International Standard

ISO 21219-21

Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) —

Part 21:
Geographic location referencing (TPEG-GLR)

Systèmes intelligents de transport — Informations sur le trafic et le tourisme via le groupe expert du protocole de transport, génération 2 (TPEG2) —

Partie 21: Information géographique (TPEG-GLR)

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Foreword

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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 document 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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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 204, *Intelligent transport systems*.

This first edition cancels and replaces the first edition of ISO/TS 21219-21:2018, which has been technically revised.

The main changes are as follows:

— the document status has been changed from Technical Specification (TS) to International Standard (IS).

A list of all parts in the ISO 21219 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

0.1 History

TPEG technology was originally proposed by the European Broadcasting Union (EBU) Broadcast Management Committee, who established the B/TPEG project group in the autumn of 1997 with a brief to develop, as soon as possible, a new protocol for broadcasting traffic and travel-related information in the multimedia environment. TPEG technology, its applications and service features were designed to enable travel-related messages to be coded, decoded, filtered and understood by humans (visually and/or audibly in the user's language) and by agent systems. Originally, a byte-oriented data stream format, which can be carried on almost any digital bearer with an appropriate adaptation layer, was developed. Hierarchically structured TPEG messages from service providers to end-users were designed to transfer information from the service provider database to an end-user's equipment.

One year later, in December 1998, the B/TPEG group produced its first EBU specifications. Two documents were released. Part 2 (TPEG-SSF, which became ISO/TS 18234-2) described the syntax, semantics and framing structure which was used for all TPEG applications. Meanwhile, Part 4 (TPEG-RTM, which became ISO/TS 18234-4) described the first application for road traffic messages.

Subsequently, in March 1999, CEN/TC 278, in conjunction with ISO/TC 204, established a group comprising members of the former EBU B/TPEG and this working group continued development work. Further parts were developed to make the initial set of four parts, enabling the implementation of a consistent service. Part 3 (TPEG-SNI, ISO/TS 18234-3) described the service and network information application used by all service implementations to ensure appropriate referencing from one service source to another.

Part 1 (TPEG-INV, ISO/TS 18234-1) completed the series by describing the other parts and their relationship. It also contained the application IDs used within the other parts. Additionally, Part 5, the public transport information application (TPEG-PTI, ISO/TS 18234-5), was developed. The so-called TPEG-LOC location referencing method, which enabled both map-based TPEG-decoders and non-map-based ones to deliver either map-based location referencing or human readable text information, was issued as ISO/TS 18234-6 to be used in association with the other applications of parts of the ISO 18234 series to provide location referencing.

The ISO 18234 series has become known as TPEG Generation 1.

0.2 TPEG Generation 2

When the Traveller Information Services Association (TISA), derived from former forums, was inaugurated in December 2007, TPEG development was taken over by TISA and continued in the TPEG applications working group.

It was about this time that the (then) new Unified Modelling Language (UML) was seen as having major advantages for the development of new TPEG applications in communities who would not necessarily have the binary physical format skills required to extend the original TPEG TS work. It was also realized that the XML format for TPEG described within the ISO 24530 series (now superseded) had a greater significance than previously foreseen, especially in the content-generation segment, and that keeping two physical formats synchronized, in different standards series, would be rather difficult.

As a result, TISA set about the development of a new TPEG structure that would be UML-based. This has subsequently become known as TPEG Generation 2.

TPEG2 is embodied in the ISO 21219 series and it comprises many parts that cover introduction, rules, toolkit and application components. TPEG2 is built around UML modelling and has a core of rules that contain the modelling strategy covered in ISO 21219-2, ISO 21219-3 and ISO 21219-4 and the conversion to two current physical formats: binary (see Annex A) and XML (see Annex B); others could be added in the future. TISA uses an automated tool to convert from the agreed UML model XMI file directly into an MS Word document file that forms the annex for each physical format.

TPEG2 has a three-container conceptual structure: message management (ISO 21219-6), application (several parts) and location referencing (ISO 21219-7). This structure has flexible capability and can accommodate

many differing use cases that have been proposed within the TTI sector and more broadly for hierarchical message content.

TPEG2 also has many location referencing options as required by the service provider community, any of which may be delivered by vectoring data included in the location referencing container.

The following classification provides a helpful grouping of the different TPEG2 parts according to their intended purpose. Note that the list below is potentially incomplete, as it is possible that new TPEG2 parts will be introduced after publication of this document.

— Toolkit parts: TPEG2-INV (ISO 21219-1), TPEG2-UML (ISO 21219-2), TPEG2-UBCR (ISO 21219-3), TPEG2-UXCR (ISO 21219-4), TPEG2-SFW (ISO 21219-5), TPEG2-MMC (ISO 21219-6), TPEG2-LRC (ISO 21219-7).

— Special applications: TPEG2-SNI (ISO 21219-9), TPEG2-CAI (ISO 21219-10), TPEG2-LTE (ISO/TS 21219-24).

— Location referencing: TPEG2-OLR (ISO/TS 21219-22), TPEG2-GLR (ISO 21219-21 – this document), TPEG2-TLR (ISO 17572-2), TPEG2-DLR (ISO 17572-3).

— Applications: TPEG2-PKI (ISO 21219-14), TPEG2-TEC (ISO 21219-15), TPEG2-FPI (ISO 21219-16), TPEG2-TFP (ISO 21219-18), TPEG2-WEA (ISO 21219-19), TPEG2-RMR (ISO/TS 21219-23), TPEG2-EMI (ISO 21219-25), TPEG2-VLI (ISO/TS 21219-26).

TPEG2 has been developed to be broadly (but not totally) backward compatible with TPEG1 to assist in transitions from earlier implementations, while not hindering the TPEG2 innovative approach and being able to support many new features, such as dealing with applications with both long-term, unchanging content and highly dynamic content, such as parking information.

This document is based on the TISA specification technical/editorial version reference:

SP22005_2.1_002

Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) —

Part 21:
Geographic location referencing (TPEG-GLR)

1 Scope

This document establishes a method of using geographic location referencing (GLR) that can be used by relevant TPEG applications. The GLR type, defined in this document, is used for defining geographic location references (points, polylines and geographical areas). The GLR method is intended to be one of the methods that can be transported inside a TPEG-Location Referencing Container (TPEG-LRC) for those TPEG applications providing information for primarily geographical locations (e.g. weather).

