
**Intelligent transport systems (ITS) —
Location referencing for geographic
databases —**

**Part 3:
Dynamic location references
(dynamic profile)**

*Systèmes intelligents de transport (SIT) — Localisation pour bases de
données géographiques —*

Partie 3: Localisations dynamiques (profil dynamique)

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Contents

Page

Foreword	v
Introduction	vi
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Abbreviated terms and attribute codes	4
4.1 Abbreviated terms	4
4.2 Attribute codes	5
5 Objectives and requirements for a location referencing method	6
6 Conceptual data model for location referencing methods	6
7 Specification of dynamic location references	6
7.1 General specification	6
7.2 Location referencing building blocks	7
7.2.1 General	7
7.2.2 Points	7
7.2.3 Attributes	8
7.2.4 Next-point relationship	15
7.2.5 Attribute type list	15
8 Encoding rules	15
8.1 General	15
8.2 General point representation and selection rules	21
8.3 Location reference core encoding rules	21
8.3.1 Location selection	21
8.3.2 Location reference core point selection	22
8.3.3 Core point selection — Location points	22
8.3.4 Core point selection — Intersection points	23
8.3.5 Core point selection — Routing points	25
8.3.6 Intersection point attributes	27
8.3.7 Routing point attributes	28
8.3.8 Location reference core encoding parameters	29
8.4 Location reference extension encoding rules	29
8.4.1 General	29
8.4.2 Location reference extension necessity rules	30
8.4.3 Location reference extension point selection rules	30
8.4.4 Location reference extension encoding parameters	31
8.5 Coding of point locations	32
8.6 Coding of area locations	32
8.6.1 Coding of explicit area	32
8.6.2 Coding of implicit area	34
9 Logical data format specification	37
9.1 General	37
9.2 Data model definition	37
9.2.1 General	37
9.2.2 General data model	38
9.2.3 Linear location data model	38
9.2.4 Implicit area data model	39
9.2.5 Explicit area data model	40
Annex A (informative) Dynamic location reference, TPEG2 logical structure	41
Annex B (normative) Dynamic location reference, TPEG2 binary representation	58

Annex C (normative) Dynamic location reference, TPEG2 XML representation	66
Annex D (informative) Coding guidelines for dynamic location references	73
Annex E (informative) Compressed data format specification	79
Bibliography	103

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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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT), see the following URL: [Foreword — Supplementary information](#).

The committee responsible for this document is ISO/TC 204, *Intelligent transport systems*.

This second edition cancels and replaces the first edition (ISO 17572-3:2008), which has been technically revised. It also incorporates Technical Corrigendum ISO 17572-3:2008/Cor1:2009.

ISO 17572 consists of the following parts, under the general title *Intelligent transport systems (ITS) — Location referencing for geographic databases*:

- *Part 1: General requirements and conceptual model*
- *Part 2: Pre-coded location references (pre-coded profile)*
- *Part 3: Dynamic location references (dynamic profile)*

Introduction

A location reference (LR) is a unique identification of a geographic object. In a digital world, a real-world geographic object can be represented by a feature in a geographic database. An example of a commonly known location reference is a postal address of a house. Examples of object instances include a particular exit ramp on a particular motorway, a road junction, or a hotel. For efficiency reasons, location references are often coded. This is especially significant if the location reference is used to define the location for information about various objects between different systems. For intelligent transport systems (ITS), many different types of real-world objects will be addressed. Amongst these, location referencing of the road network, or components thereof, is a particular focus.

Communication of a location reference for specific geographic phenomena, corresponding to objects in geographic databases, in a standard, unambiguous manner is a vital part of an integrated ITS system, in which different applications and sources of geographic data will be used. Location referencing methods (LRMs, methods of referencing object instances) differ by applications, by the data model used to create the database, or by the enforced object referencing imposed by the specific mapping system used to create and store the database. A standard location referencing method allows for a common and unambiguous identification of object instances representing the same geographic phenomena in different geographic databases produced by different vendors, for varied applications, and operating on multiple hardware/software platforms. If ITS applications using digital map databases are to become widespread, data reference across various applications and systems has to be possible. Information prepared on one system, such as traffic messages, has to be interpretable by all receiving systems. A standard method to refer to specific object instances is essential to achieving such objectives.

