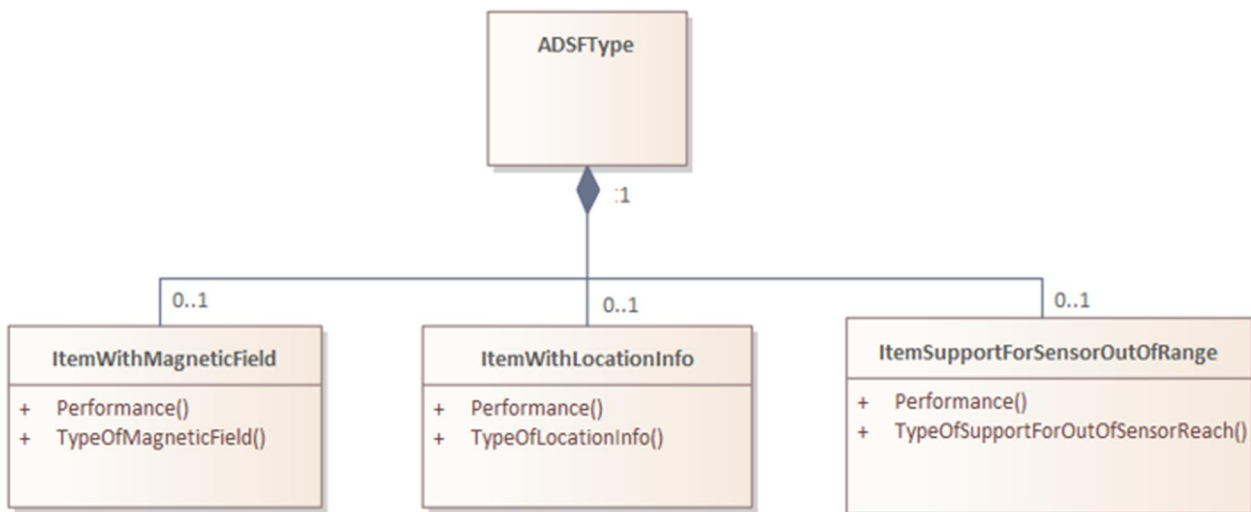

Figure 4 — Class: ADSFType

5.5 Class: ItemWithMagneticField

ItemWithMagneticField is a feature enabled to emit a magnetic field. This class should have a property, TypeOfMagneticField, indicating the type of magnetic field emitted, such as electromagnetic induction wires, magnetic markers, and so on. Additionally, it should have a Performance property to indicate the strength of the magnetic field.
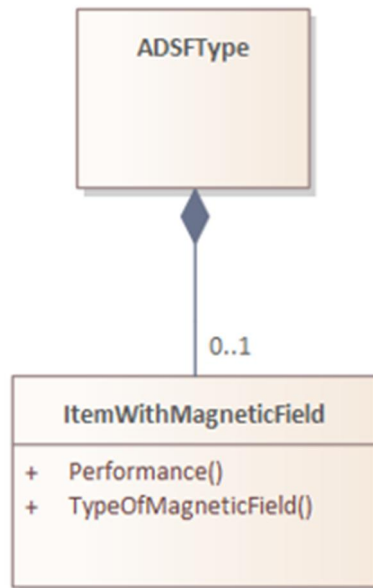
**Figure 5 — Class: ItemWithMagneticField**

5.6 Class: ItemWithLocationInfo

ItemWithLocationInfo is a feature enabled to display information indicating the location where it is installed. This class should have a TypeOfLocationInfo property indicating the type of location information, such as location information signs and a Performance property indicating the accuracy of the location.
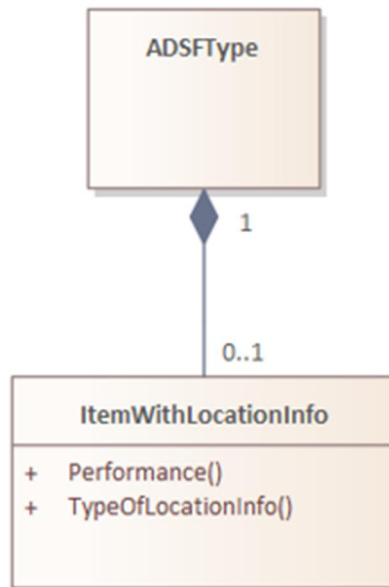
Figure 6 — Class: ItemWithLocationInfo

