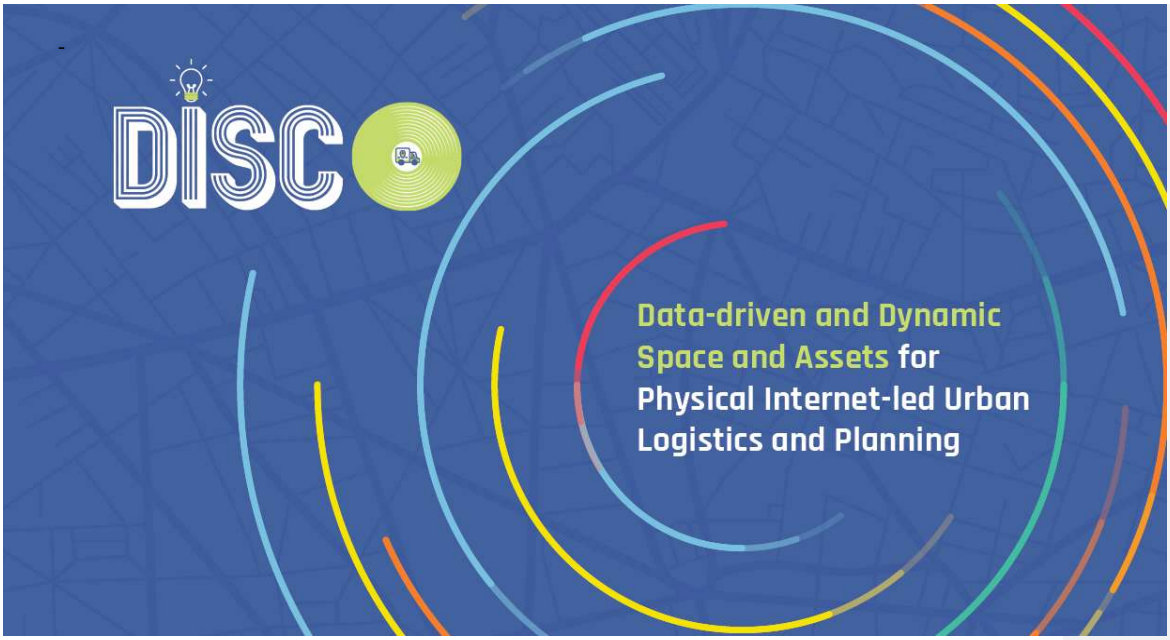

DATA MODEL CONVERSION GUIDE: APDS & DATEX II

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April 2025

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Abstract

Data-level interoperability plays a vital role in a data space, and leveraging standard data models significantly simplifies this process. As a first proof-of-concept, this document shows how the DISCO project incorporates the APDS and DATEX II standards.

APDS (Alliance for Parking Data Standards) is an international standard designed to establish a common language for sharing parking data. It aims to promote interoperability between parking systems and services, enabling seamless data exchange across various regions and platforms.

DATEX II, on the other hand, is Europe's most widely adopted standard for road situations and traffic regulations. It provides a structured framework for sharing information related to traffic management, road conditions, and regulations, ensuring consistency and compatibility across European transportation systems.

This document outlines mapping data from its sources to these two standards. It provides an overview of the APDS and DATEX II standards, detailing their structure and practical applications. Furthermore, it includes specific data mapping examples from the city of Ghent, demonstrating how real-world data can be transformed to comply with these standards. For an in-depth explanation of the ETL (Extract, Transform, Load) technical implementation, including insights into the code and workflows used for this mapping within the framework of the Smart Data Platform, please refer to the DISCOLLECTION Design and Architecture Documentation.

Commented [CV1]: Abstract should be extended with a bit of information on what this document will actually do, i.e. provide more detail about these standards, provide data mapping examples from the city of Ghent, provide insight in the code used to make this mapping within Dagster

Commented [XD1R2]: Ok, modified, thanks! @Casper Van Gheluwe (imec)

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Document history

Version	Date	Organisation	Main area of changes	Comments
0.9	10 April 2025	imec		First version
1.0	22 April 2025	imec	Further fill out examples and some spelling changes	

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List of acronyms

EPA	European Parking Association
API	Application Programming Interface
APDS	Alliance for Parking Data Standards
DATEX II	DAta EXchange second version
EPA	European Parking Association
ETL	Extract, Transform, Load
UVAR	Urban Vehicle Access Regulation
XML	eXtensible Markup Language

Commented [CV2]: Sort this table alphabetically once it is complete :)

Commented [XD2R2]: Done

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1. APDS

To follow a standard for parking spaces data format, the Alliance for Parking Data Standards (APDS)[1] was chosen. It follows a strict API specification interface documented in an Open API document[2]. For more detailed info on the specification, we refer the reader to the ADPS specs folder on their GitHub repository[3].