The GLR specification is deliberately kept basic and compact, so that it can also be employed advantageously in non-navigation devices, for simple TPEG services such as weather information, safety alerts, etc. As such, the GLR location referencing method is intended to be complementary to map-related location referencing methods, where the focus is on the referencing of anthropogenic artefacts such as roads and highways.

For this reason, the scope of GLR is limited to geographic locations on the Earth's surface.

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 21219-1, *Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 1: Introduction, numbering and versions (TPEG2-INV)*

ISO 21219-9, *Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 9: Service and network information (TPEG2-SNI)*

ISO 21219-14, *Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 14: Parking information (TPEG2-PKI)*

ISO 21219-16, *Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 16: Fuel price information and availability (TPEG2-FPI)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
point of interest
specific point location that someone may find useful or interesting

EXAMPLE 1   A point on the Earth representing the location of the Eiffel Tower, in Paris, France.

EXAMPLE 2   The location of a weather station on top of Mount Washington in New Hampshire, VT, USA.

EXAMPLE 3   The location of a fuel station.

4   Abbreviated terms

For the purposes of this document, the abbreviated terms in ISO 21219-1, ISO 21219-9, ISO 21219-14, ISO 21219-16 shall apply.

5   Toolkit specific constraints

5.1   Version number signalling

Version numbering is used to track the separate versions of an application through its development and deployment. The differences between these versions could have an impact on client devices.

The version numbering principle is defined in ISO 21219-1.

Table 1 shows the current version numbers for signalling GLR versions within the SNI application.

Table 1 — Current version numbers for signalling of GLR

Major version number	2
Minor version number	1

5.2   Extendibility

Future toolkit extensions may insert new components or may replace existing components by new ones without losing backward compatibility. This means that a TPEG2-GLR decoder shall be able to detect and skip unknown components.

6   GLR toolkit structure

6.1   General

The GLR toolkit provides a component for simple geographic location references. This component can be inserted in an LRC inside a TPEG message, when this type of location reference is relevant and suitable for the particular TPEG application.

Figure 1 shows the structure of GeographicLocationReference in the GLR toolkit. Other classes used in the toolkit are shown in Figure 2, Figure 3, Figure 4 and Figure 5. The GLR location reference offers several variants of geographic location references. However, each instance shall contain only a single type of the provided various types of geographic location references.

The binary format and XML format of the TPEG2-SNI application for use in transmission shall be in accordance with Annexes A and B, respectively.
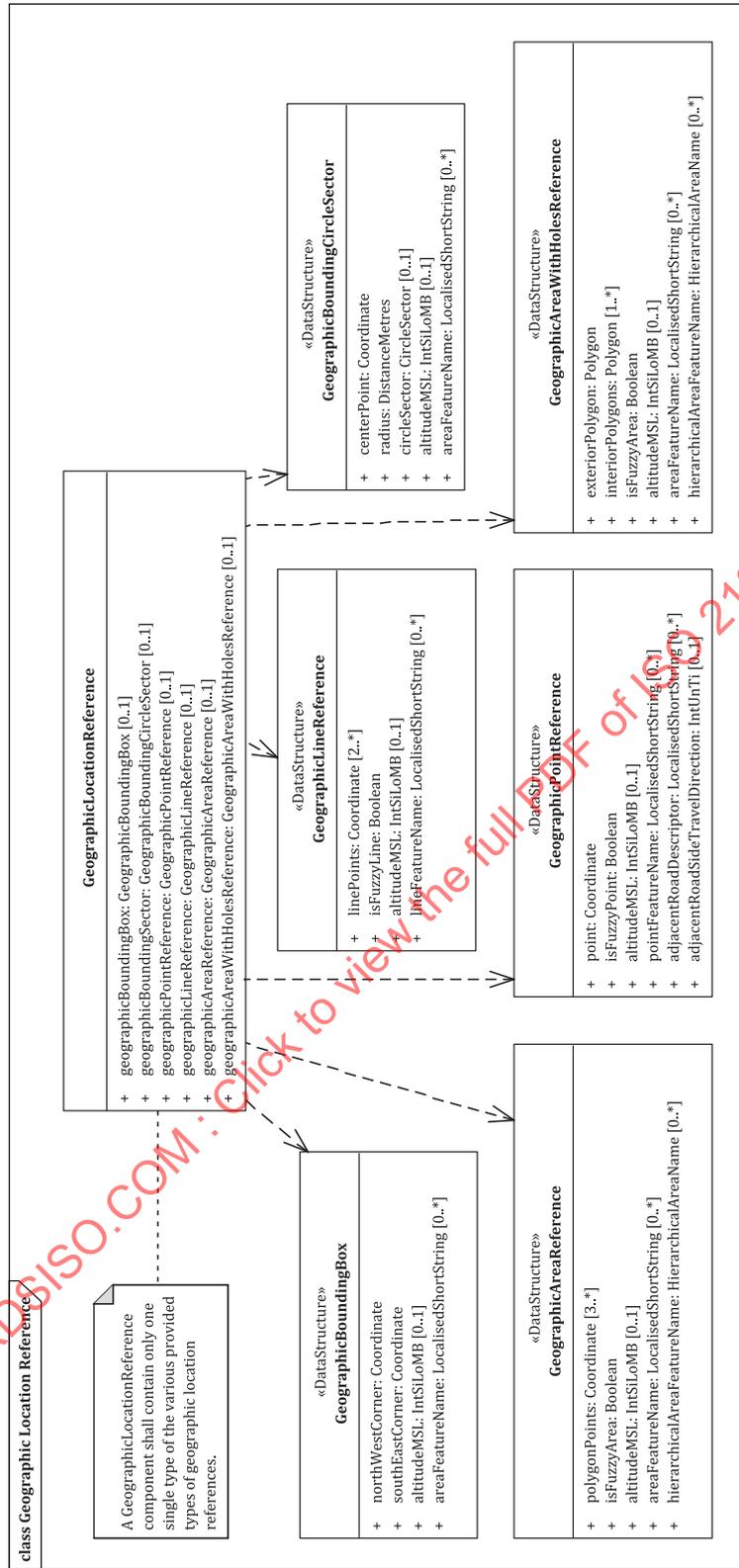
Figure 1 — GLR toolkit structure