5.7 Class: ItemSupportForSensorOutOfRange

ItemSupportForSensorOutOfRange is a feature enabled to display information of the horizontal and vertical road alignment, other vehicles and obstacles that are beyond the reach of vehicle sensors. This class should have a property, TypeOfSupportForOutOfSensorReach, indicating the method for supporting the sensor out-of-range and a Performance property indicating the coverage area.
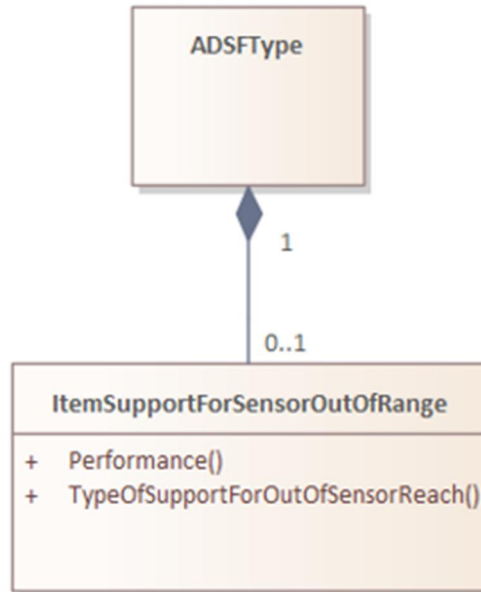
Figure 7 — Class: ItemSupportForSensorOutOfRange

5.8 Class: SpatialRepresentation

SpatialRepresentation is a class used to represent spatial information such as shape and location.
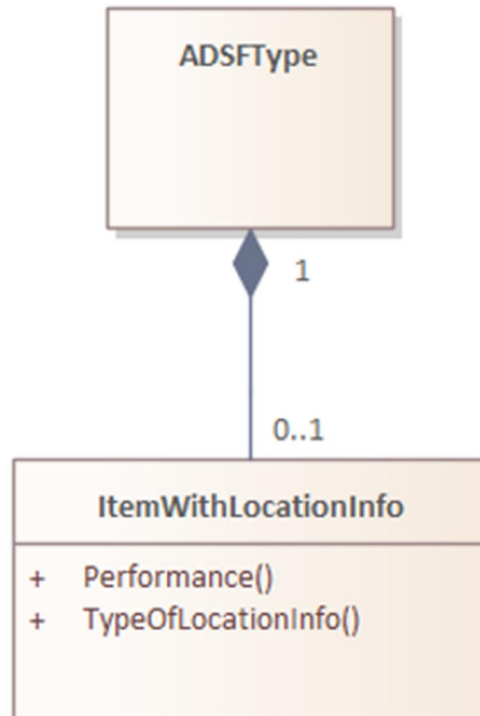
Figure 8 — Class: ItemWithLocationInfo

5.9   Class: GM_Point

See ISO19107.

5.10 Class: GM_Curve

See ISO19107.

5.11 Class: GM_Surface

See ISO19107.

5.12 Class: TP_Node

See ISO19107.

5.13 Class: TP_Edge

See ISO19107.

5.14 Class: TP_Face

See ISO19107.