Japan, Korea, Australia, Canada, the US, and European ITS bodies are all supporting activities of location referencing. Japan has developed a Link Specification for VICS. In Europe, the RDS-TMC traffic messaging system has been developed. In addition, methods have been developed and refined in the EVIDENCE and AGORA projects based on intersections identified by geographic coordinates and other intersection descriptors. After the publication of the first edition of this International Standard in 2008, TPEG had changed to TPEG2. Modifications related to this change are captured in this second edition. In the US, standards for location referencing have been developed to accommodate several different location referencing methods.

This International Standard provides specifications for location referencing for ITS systems (although other committees or standardization bodies can subsequently consider extending it to a more generic context). In addition, this version does not deal with public transport location referencing; this issue will be dealt with in a later version.

The International Organization for Standardization (ISO) draws attention to the fact that it is claimed that compliance with this part of ISO 17572 can involve the use of a patent concerning procedures, methods and/or formats given in this part of ISO 17572 in [Clauses 8](#) and [9](#) and [Annexes A, B, and C](#).

ISO takes no position concerning the evidence, validity, and scope of this patent right.

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Intelligent transport systems (ITS) — Location referencing for geographic databases —

Part 3: Dynamic location references (dynamic profile)

1 Scope

This International Standard specifies location referencing methods (LRMs) that describe locations in the context of geographic databases and will be used to locate transport-related phenomena in an encoder system as well as in the decoder side. This International Standard defines what is meant by such objects and describes the reference in detail, including whether or not components of the reference are mandatory or optional, and their characteristics.

This International Standard specifies two different LRMs:

- pre-coded location references (pre-coded profile);
- dynamic location references (dynamic profile).

This International Standard does not define a physical format for implementing the LRM. However, the requirements for physical formats are defined.

This International Standard does not define details of the location referencing system (LRS), i.e. how the LRMs are to be implemented in software, hardware, or processes.

This part of ISO 17572 specifies the dynamic location referencing method, comprising

- attributes and encoding rules
- logical data modelling
- TPEG physical format specification for dynamic location references,
- coding guidelines for dynamic location references;
- compressed data format specification.

It is consistent with other International Standards developed by ISO/TC 204 such as ISO 14825.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 17572-1, *Intelligent transport systems (ITS) — Location referencing for geographic databases — Part 1: General requirements and conceptual model*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 17572-1 and the following apply.

3.1
bearing

angle between a reference direction and the direction to an object measured clockwise

Note 1 to entry: Unless otherwise specified, the reference direction is generally understood to be geographic north.

3.2
connection angle

CA

difference between *side road bearing* (3.23) and *bearing* (3.1) at a point

3.3
connection point

location point captured in the location reference core, which forms the start point of a path external to the location

Note 1 to entry: Connection points are used to connect a location reference extension to a location reference core and to connect linear locations to form a subnetwork. The connection point is identified using its connection point index.

Note 2 to entry: The connection point index is implicitly defined by the order of the points in a location reference.

3.4
connectivity

status of being topologically connected

Note 1 to entry: In a graph, two or more edges are said to be connected if they share one or more nodes.

3.5
coordinate pair

set of two coordinates (one longitude value and one latitude value), representing a position on the earth model

Note 1 to entry: Within the scope of this International Standard, the earth model is embodied by ITRS and by ITRF coordinates.

3.6
core point

CP

point belonging to the location reference core

3.7
destination location

location to be used as the end location of a journey for a route guidance application

3.8
extension point

EP

point belonging to the location reference extension

3.9
great circle

circle on the surface of a sphere that has the same circumference as the sphere

Note 1 to entry: The connection between two points on a sphere along the great circle passing through the said two points is the shortest connection (airline distance or distance "as the crow flies").

3.10 intersection point IP

core point representing an intersection, located at places where the road section signature at the location changes

Note 1 to entry: The intersection point is one of the three defined core point types.

3.11 location point LP

core point that bounds or is located on the location

Note 1 to entry: Location points can coincide with intersection points or routing points. The start and the end of the location are always represented by a location point. Additional intermediate location points can be created to represent the shape of the location. The location point is one of the three defined core point types.

3.12 location reference core

point or set of points that is available in any location reference

Note 1 to entry: The rules in [Clause 8](#) control the data to be stored in the location reference core.