class CircleSector

«DataStructure»
CircleSector

+   sectorStartAngle: IntUnTi
+   sectorEndAngle: IntUnTi

Figure 2 — CircleSector

class Coordinate

«DataStructure»
Coordinate

+   Longitude: IntSi24
+   Latitude: IntSi24

Figure 3 — Coordinate

class HierarchicalAreaName

«DataStructure»
HierarchicalAreaName

+   languageCode: typ001:LanguageCode
+   areaName: ShortString
+   detailAreaName: ShortString [1..*]
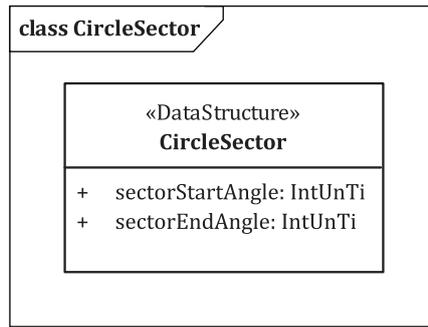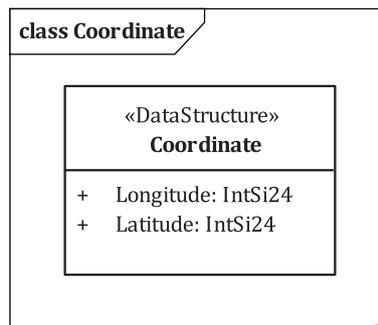
Figure 4 — HierarchicalAreaName

class Polygon

«DataStructure»
Polygon

+   polygonPoints: Coordinate [3..*]
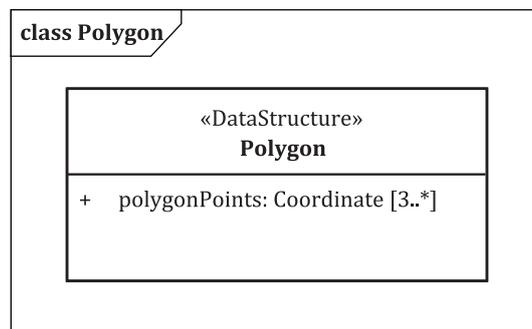
Figure 5 — Polygon

In a GLR location reference, coordinates are specified in the WGS84 geodetic system, unless explicitly signalled otherwise at service level or service component level (see also 8.8).

The GLR toolkit contains two versions of bounding areas, and point, line and area location references. Subclauses 6.2 – 6.6 explain each of these variants of geographic location references in more detail.

6.2 Geographic bounding box location reference

A geographic bounding box location reference defines a rectangular area to indicate, for example, a search area or encompassing area of a collection of features, e.g. fuel stations or other points of interest (POIs). Figure 6 shows a bounding box, with its defining north-west (NW) and south-east (SE) corners. For example, this bounding box location reference delineates the locations of a collection of fuel stations in Manhattan, NY, USA.

Key

1   NW corner

2   SE corner

Figure 6 — Example of a geographic bounding box indicating a delineating search area for a set of fuel stations

Geographic bounding box location references may indicate the altitude above mean sea level (MSL) of the area, and may have an area name as descriptor.
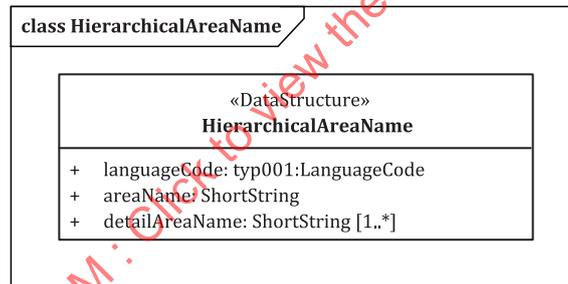
6.3 Geographic bounding circle or sector of circle location reference

A geographic bounding circle location reference is very similar in nature to the geographic bounding box location reference. The main difference is the definition of the encompassing area: in this case it is a circle rather than a rectangle. This circle is defined by a centre point and a radius (see Figure 7).

Key
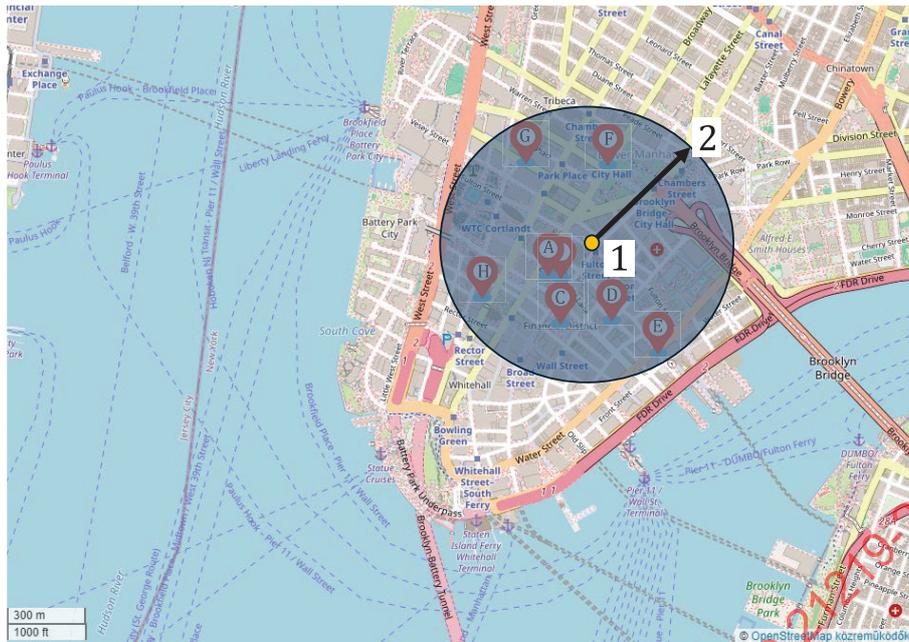
1 centre point
2 radius

Figure 7 — Example of a geographic bounding circle location reference

Geographic bounding circle location references may indicate the altitude above MSL of the area, and may have an area name as descriptor.

When geographic bounding is to be limited to only a sector of a circle with a defined radius, this is specified through two azimuth angles. These angles specify the angular start and angular end of the sector (in clockwise direction) respectively. Both these angles are measured with respect to the geographic north (see Figure 8).

