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# Intelligent transport systems — Mobility integration — 'Controlled zone' management for urban vehicle access restrictions (UVARs) using C-ITS

*Systèmes de transport intelligents — ITS urbains — Gestion de "zones contrôlées" pour les UVAR à l'aide de C-ITS*



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# Foreword

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

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

This document is part of a set of standards from ISO/TC 204 related to ITS Mobility Integration/Urban ITS (U-ITS). It provides an internationalized, version of CEN/TS 17380 for management of vehicles in a "Controlled Zone" (CZ). It is primarily designed for urban vehicle access restrictions (although it is also appropriate for similar restriction control in any road system context). Its technical provisions are interoperable with CEN/TS 17380. This document aims to complement CEN/TS 16157-11.

A CZ is a geographically contained physical area for which access restriction conditions are applicable for all or some categories of vehicle or user, at all or specified times.

Management of traffic in a CZ is important for the following reasons, amongst others.

— As cities and urban complexes expand, and the significant trend of movement from rural areas to cities continues around the world, pollution and congestion in these urban areas is becoming an increasingly significant problem. Traffic, i.e. vehicle movements within the urban complex, is a source of pollution.

NOTE Other causes of pollution include air conditioning, central heating systems, coal and wood burning heating, factories, etc.

— Jurisdictions can wish to control certain issues, such as movement of vehicles in cities producing traffic congestion and overcrowding on public transport at peak periods, as this can enable better management of traffic flow.

A CZ, also referred to as an "Urban Vehicle Access Restriction" (UVAR) zone, is a zone of enactment of one or more traffic restrictions to adhere to a permanent or temporary regulation applicable in a defined geographical area. These restrictions are frequently referred to as "Urban Vehicle Access Regulations".

It is recognized that different jurisdictions will design and introduce their own CZ paradigms of different method and construct. However, regardless of the goal to be achieved or the political objective, the basic technical requirements for managing road traffic in a CZ are similar, and the basic methodologies are the same.

The methodology specified in this document is often referred to as "geofencing", i.e. the creation of a virtual geographic boundary.

Management of CZs can be achieved using data frames from the data dictionary (CZDD) specified in this document, and data frames contained in the in-vehicle information (IVI) data dictionary specified in ISO/TS 19321. Data frames specified in this document and in ISO/TS 19321 constitute Application Data Units.

While the CZDD is dedicated to CZs, the IVI data dictionary is of a general nature. There is no strict one-to-one mapping between the CZDD data frames and the data frames from the IVI data dictionary related to CZ.

This document identifies two possible methods for transmitting CZ data frames:

1) a method based on the general CZ message being part of the general TMS message set (see the concept of ITS messages and ITS message sets specified in ISO 17419, which does not require a specific communications technology);

2) the IVI message method, which is specified in ETSI TS 103 301.

# Intelligent transport systems — Mobility integration — 'Controlled zone' management for urban vehicle access restrictions (UVARs) using C-ITS

## 1 Scope

This document provides information and specifications on the management of road traffic in controlled zones (CZ) through the application of geofencing. Specifically, this document specifies a "Controlled Zone Data Dictionary" (CZDD) for management of controlled zones, and provides an extendible toolkit that regulators can use, for example, to inform potential CZ users (e.g. vehicles) about:

— the CZ area, i.e. the geographical boundaries of the CZ;

— CZ access conditions including exemptions;

— time windows indicating when these CZ access conditions are applicable.

This allows potential CZ users to select an appropriate routing, either by pre-trip planning or ad hoc re-routing.

This document also provides illustrations and guidelines on how to use this toolkit.

The toolkit is designed in accordance with the general ITS station and communications architecture specified in ISO 21217, and with optionally applicable C-ITS protocols and procedures, e.g. ISO 22418 on "Service Announcement", ISO 18750 on the "Local Dynamic Map", and ISO 17419 on globally unique identifiers. Cybersecurity provision can be provided through conformance to ISO 21177.

Enforcement is out of scope of this document.



## 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 17419, *Intelligent transport systems — Cooperative systems — Globally unique identification*

ISO 18750, *Intelligent transport systems — Co-operative ITS — Local dynamic map*

ISO/TS 19321, *Intelligent transport systems — Cooperative ITS — Dictionary of in-vehicle information (IVI) data structures*

ISO 21177, *Intelligent transport systems — ITS station security services for secure session establishment and authentication between trusted devices*

ETSI TS 103 301, *Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Facilities layer protocols and communication requirements for infrastructure services*

ETSI TS 103 097 V2.1.1, *(2021-10), Intelligent Transport Systems (ITS); Security; Security header and certificate formats; Release 2*

## 3 Terms and definitions

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

ISO and IEC maintain terminological 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**
**controlled zone**
**CZ**
area for which access conditions are applicable

**3.2**
**CZ area**
**controlled zone area**
geographical location of a *controlled zone (CZ)* (3.1) in terms of precisely defined boundaries

Note 1 to entry: In the context of this document, a CZ area is not necessarily a two-dimensional area, but may be a location identified with any kind of location referencing method (linear, two-dimensional, three-dimensional).