6   Reference system

This data uses JGD2011 for spatial reference system and UTC for temporal reference system.
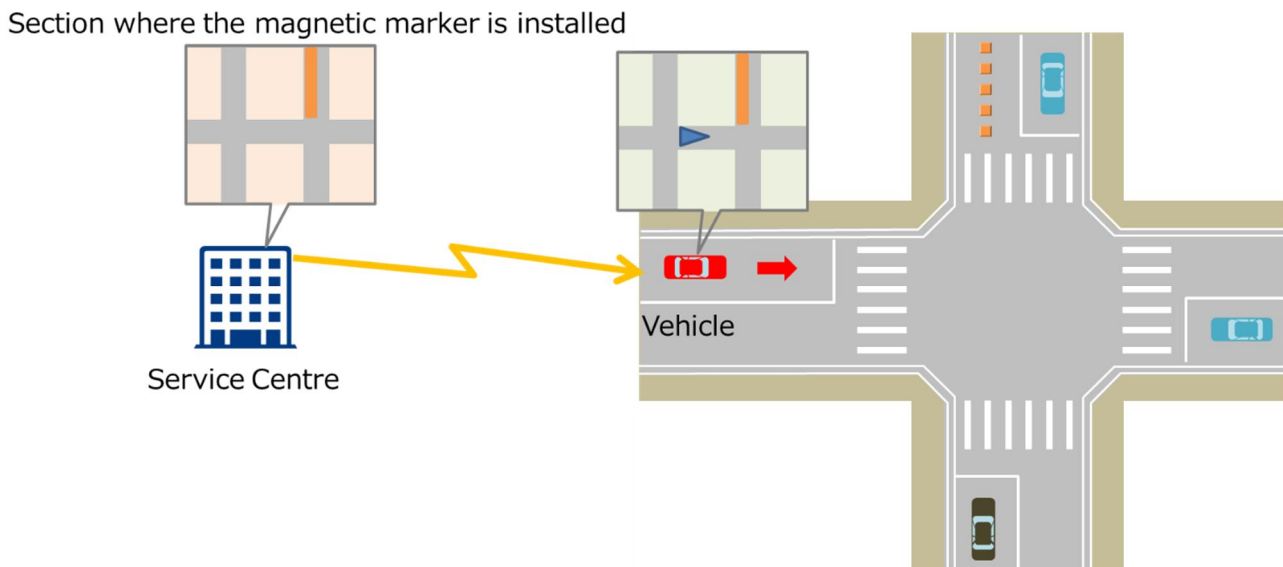

7   Metadata requirements

The owner of the data product and the last updated time (date) are mandatory as a metadata for a data set.

Annex A
(informative)

Use cases

A.1 Delivering information on the section or lane where ADSF are installed

Figure A.1 shows how a vehicle uses ADSF to obtain information about lanes from a service centre.
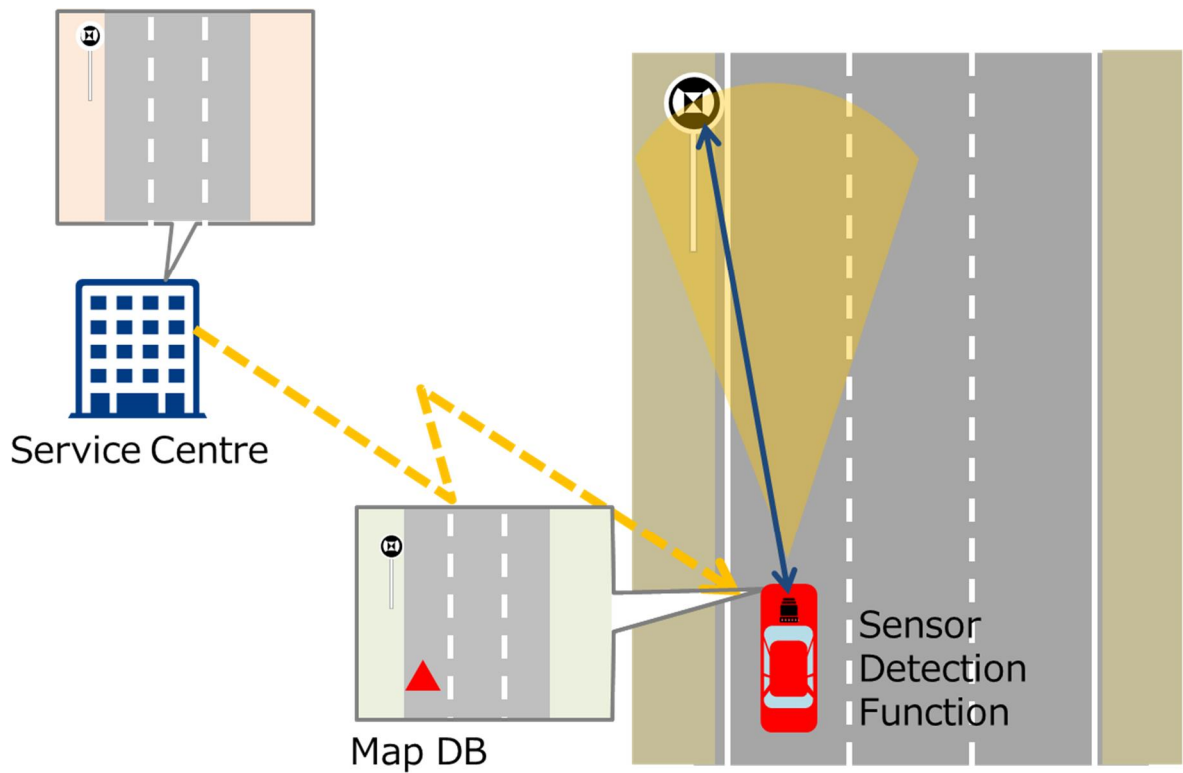