Key
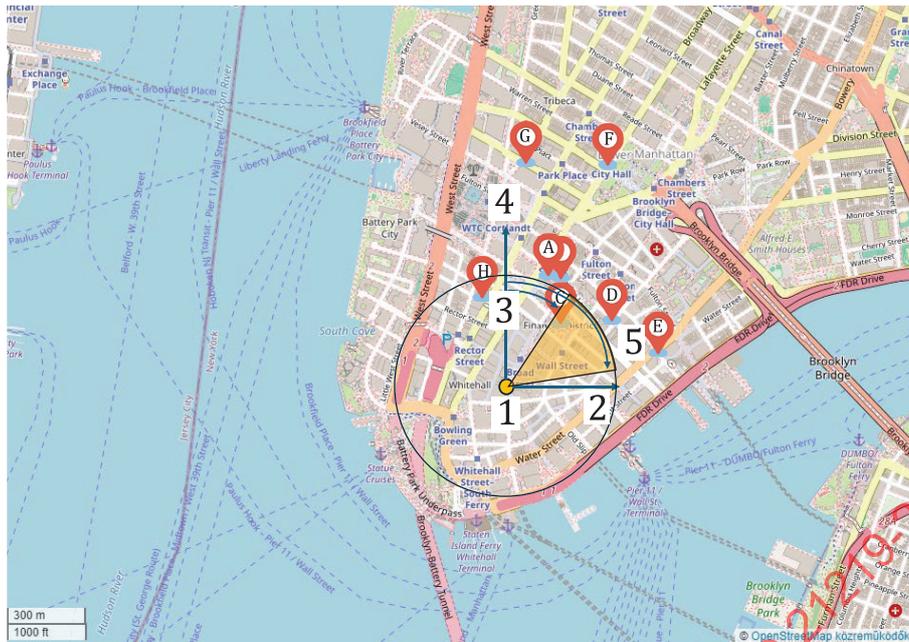
1   centre point
2   radius
3   sectorStartAngle
4   geographic north
5   sectorEndAngle

Figure 8 — Definition of a sector of a circle with sectorStartAngle and sectorEndAngle

6.4   Geographic point location reference

A geographic point location reference references the location of a point-type feature, e.g. a weather station, a theatre, or one of the individual fuel stations in Figure 6 and Figure 7. If the location is approximate, e.g. the location of a highway intersection, the location reference can indicate this through an attribute "isFuzzyPoint" (see Figure 1).

Furthermore, for geographic location references of features close to roads, the road name of the adjacent road may optionally be indicated, and optionally the direction one travels on that road, leading to the primary entry point of that feature. Geographic point location references may also optionally indicate the altitude above MSL of the area, and optionally contain a point feature name as descriptor.

6.5   Geographic line location reference

A geographic line location reference references the location of a line-type feature, e.g. a squall line or the San Andreas Fault line in California, USA. If the location is approximate (e.g. the location of a squall line), the location reference can indicate this through an attribute "isFuzzyLine" (see Figure 1).

Geographic line location references may also indicate the altitude above MSL of the area, and may have a line feature name as descriptor.
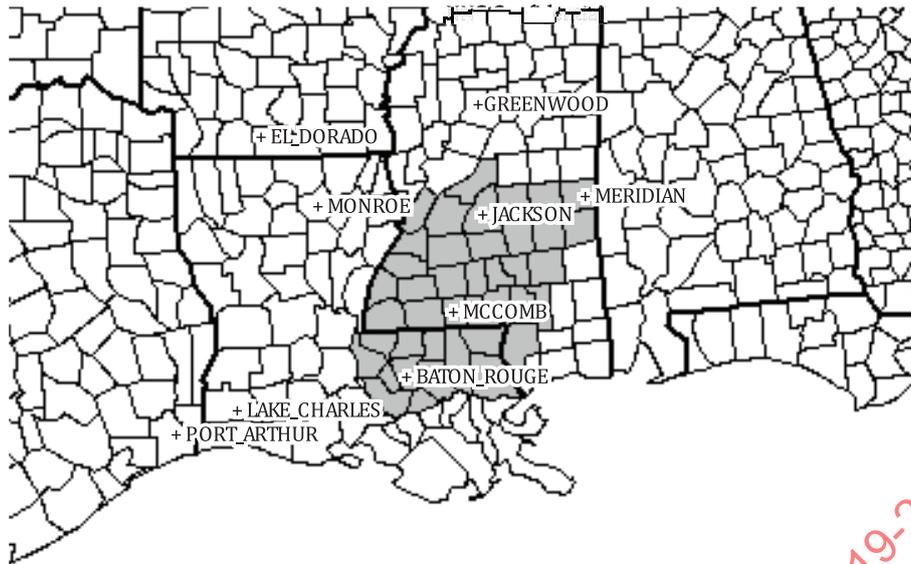
Figure 9 — Tornado watch location indication

6.6   Geographic area location reference

A geographic area location reference references the location of an area-type feature, e.g. the location of a forest fire, or a tornado warning. If the location is approximate, such as the location of a forest fire, the location reference can indicate this through an attribute "isFuzzyArea" (see Figure 1). Geographic area location references may also optionally indicate the altitude above MSL of the area.

Furthermore, geographic area location references may include an area feature name as descriptor, or one or more hierarchical area names as descriptor. Hierarchical area names are used in situations such as a weather report for a tornado watch, for example (see Figure 9).

For the tornado watch example shown in Figure 9, the hierarchical name descriptor is composed of two states (USA), Louisiana and Mississippi, and for each of these two states, the following parishes/counties, indicating the parts of that state for which the tornado watch is issued:

—   Louisiana   Ascension, East Baton Rouge, East Feliciana, Iberville, Livingston, Pointe Coupee, St. Helena, St. Tammany, Tangipahoa, Washington, West Baton Rouge, West Feliciana

—   Mississippi   Adams, Amite, Claiborne, Clarke, Copiah Covington, Forrest Franklin, Hinds, Jasper, Jefferson, Jefferson Davis, Jones, Lamar, Lauderdale, Lawrence, Lincoln, Madison, Marion, Newto, Pearl River, Pike, Rankin Scott, Simpson, Smith, Walthall, Warren, Wilkinson

In the geographic area location reference for this example tornado watch, these composite locations can be encoded with two HierarchicalAreaName data structures, one for each state.