**3.3**
**CZ user**
**controlled zone user**
physical entity, typically a vehicle, that intends operating in a *CZ* (3.1) or is already operated in a CZ

**3.4**
**geofencing**
creation of a virtual geographic boundary by applying information and communication technologies such as those specified for intelligent transport systems (ITS)

**3.5**
**in-vehicle system**
**IVS**
ITS-station unit or a navigation device or mobile phone application used in a vehicle which is capable of handling the control zone system transactions



## 4 Symbols and abbreviations

| | |
|---|---|
| C-ITS | cooperative ITS |
| CZM | controlled zone manager |
| ITS | intelligent transport systems |
| ITS-SU | ITS station unit |
| IVI | in-vehicle information |
| U-ITS | ITS mobility integration / urban ITS |
| UVAR | urban vehicle access restrictions |

## 5 Management of controlled zones

### 5.1 General

Central management of traffic flows in a “Controlled Zone” (CZ) is complex, and to date has proven difficult. Technically, it may involve downloading data to an “In-Vehicle System” (IVS), for example, an ITS station unit (ITS-SU; as specified in ISO 21217) or a navigation device. Alternatively, it may be undertaken by control of traffic signals (for example in a ferry: boarding and customs-controlled zone). It may also be a combination

of these. Real world implementation widely uses traffic control devices such as road traffic signs and road markings to identify controlled zones.

Controlling access to urban zones, i.e. applying respective access restrictions, is also referred to as “Urban Vehicle Access Restriction” (UVAR).

## 5.2 CZ manager

In order to identify a CZ and to achieve control of it, an authority, i.e. an entity or body or person, has to manage the CZ. Within this document, that role is called the “Controlled Zone Manager”. In administrative terms, there are many ways this can be instantiated. This is a matter of local policy, and not determined in this document.

Every CZ created by a CZ manager shall be globally uniquely identified by a CZ identifier. This document specifies the CZ identifier as a universal object identifier (OID). The IVI data dictionary specified in ISO/TS 19321 uses a Service Provider ID for this purpose; this Service Provider ID is specified in ISO 14816.

NOTE 1 A service provider identified by a Service Provider ID can also have an OID.

NOTE 2 Organizations acting as a CZ manager identified by an OID are responsible for creating subsequent branches of the organization themselves (for example, branches which are used for CZ purposes). This enables the creation of globally unique CZ identifiers without the need for creating a respective registration authority.

The CZ manager is in charge of disseminating information on the existence of its CZs and the related CZ access conditions, such that potential road users are informed in due time about restrictions to access CZ areas.

## 5.3 Controlled zone



A CZ is defined as a physical location which has restricted access defined by CZ access conditions (see 5.4) and optional CZ exemptions (see 5.5), including information on timely validity. The location of a CZ, i.e. the CZ area, may be defined quite differently, for example:

— as a linear location, e.g. a street identified by the street name;

— as a contiguous two-dimensional area, optionally with “holes”;

— as a contiguous three-dimensional space, optionally with “holes”;

— as a set of non-overlapping contiguous locations / areas / spaces with or without “holes”;

— as one or several identified streets or segments thereof;

— as a complete city;

— as any other reasonable definition.

However, once the definition of a CZ area changes, the previously valid CZ identifier shall become invalid, and a new CZ identifier shall be assigned.

The boundary of a CZ shall be designed such that it is outside of the CZ area.

If the boundary is given by a closed polygon, the inner area of the polygon, i.e. the area of the CZ, shall be defined by the vertices of the polygon in ascending order such that the inner area is to the right of the edges of the polygon.

NOTE 1 A closed polygon is a plane figure that is described by a finite number *N* of straight-line segments connected to form a closed polygonal chain. The segments of a polygonal circuit are called its edges. The points where two edges meet are the polygon's vertices. The vertice given by the start point of the first segment is identical with the vertice given by the end point of the last (*N*-th) segment. A closed polygon defines two areas, i.e. an inner area and an outer area.

NOTE 2 The examples used in this document are provided as examples of how CZs can be applied and do not represent accurate representations of current regulations in place at the time of the publication of this document.

EXAMPLE The centre of the city of Ulm in Germany is surrounded by streets and segments of streets, see Figure 1. The boundary of the CZ "centre of the city of Ulm" is given by (1) Bahnhofsplatz, (2) segment of Olgastrasse between Bahnhofsplatz and Salzstadelgasse, (3) segment of Salzstadelgasse between Olgastrasse and car park "Salzstadel", (4) segment of Olgastrasse between Salzstadelgasse and Frauenstrasse, (5) segment of Frauenstrasse between Olgastrasse and Neue Strasse, (6) segment of Neue Strasse between Frauenstrasse and Friedrich-EbertStrasse, (7) segment of Friedrich-Ebert-Strasse between Neue Strasse and Bahnhofsplatz. CZ users, regardless of the given CZ access conditions, are allowed to use these streets that define the CZ boundary. This enables access to the car parks located at the boundary of this CZ, e.g. from "Olgastraße" following "Salzstadelgasse" up to "Museum der Brotkultur", below which the car park "Salzstadel" is located.