Figure A.1 — Service Centre provides a vehicle with information on the lane.

Use Case Name	**Delivering information on the section or lane where ADSF are installed.**			
Actors	Service Centre	Vehicle		
Description	A service centre provides a vehicle with information on the sections and lanes where ADSF are installed.			
Flow	1. A service centre provides a vehicle with the information.			
Dependencies	—			
Preconditions/ Post-conditions	—			
Alternative flow (number indicates item in the flow above)	—			
Notes	—			

A.2 Localization of ego-vehicle using information provided by the sign

Figure A.2 shows how the vehicle estimates its own location by detecting sign.

Figure A.2 — A vehicle detects a sign and estimates ego-vehicle location.

Use Case Name	**Localization of ego-vehicle using information provided by the sign.**			
Actors	Service Centre	Vehicle		
Description	A vehicle estimates self-location using information provided by the sign.			
Flow	1. A vehicle detects the sign. 2. A service Centre provides a vehicle with the location of the sign. 3. A vehicle estimates self-location from location of the sign.			
Dependencies	—			
Preconditions/ Post-conditions	A vehicle has the function to detect signs.			
Alternative flow (number indicates item in the flow above)	—			
Notes	—			

A.3 Delivering blind section info. via the facility

Figure A.3 shows how the support facility provides information on rocks on the road in the blind area beyond the turn.
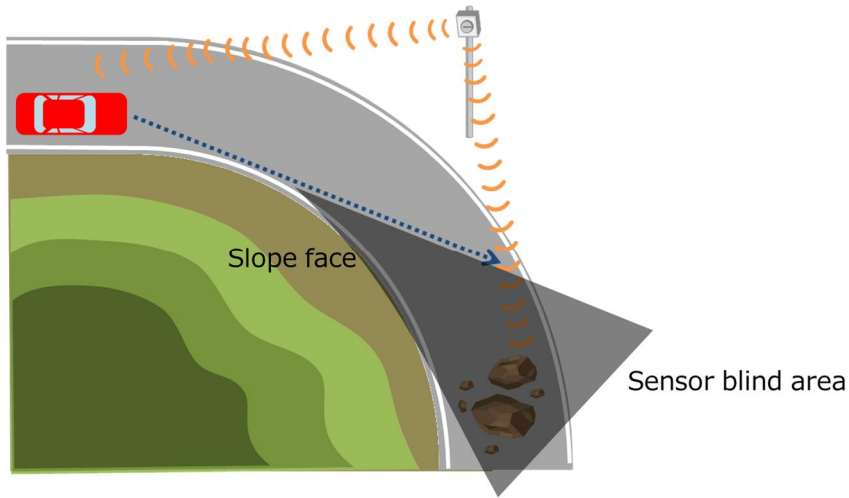

Figure A.3 — A vehicle obtains information on blind area from a facility.

Use Case Name	**Delivering blind section info. via the facility.**			
Actors	Vehicle			
Description	ADSF provides a vehicle with the information about blind area.			
Flow	1. ADSF senses blind area. 2. A vehicle approaches ADSF. 3. ADSF provides the information.			
Dependencies	—			
Preconditions/ Post-conditions	—			
Alternative flow (number indicates item in the flow above)	—			
Notes	Similar concept use cases are explained in a ETSI TR document[2].			

Bibliography

[1] The Act Partially Amending the Road Act, etc. (Act No. 31 of Reiwa 2 in Japan), Date of promulgation: May 27, 2020

[2] ETSI TR 103 562 V2.1.1 (2019-12) Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Analysis of the Collective Perception Service (CPS); Release 2