Geographic area location references may also be indicated as polygonal shapes. These polygonal shapes may even have holes in them, e.g. to indicate an applicable area, but at the same time to exclude some part of this area. Figure 10 shows an example of an area with a "hole" in it. This area with a hole is constructed with an outer, exterior polygon, and an interior polygon representing the hole (i.e. the part of the area that is "cut-out").
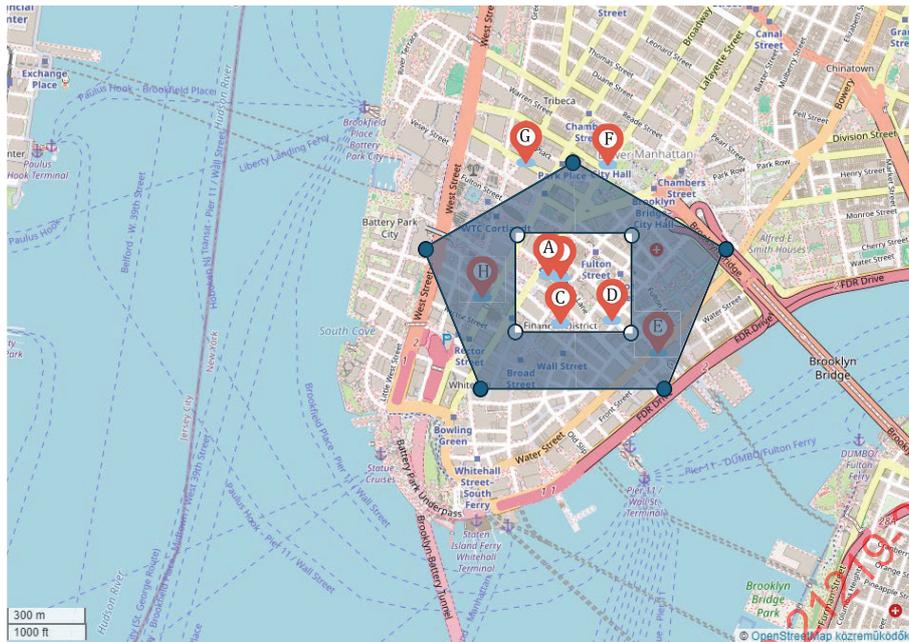
Figure 10 — Polygonal area location reference with hole inside

7 GLR toolkit components

7.1 GeographicLocationReference

GLR is the top-level toolkit component for simple geographic location references. This component shall contain only one single type of the various types of geographic location reference provided.

Table 2 defines the GeographicLocationReference component.

Table 2 — GeographicLocationReference

Name	Type	Multiplic-ity	Description
geographicBoundingBox	GeographicBoundingBox	0..1	BoundingBox-type geographic location reference.
geographicBoundingSector	GeographicBoundingCircleSector	0..1	Bounding area geographic location reference as sector of a circle or complete circle.
geographicPointReference	GeographicPointReference	0..1	Point-type geographic location reference.
geographicLineReference	GeographicLineReference	0..1	Line-type geographic location reference.
geographicAreaReference	GeographicAreaReference	0..1	Area-type geographic location reference.
geographicAreaWithHolesReference	GeographicAreaWithHolesReference	0..1	Area-type geographic location reference.

8 GLR Datatypes

8.1 GeographicAreaReference

GeographicAreReference denotes a geographic area specified as a polygon. A GeographicAreaReference shall include at most one of the attributes "areaFeatureName" and "hierarchicalAreaFeatureName", but not both.

Table 3 defines the GeographicAreaReference datatype.

Table 3 — GeographicAreaReference

Name	Type	Multiplic-ity	Description
polygonPoints	Coordinate	3..*	A sequence of points forming a closed, simple (i.e. non-self-intersecting) contour of a geographic polygon. The polygon contour is formed by line segments connecting the successive points, and finally the polygon contour is closed by the line segment connecting the last point to the first point. The resulting area polygon shall be non-self-intersecting. A counter-clockwise order of the coordinates in a (exterior) polygon is recommended. It is recommended to limit the number of points of the polygon to 32 or less.
isFuzzyArea	Boolean	1	If set, the "isFuzzyArea" attribute indicates that the polygon shape represents a fuzzy area, i.e. the polygon shape is an approximate description of the location of the referenced feature.
altitudeMSL	IntSiLoMB	0..1	Average elevation of location in metres above/below MSL.
areaFeatureName	LocalisedShortString	0..*	Feature name of the area reference in the local languages of interest.
hierarchicalAreaFeatureName	HierarchicalAreaName	0..*	Attribute to express area name(s) as hierarchical feature name. Several hierarchical area names are allowed to express a region of a number of countries, or a number of states, for example. Each such hierarchical area name structure indicates the local language of interest. Multiple hierarchical area names in a single local language may be supplied.

8.2 GeographicAreaWithHolesReference

GeographicAreaWithHolesReference denotes a geographic area with holes specified as an exterior polygon and interior polygons representing the holes. A GeographicAreaWithHolesReference shall include at most one of the attributes "areaFeatureName" and "hierarchicalAreaFeatureName", but not both.

Table 4 defines the GeographicAreaWithHolesReference datatype.

Table 4 — GeographicAreaWithHolesReference

Name	Type	Multiplic-ity	Description
exteriorPolygon	Polygon	1	Exterior polygon of the geographic area. The recommended order of the coordinates is counter-clockwise for this exterior polygon.
interiorPolygons	Polygon	1..*	Interior polygon of the geographic area, indicating a hole in the area. The recommended order of the coordinates is clockwise for the interior polygon. Interior polygons (if more than one present) shall not intersect or touch another.
isFuzzyArea	Boolean	1	If set, the "isFuzzyArea" attribute indicates that the polygon shape represents a fuzzy area, i.e. the polygon shape is an approximate description of the location of the referenced feature.
altitudeMSL	IntSiLoMB	0..1	Average elevation of location in metres above/below MSL.
areaFeatureName	LocalisedShortString	0..*	Feature name of the area reference in the local languages of interest.
hierarchicalAreaFeatureName	HierarchicalAreaName	0..*	Attribute to express area name(s) as hierarchical feature name. Several hierarchical area names are allowed to express a region of a number of countries, or a number of states, for example. Each such hierarchical area name structure indicates the local language of interest. Multiple hierarchical area names in a single local language may be supplied.