3.13 location reference extension

additional point or set of points, not belonging to the location reference core, available in a location reference under special conditions

Note 1 to entry: The rules in [Clause 8](#) specify the conditions under which a location reference extension is to be used and control the data to be stored in a location reference extension.

3.14 next point

point that is directly (topologically) connected to a given point, in a direction that is defined by the defined direction of the location

Note 1 to entry: A point can have zero or more next points.

3.15 next point relation

ordered pair of points (A, B) for which a direct connection exists from A to B along the path of the referenced location

Note 1 to entry: In the road network, a direct connection between points A and B exists when point B can be reached from point A *via* part of the road network, without visiting intermediate points in the location reference. This excludes points connected in a GDF graph *via* a node representing an intersection-not-at-grade. Such points are not considered to be directly connected.

3.16 parallel carriageway indicator

non-negative integer which indicates if a road segment contains more than one carriageway in parallel in the direction of interest, and how many

3.17 precise geometry description

shape along the location, coded on the most detailed level of the digital map, lying in a corridor with a defined perpendicular distance to the great circle connection between two successive points on a location

3.18

road descriptor

full road number, or a significant substring of the official road name

Note 1 to entry: The road descriptor is ideally three to five characters in length.

3.19

road network location

location which has a one-dimensional and continuous structure, being part of a road network

Note 1 to entry: It is a continuous stretch of that road network as realized in the database, which can cover different roads, and can be bounded on either side by an intersection. Alternatively it can be bounded on either side by a position on a road.

3.20

road section signature

road signature

value of the attribute quadruple {functional road class, form-of-way, road descriptor, driving direction}

3.21

routing point

RP

point used to reconstruct the location by route calculation

Note 1 to entry: RPs are intended to allow point-based matching to the map database of the end user. When such an RP match is found, the location then can be further reconstructed using the connectivity of the road network as represented in the map database of the end user. The routing point is one of the three defined core point types.

3.22

side road section

road section which is not part of the location to be referenced, but connected to it *via* an at least trivalent junction

3.23

side road bearing

bearing of the side road section

3.24

side road direction

driving direction of the side road section

3.25

side road signature

road section signature of a side road section

3.26

status location

location to be used to position location-based status information

EXAMPLE A location for speed limit information or traffic level information.

4 Abbreviated terms and attribute codes

4.1 Abbreviated terms

AGORA Implementation of Global Location Referencing Approach
(Name of a European project 2000–2002)

DLR dynamic location reference (also known as DLR1 because this is the first LRM under dynamic profile)

GCIId	generic component identifier
GDF	Geographic Data Files (data model, data specification, and exchange standard for geographic data for road transport applications)
ISO	International Organization for Standardization
ITRF	International Terrestrial Reference Frame
ITRS	International Terrestrial Reference System
ITS	intelligent transport system
LR	location reference
LRM	location referencing method
LRS	location referencing system
NLR	network location reference
RDS	Radio Data System (digital data channel on FM subcarrier)
RFU	Reserved for Future Use
SSF	Syntax, Semantics, and Framing Structure (TPEG ISO/TS 18234-2)
TMC	Traffic Message Channel [system for broadcast of (digitally encoded) traffic messages on RDS]
UML	Unified Modelling Language
VLC	Variable Length Coding
XML	Extensible Markup Language

4.2 Attribute codes

AFR	accessible for routing flag
BR	bearing
CA	connection angle
CPI	connection point index
DCA	distance measure CA
DD	driving direction
DMB	distance measure bearing
DSF	destination flag
FC	functional road class
FCM	functional road class minimal
FW	form of way
IT	intersection type

PCI	parallel carriageway indicator
PD	point distance
PDM	$D_{\text{perp-max}}$ (attribute to measure distance on shapes)
RD	road descriptor
RDI	road descriptor of intersection
RP	routing point
SNI	subnetwork index

5 Objectives and requirements for a location referencing method

For details, see ISO 17572-1:2014, Clause 4.

For an inventory of location referencing methods, see ISO 17572-1:2014, Annex A.

6 Conceptual data model for location referencing methods

For details, see ISO 17572-1:2014, Clause 5.

For examples of conceptual data model use, see ISO 17572-1:2014, Annex B.