**Figure 1 — Example of CZ "centre of the city of Ulm"**



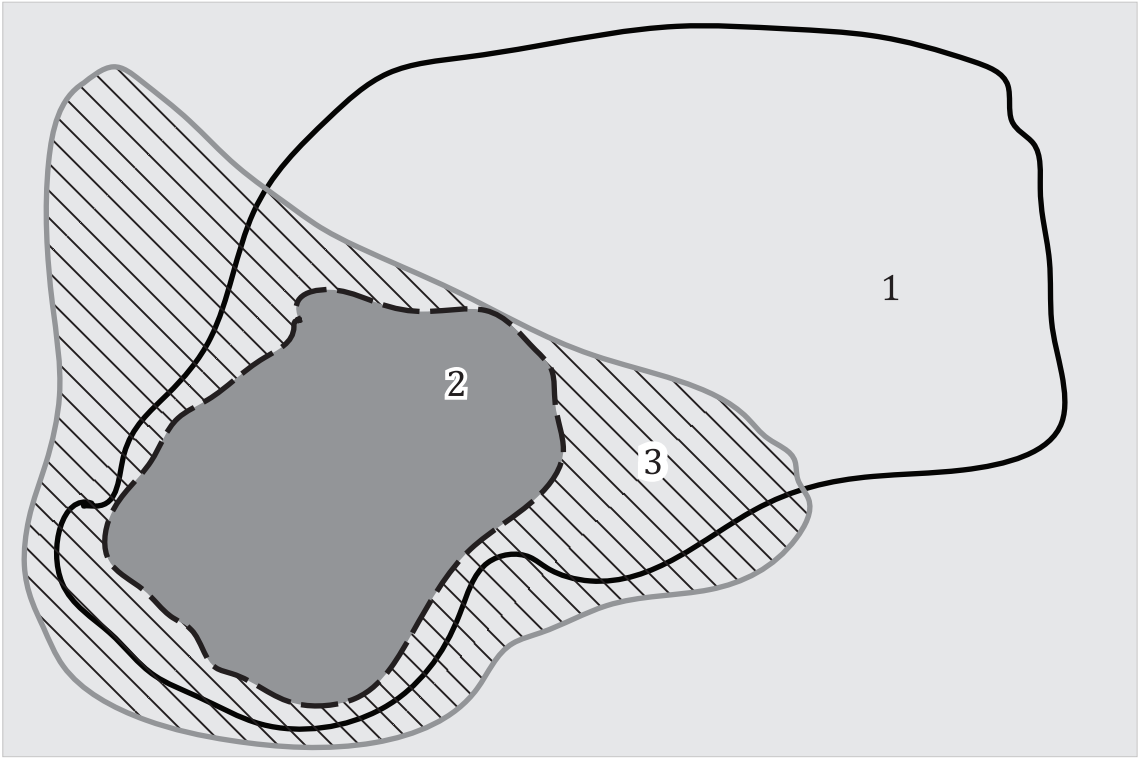
CZs may be:

— located adjacent to each other,

— overlapping with other CZs for other control purposes; thus, multiple CZs can exist in the same physical geographical location.

Exemptions can be applicable for explicitly identified CZ users or CZ user groups, i.e. for preferred CZ users (see 5.5).

Figure 2 provides an example of three different and overlapping CZs in a city.




**Key**

1 diesel engine control zone

2 zero emissions zone

3 3,5 metre height / 7,5 tonne weight limit zone



**Figure 2 — Co-located control zones**

Figure 2 shows a geographical area with three CZs.



— The first, and largest, in this example, is a “diesel engine control zone”, where there is a ban on the use of diesels prior to Euro Class 5, and time-of-day limitations on the use of any diesel.

— The second CZ is a “vehicle size-controlled zone” that covers an area both inside and outside of the “diesel engine control zone” (but not all of the “diesel engine control zone”) and prohibits both tall and heavy or wide vehicle traffic because of narrow roads and low bridges.

— The third CZ is a “zero tailpipe emission zone” in the historic city centre and its main shopping street. It is located entirely within the two other CZs and controls on the single parameter of zero tailpipe emissions.

In this example, the “diesel engine control zone” covers multiple factors in respect of diesel vehicles. The “vehicle size-controlled zone” covers height, weight, and width restriction in a common zone that is partly within and partly outside the “diesel engine control zone” (overlapping CZs). In case of overlapping CZs, within an overlap area the access restrictions of all overlapping CZs shall apply.

The CZ user thus has to evaluate up to three sets of CZ access conditions (see 5.3) for up to three CZs. The result will be the granted access conditions.

This document does not impose any design requirements on CZ managers. Thus, CZ managers have the free choice on how to define CZs and the related CZ access conditions, e.g. whether they define a new CZ per CZ access condition, or whether they define several CZ access conditions per CZ, if applicable. With reference to the example in Figure 2, instead of defining three overlapping CZs, the CZ manager can also specify four CZs:

1) diesel engine CZ access condition (black-only);

2) height and weight CZ access condition (blue-only);