8.3 GeographicBoundingBox

GeographicBoundingBox denotes a geographic area specified as a bounding box. A bounding box area is always an approximate geometric description completely including the actual location of an area or a collection of point locations intended to be referenced.

Table 5 defines the GeographicBoundingBox datatype.

Table 5 — GeographicBoundingBox

Name	Type	Multiplic-ity	Description
northWestCorner	Coordinate	1	Coordinate of the north west corner of the bounding box enclosing the area.
southEastCorner	Coordinate	1	Coordinate of the south east corner of the bounding box enclosing the area.
altitudeMSL	IntSiLoMB	0..1	Average elevation of location in metres above/below MSL.
areaFeatureName	LocalisedShortString	0..*	(optional) Feature name of the area in the local languages of interest.

8.4 GeographicBoundingCircleSector

GeographicBoundingCircleSelector denotes a geographic bounding area specified as a complete circle or a sector of a circle. A bounding circle (or sector of a circle) area is always an approximate geometric

description, completely including the actual location of an area location or a collection of point locations intended to be referenced.

Table 6 defines the GeographicBoundingCircleSector datatype.

Table 6 — GeographicBoundingCircleSector

Name	Type	Multiplic-ity	Description
centrePoint	Coordinate	1	Coordinate of centre point of the bounding circle enclosing the area.
radius	DistanceMetres	1	Radius of the bounding circle enclosing the area.
circleSector	CircleSector	0..1	Optional attribute to limit the bounding area to only a sector of the complete circle. If this attribute is not present, the bounding area shall be taken as the complete circle.
altitudeMSL	IntSiLoMB	0..1	Average elevation of location in metres above/below MSL.
areaFeatureName	LocalisedShortString	0..*	(optional) Feature name of the area in the local languages of interest.

8.5 GeographicLineReference

GeographicLineReference denotes a geographic line specified as a polyline.

Table 7 defines the GeographicLineReference datatype.

Table 7 — GeographicLineReference

Name	Type	Multiplic-ity	Description
linePoints	Coordinate	2..*	A sequence of points forming a line. The polyline shape is formed by line segments connecting the successive points from the first point to the last point. The resulting polyline shall be non-self-intersecting. It is recommended to limit the number of points of the polyline to 32 or fewer.
isFuzzyLine	Boolean	1	If set, the "isFuzzyLine" attribute indicates that the polyline shape represents a fuzzy line, i.e. the polyline is an approximate description of the location of the referenced feature.
altitudeMSL	IntSiLoMB	0..1	Average elevation of location in metres above/below MSL.
lineFeatureName	LocalisedShortString	0..*	(optional) Feature name of the referenced line location in the local languages of interest.

8.6 GeographicPointReference

GeographicPointReference denotes a point-type geographic location reference.

Table 8 defines the GeographicPointReference datatype.

Table 8 — GeographicPointReference

Name	Type	Multiplicity	Description
point	Coordinate	1	(centre) Coordinate of the point location reference.
isFuzzyPoint	Boolean	1	If set, the "isFuzzyPoint" attribute indicates that the supplied WGS-84 coordinate represents an approximate location only.
altitudeMSL	IntSiLoMB	0..1	Elevation of location in metres above/below MSL.
pointFeatureName	LocalisedShortString	0..*	(optional) Feature name of the referenced point location in the local languages of interest.
adjacentRoadDescriptor	LocalisedShortString	0..*	(optional, if it exists) Name and/or road number of the road adjacent to the location in the local languages of interest.
adjacentRoadSideTravelDirection	IntUnTi	0..1	(optional) Approximate direction of travel for the closest side of the adjacent road (if it exists) at which the point location is located. The adjacentRoadSideTravelDirection is an azimuth angle. It is measured clockwise from geographic north, and expressed in units of 360°/256°.

8.7 CircleSector

CircleSelector denotes a data structure to specify the relevant sector of the circle.

Table 9 defines the CircleSector datatype.

Table 9 — CircleSector

Name	Type	Multiplicity	Description
sectorStartAngle	IntUnTi	1	Azimuth angle to start of circle sector of interest. The sectorStartAngle is measured clockwise from geographic north, expressed in units of 360°/256°.
sectorEndAngle	IntUnTi	1	Azimuth angle to end of circle sector of interest. The sectorEndAngle is measured clockwise from geographic north, expressed in units of 360°/256°.

8.8 Coordinate

Coordinate denotes a data structure specifying geographic coordinates. Coordinates are specified by default in the WGS-84 geodetic system, unless explicitly signalled otherwise at service level or service component level.

Table 10 defines the Coordinate datatype.

Table 10 — Coordinate

Name	Type	Multiplic-ity	Description
Longitude	IntSi24	1	Longitude in standard 24 bit accuracy stores coordinates in order of magnitude of 10 micro degrees resolution (five decimals). Longitude-in-degrees (longitude in unit degrees) is encoded as follows: $$longitude = int\big(sign(\text{longitude-in-degrees}) * 0{,}5 \\ + \big(\text{longitude-in-degrees} * 2^{24}\big) / 360\big)$$
Latitude	IntSi24	1	Latitude in standard 24 bit accuracy stores coordinates in order of magnitude of 10 micro degrees resolution (five decimals). Latitude-in-degrees (latitude in unit degrees) is encoded as follows: $$latitude = int\big(sign(\text{latitude-in-degrees}) * 0{,}5 \\ + \big(\text{latitude-in-degrees} * 2^{24}\big) / 360\big)$$

8.9 HierarchicalAreaName

HierarchicalAreaName denotes a data structure to specify an area as a collection of smaller areas as part of a larger area. Typical usage would be to specify a province or state as the larger administrative area, and the counties as the smaller administrative areas.

The supplied languageCode indicates the relevant local language for both the areaName as the detailedAreaNames supplied.

In certain applications (e.g. weather alerts) affected areas may be specified as such hierarchical areas.

Table 11 defines the HierarchicalAreaName datatype.

Table 11 — HierarchicalAreaName

Name	Type	Multiplic-ity	Description
languageCode	typ001:LanguageCode	1	Specifies the local language used for the names making up the hierarchical area name.
areaName	ShortString	1	Overall feature name of the area reference.
detailAreaName	ShortString	1..*	One or more detailed area name(s) of the area reference.

8.10 Polygon

A sequence of points forming a closed, simple (i.e. non-self-intersecting) exterior or interior contour of a geographic polygon. The polygon contour is formed by line segments connecting the successive points, and finally the polygon contour is closed by the line segment connecting the last point to the first point.