7 Specification of dynamic location references

7.1 General specification

Dynamic location referencing is also known as the AGORA-C method and relies on specific attributes that are mostly available in current digital map databases. Consequently, this LRM is adequate for LRSs that have a physical format specification based on GDF. The method relies on real-time access by the software to the original or translated values of the relevant attributes from its own digital map. This LRM will also be called “on-the-fly referencing” because the location reference code can be immediately discarded after internal definition of the location has been decoded. The dynamic location referencing concept is designed to compensate for differences that might exist between the map used at the sending system (the encoding side) and the map on board the receiving system (the decoding side). Such map differences can be caused by the receiving system using an older map data set of the same supplier, or *vice versa*, or the receiving system using a map data set from a different supplier.

Dynamic location referencing is often not as compact as pre-coded location coding. However, it is generally accepted that if dynamic location reference codes can on average stay within 50 bytes for problem and status locations, this would be acceptable in terms of bandwidth occupation. The specification focuses on LRSs for two purposes, and hence provides two building blocks.

— Location reference core

The location reference core is applicable to problem and status locations, e.g. road traffic messages. The location reference core is intended to provide location information much like ALERT-C location referencing^[10] for which this specification actually intends to provide a lightweight dynamic location reference (not requiring pre-coding and the use of location tables). The location reference core prepares a function for additional robustness called precise geometry description in cases where a lack of information elements in the decoder’s map is expected or under conditions defined in the following clause.

— Location reference extension

The location reference extension is applicable to use in routing to destination locations, i.e. the location of interest is to be used as the destination of a route guidance application. The location reference extension augments the location reference core to an extended location reference, in which the location reference extension is provided to ensure that a path from the location of interest to the nearest part of the road network defined in the location reference core exists.

A dynamic location reference is constructed as a set of information elements, which consists of points and related attributes. All points in both building blocks of the location reference (location reference core and location reference extension) together constitute a linear set, i.e. they form a list where each point in the list except the last one relates to the next point in the list, and to no other points. Each point can have one or more attributes.

On reception of this location reference, the receiving system needs to reconstruct the location as intended by the sending system. The encoding rules provided in [Clause 8](#) provide the necessary semantics both for creating the location code at the sending system and for interpreting this code in the receiving system. Thus, the role of the encoding rules is both to provide constraints for selecting and creating this set of information elements at the sending system and to provide a consistent interpretation basis for the receiving system to reconstruct the location reference as intended by the sending system.

This clause describes the building blocks for the dynamic location reference and specifies different types of attributes. [Clause 8](#) defines the Dynamic Profile LRM as a set of rules. These rules are mandatory, and any shall adhere to these. [Clause 9](#) defines the minimum requirements for any physical data format, which is for storing Dynamic Profile Location References of this LRM. [Annex D](#) describes hints to add optional attributes to the dynamic location reference and proposes a coding procedure, which can serve as a basis for the creation of a coding algorithm. Through application of the rules and the coding procedure, the sending system should be able to create a location reference that can be interpreted consistently by a variety of receiving systems if the physical format is well-known. For this reason two physical formats (binary and XML) are defined in [Annexes B](#) and [C](#), based on the logical format in [Annex A](#). This presents the opportunity to have at least one exchange format usable for the variety of LRS. If application of an LRM cannot implement either physical format of [Annex B](#) or [Annex C](#), the LRS might specify its own proprietary physical format, still fulfilling all format requirements defined by [Clause 9](#) of this International Standard. A third physical format defined in [Annex E](#) is specifically optimized for implicit areas and location references with precise geometry description and allows storing the location references in a very size efficient way.

Robustness of the codes is acquired by uniqueness. The information elements used and (certain aspects of) their combination shall be unique for these different parameters are defined as thresholds, e.g. the certain area around a point by the default distance $D_{\text{search_area}}$. These parameters are specified in different rules and the best known values are given in [Table 3](#).

7.2 Location referencing building blocks

7.2.1 General

In [7.2.2](#) to [7.2.5](#), the building blocks for dynamic location reference encoding are defined and specified. These are points and attributes.

7.2.2 Points

The basis of the dynamic location reference is a set (or list) of points, which can be described as follows.

Point in general

A point can reference an intersection or can reference a position on the road network away from intersections. The set of points in a location reference constitute a next point relationship such that each point except the last one refers to one and only one other point (its “next point”).