The resulting area polygon shall be non-self-intersecting.

Table 12 defines the Polygon datatype.

Table 12 — Polygon

Name	Type	Multiplic-ity	Description
polygonPoints	Coordinate	3..*	A sequence of points forming a closed, simple (i.e. non-self-intersecting) contour of a geographic polygon. The polygon contour is formed by line segments connecting the successive points, and finally the polygon contour is closed by the line segment connecting the last point to the first point. The resulting area polygon shall be non-self-intersecting.

Annex A
(normative)

TPEG application, TPEG-binary representation

A.1 Message components

A.1.1 List of generic component IDs

Table A.1 lists the generic component IDs.

Table A.1 — List of generic component IDs

Name	Id
GeographicLocationReference	X (this ID is assigned in the TPEG location referencing container)

A.1.2 GeographicLocationReference

Table A.2 shows the binary representation of the GeographicLocationReference structure.

Table A.2 — Binary representation of GeographicLocationReference structure

<GeographicLocationReference(x)>:=	
<IntUnTi>(x),	ID of this component
<IntUnLoMB>(lengthComp),	Number of bytes in component, excluding the ID and lengthComp indicator
<IntUnLoMB>(lengthAttr),	Number of bytes in attributes
BitArray(selector),	
if (bit 0 of selector is set)	
<GeographicBoundingBox>(geographicBoundingBox),	BoundingBox-type geographic location reference.
if (bit 1 of selector is set)	
<GeographicBoundingCircleSector>(geographicBoundingSector),	Bounding area geographic location reference as sector of a circle or complete circle.
if (bit 2 of selector is set)	
<GeographicPointReference>(geographicPointReference),	Point-type geographic location reference.
if (bit 3 of selector is set)	
<GeographicLineReference>(geographicLineReference),	Line-type geographic location reference.
if (bit 4 of selector is set)	
<GeographicAreaReference>(geographicAreaReference),	Area-type geographic location reference.
if (bit 5 of selector is set)	
<GeographicAreaWithHolesReference>(geographicAreaWith-HolesReference);	Area-type geographic location reference.

A.2 GLR Datatypes

A.2.1 GeographicAreaReference

[Table A.3](#) shows the binary representation of the GeographicAreaReference structure.

Table A.3 — Binary representation of GeographicAreaReference structure

<GeographicAreaReference>:=	
<IntUnLoMB>(n),	$\{3 \leq n \leq *\}$
n ***<Coordinate>**(polygonPoints),	A sequence of points forming a closed, simple (i.e. non-self intersecting) contour of a geographic polygon. The polygon contour is formed by line segments connecting the successive points, and finally the polygon contour is closed by the line segment connecting the last point to the first point. The resulting area polygon shall be non-self intersecting. A counter-clockwise order of the coordinates in a (exterior) polygon is recommended. It is recommended to limit the number of points of the polygon to 32 or less.
BitArray(selector),	
if (bit 0 of selector is set)	
<Boolean>(isFuzzyArea),	If set, the "isFuzzyArea" attribute indicates that the polygon shape represents a fuzzy area, i.e. the polygon shape is an approximate description of the location of the referenced feature.
if (bit 1 of selector is set)	
<IntSiLoMB>(altitudeMSL),	Average elevation of location in metres above/below MSL.
if (bit 2 of selector is set)	
{	
<IntUnLoMB>(n),	
n ***<LocalisedShortString>**(areaFeatureName),	Feature name of the area reference in the local languages of interest.
}	
if (bit 3 of selector is set)	
{	
<IntUnLoMB>(n),	
n ***<HierarchicalAreaName>**(hierarchicalAreaFeatureName)	Attribute to express area name(s) as hierarchical feature name. Several hierarchical area names are allowed to express e.g. a region of a number of countries, or a number of states. Each such hierarchical area name structure indicates the local language of interest. Multiple hierarchical area names in a single local language may be supplied.
};	

A.2.2 GeographicAreaWithHolesReference

[Table A.4](#) shows the binary representation of the GeographicAreaWithHolesReference structure.

Table A.4 — Binary representation of GeographicAreaWithHolesReference structure

<GeographicAreaWithHolesReference>:=	
<Polygon>(exteriorPolygon),	Exterior polygon of the geographic area. The recommended order of the coordinates is counter-clockwise for this exterior polygon.
<IntUnLoMB>(n),	
n ***<Polygon>**(interiorPolygons),	Interior polygon of the geographic area, indicating a hole in the area. The recommended order of the coordinates is clockwise for the interior polygon. Interior polygons (if more than one present) shall not intersect or touch another.
BitArray(selector),	
if (bit 0 of selector is set)	
<Boolean>(isFuzzyArea),	If set, the "isFuzzyArea" attribute indicates that the polygon shape represents a fuzzy area, i.e. the polygon shape is an approximate description of the location of the referenced feature.
if (bit 1 of selector is set)	
<IntSiLoMB>(altitudeMSL),	Average elevation of location in metres above/below MSL.
if (bit 2 of selector is set)	
{	
<IntUnLoMB>(n),	
n ***<LocalisedShortString>**(areaFeatureName),	Feature name of the area reference in the local languages of interest.
}	
if (bit 3 of selector is set)	
{	
<IntUnLoMB>(n),	
n ***<HierarchicalAreaName>**(hierarchicalAreaFeatureName)	Attribute to express area name(s) as hierarchical feature name. Several hierarchical area names are allowed to express e.g. a region of a number of countries, or a number of states. Each such hierarchical area name structure indicates the local language of interest. Multiple hierarchical area names in a single local language may be supplied.
};	

A.2.3 GeographicBoundingBox

Table A.5 shows the binary representation of the GeographicBoundingBox structure.

Table A.5 — Binary representation of GeographicBoundingBox structure

<GeographicBoundingBox>:=	
<Coordinate>(northWestCorner),	Coordinate of the north west corner of the bounding box enclosing the area.
<Coordinate>(southEastCorner),	Coordinate of the south east corner of the bounding box enclosing the area.
BitArray(selector),	
if (bit 0 of selector is set)	
<IntSiLoMB>(altitudeMSL),	Average elevation of location in metres above/below MSL.
if (bit 1 of selector is set)	
{	

Table A.5 *(continued)*

<IntUnLoMB>(n),	
n ***<LocalisedShortString>**(areaFeatureName)	(optional) Feature name of the area in the local languages of interest.
};	

A.2.4 GeographicBoundingCircleSector

Table A.6 shows the binary representation of the GeographicBoundingCircleSector structure.

Table A.6 — Binary representation of GeographicBoundingCircleSector structure

<GeographicBoundingCircleSector>:=	
<Coordinate>(centrePoint),	Coordinate of centre point of the bounding circle enclosing the area.
<DistanceMetres>(radius),	Radius of the bounding circle enclosing the area.
BitArray(selector),	
if (bit 0 of selector is set)	
<CircleSector>(circleSector),	Optional attribute to limit bounding area to only a sector of the complete circle. If this attribute is not present, the bounding area shall be taken as the complete circle.
if (bit 1 of selector is set)	
<IntSiLoMB>(altitudeMSL),	Average elevation of location in metres above/below MSL.
if (bit 2 of selector is set)	
{	
<IntUnLoMB>(n),	
n ***<LocalisedShortString>**(areaFeatureName)	(optional) Feature name of the area in the local languages of interest.
};	

A.2.5 GeographicLineReference

Table A.7 shows the binary representation of the GeographicLineReference structure.

Table A.7 — Binary representation of GeographicLineReference structure

<GeographicLineReference>:=	
<IntUnLoMB>(n),	$\{ 2 \le n \le * \}$
n ***<Coordinate>**(linePoints),	A sequence of points forming a line. The polyline shape is formed by line segments connecting the successive points from the first point to the last point. The resulting polyline shall be non-self-intersecting. It is recommended to limit the number of points of the polyline to 32 or fewer.
BitArray(selector),	
if (bit 0 of selector is set)	
<Boolean>(isFuzzyLine),	If set, the "isFuzzyLine" attribute indicates that the polyline shape represents a fuzzy line, i.e. the polyline is an approximate description of the location of the referenced feature.
if (bit 1 of selector is set)	
<IntSiLoMB>(altitudeMSL),	Average elevation of location in metres above/below MSL.
if (bit 2 of selector is set)	

Table A.7 *(continued)*

{	
<IntUnLoMB>(n),	
n *<**LocalisedShortString**>(lineFeatureName)	(optional) Feature name of the referenced line location in the local languages of interest.
};	

A.2.6 GeographicPointReference

Table A.8 shows the binary representation of the GeographicPointReference structure.

Table A.8 — Binary representation of GeographicPointReference structure

<GeographicPointReference>:=	
<Coordinate>(point),	(centre) Coordinate of the point location reference.
BitArray(selector),	
if (bit 0 of selector is set)	
<Boolean>(isFuzzyPoint),	If set, the "isFuzzyPoint" attribute indicates that the supplied WGS-84 coordinate represents an approximate location only.
if (bit 1 of selector is set)	
<IntSiLoMB>(altitudeMSL),	Elevation of location in metres above/below MSL.
if (bit 2 of selector is set)	
{	
<IntUnLoMB>(n),	
n *<**LocalisedShortString**>(pointFeatureName),	(optional) Feature name of the referenced point location in the local languages of interest.
}	
if (bit 3 of selector is set)	
{	
<IntUnLoMB>(n),	
n *<**LocalisedShortString**>(adjacentRoadDescriptor),	(optional, if it exists) Name and/or road number of the road adjacent to the location in the local languages of interest.
}	
if (bit 4 of selector is set)	
<IntUnTi>(adjacentRoadSideTravelDirection);	(optional) Approximate direction of travel for the closest side of the adjacent road (if it exists) at which the point location is located. The adjacentRoadSideTravelDirection is an azimuth angle. It is measured clockwise from geographic north, and expressed as 360°/256°.

A.2.7 CircleSector

Table A.9 shows the binary representation of the CircleSector structure.

Table A.9 — Binary representation of CircleSector structure

<CircleSector>:=	
<IntUnTi>(sectorStartAngle),	Azimuth angle to start of circle sector of interest. The sectorStartAngle is measured clockwise from geographic north, expressed in units of 360°/256°.
<IntUnTi>(sectorEndAngle);	Azimuth angle to end of circle sector of interest. The sectorEndAngle is measured clockwise from geographic north, expressed in units of 360°/256°.

A.2.8 Coordinate

Table A.10 shows the binary representation of the Coordinate structure.

Table A.10 — Binary representation of Coordinate structure

<Coordinate>:=	
<IntSi24>(Longitude),	Longitude in standard 24 bit accuracy stores coordinates in order of magnitude of 10 micro degrees resolution (five decimals). Longitude-in-degrees (longitude in unit degrees) is encoded as follows: $$longitude = int\left(sign(\text{longitude-in-degrees})*0,5 \right.$$ $$\left. +\left(\text{longitude-in-degrees}*2^{24}\right)/360\right)$$
<IntSi24>(Latitude);	Latitude in standard 24 bit accuracy stores coordinates in order of magnitude of 10 micro degrees resolution (five decimals). Latitude-in-degrees (latitude in unit degrees) is encoded as follows: $$latitude = int\left(sign(\text{latitude-in-degrees})*0,5 \right.$$ $$\left. +\left(\text{latitude-in-degrees}*2^{24}\right)/360\right)$$

A.2.9 HierarchicalAreaName

Table A.11 shows the binary representation of the HierarchicalAreaName structure.

Table A.11 — Binary representation of HierarchicalAreaName structure

<HierarchicalAreaName>:=	
<typ001:LanguageCode>(languageCode),	Specifies the local language used for the names making up the hierarchical area name.
<ShortString>(areaName),	Overall feature name of the area reference.
<IntUnLoMB>(n),	
n ***<ShortString>**(detailAreaName);	One or more detailed area name(s) of the area reference.

A.2.10 Polygon

Table A.12 shows the binary representation of the Polygon structure.

Table A.12 — Binary representation of Polygon structure

<Polygon>:=	
<IntUnLoMB>(n),	$\{3 \leq n \leq *\}$
n *<**Coordinate**>(polygonPoints);	A sequence of points forming a closed, simple (i.e. non-self-intersecting) contour of a geographic polygon. The polygon contour is formed by line segments connecting the successive points, and finally the polygon contour is closed by the line segment connecting the last point to the first point. The resulting area polygon shall be non-self-intersecting.