1.1. Mapping to APDS

Matching the data to the APDS `Places` schema is crucial. Below is an example of how a single record from the city of Ghent's car parking data is mapped into the APDS following format (excluding null values):


```
{
  "name": "Vrijdagmarkt",
  "lastupdate": "2024-07-30T10:00:31+02:00",
  "totalcapacity": 593,
  "availablecapacity": 452,
  "occupation": 23,
  "type": "carPark",
  "description": "Ondergrondse parkeergarage Vrijdagmarkt in Gent",
  "id": "https://stad.gent/nl/mobiliteit-openbare-werken/parkeren/parkings-gent/parking-
vrijdagmarkt",
  "openingtimesdescription": "24/7",
  "isopennow": 1,
  "temporaryclosed": 0,
  "operatorinformation": "Mobiliteitsbedrijf Gent",
  "freeparking": 0,
  "urllinkaddress": "https://stad.gent/nl/mobiliteit-openbare-werken/parkeren/parkings-gent/parking-
vrijdagmarkt",
  "occupancytrend": "unknown",
  "locationanddimension": {
    "specificAccessInformation": ["inrit"],
    "level": "0",
    "roadNumber": "?",
    "roadName": "Vrijdagmarkt 1\n9000 Gent",
    "contactDetailsTelephoneNumber": "Tel.: 09 266 29 00\n(permanentie)\nTel.: 09 266 29
01\n(tijdens kantooruren)",
    "coordinatesForDisplay": {
      "latitude": 51.05713405953412,
      "longitude": 3.726071777876147
    }
  },
  "location": {
    "lon": 3.726071777876147,
    "lat": 51.05713405953412
  },
  "text": null,
```


[1] https://www.allianceforparkingdatastandards.org/
[2] https://github.com/parkingdata/spec/blob/master/api/reference/APDS_API.yaml
[3] https://github.com/parkingdata/spec/tree/master/specs

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```
  "categorie": "parking in LEZ",
  "dashboard": "True"
}

{
  "id": "https://stad.gent/nl/mobiliteit-openbare-werken/parkeren/parkings-gent/parking-
vrijdagmarkt",
  "version": 1,
  "name": [{
      "language": "en",
      "string": "Vrijdagmarkt"
    }],
  "description": [{
      "language": "en",
      "string": "Ondergrondse parkeergarage Vrijdagmarkt in Gent"
    }],
  "layer": 0,
  "type": "parkingPlace",
  "aliases": [[{
        "language": "en",
        "string": "parking in LEZ"
      }]],
  "operatorDefinedReference": [{
      "language": "en",
      "string": "Mobiliteitsbedrijf Gent"
    }],
  "hierarchyElementRecord": {
    "creationTime": "1970-01-01T00:00:00Z"
  },
  "hierarchyElementReference": {
    "elementId": {
      "id": "https://stad.gent/nl/mobiliteit-openbare-werken/parkeren/parkings-gent/parking-
vrijdagmarkt",
      "version": 1
    },
    "demandTable": [{
        "timestamp": "2024-07-29T12:37:46Z",
        "demandType": [{
            "count": 32,
            "occupancyCalculation": "verified",
            "recordDateTime": "2024-07-29T12:36:14Z"
          }]}],
    "supply": [{
        "supplyViewType": "spaceView",
        "supplyQuantity": 401
      }]},
  "timeZone": "Europe/Brussels",
  "placeStreetAddress": [{
      "addressLines": [{
          "order": 0,
          "text": [{
              "language": "en",
              "string": "Vrijdagmarkt 1\n9000 Gent"
            }],
          "type": "street"
        },
        {
          "order": 1,
          "text": [{
              "language": "en",
              "string": "?"
            }],
          "type": "poBox"
        }]}],
  "indicativePlacePointLocation": [{
      "type": "Point",
      "coordinates": [
```


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```
        3.726071777876147,
        51.05713405953412
      ]}],
  "characteristics": [{
      "spacesTotal": 593,
      "structureType": "offStreetStructure"
    }],
  "contacts": [{
      "type": "operator",
      "contactDetails": [{
          "urlLinkAddress": "https://stad.gent/nl/mobiliteit-openbare-werken/parkeren/parkings-
gent/parking-vrijdagmarkt"
        }],
      "telephoneContacts": [{
          "localNumbers": [
            "Tel.: 09 266 29 00\n(permanentie)\nTel.: 09 266 29 01\n(tijdens kantooruren)"
          ]}],
      "id": "https://stad.gent/nl/mobiliteit-openbare-werken/parkeren/parkings-gent/parking-
vrijdagmarkt",
      "version": 1
    }],
  "times": {
    "available24hours": true,
    "openAllYear": true,
    "openingTimesNotSpecified": true,
    "openingTimesUnknown": true,
    "operatingTime": {
      "isOpenNow": true,
      "temporaryClosed": false
    }}
}
```


This is a more detailed and structured format, which is more suitable for further analysis and integration with other datasets. There are more APDS schemas available, such as `Rates`, `Sessions`, `Observations`, etc., which can be used to enrich the data further; however, this is out of scope for this project.

2. DATEX II

DATEX II is a widely used referenceable data model in the European context for road traffic and travel information. The DATEX II models particularly valuable for the DISCO project are the Urban Vehicle Access Regulations (UVAR) models, as the data sources being modelled primarily fall within this scope. These include:

- Low Emission Zone
- Circulation Plan Restrictions
- Loading and Unloading Points
- Sectors, Pedestrian Streets, and Car-Free Areas

We are fortunate to have the official release of DATEX II 3.6 in April 2025, which, for the first time, officially includes UVAR models under the "TrafficRegulation" ontology. DISCO is among the pioneers in mapping these standards.

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2.1. DATEX II Schemas

DATEX II provides official schemas for reference (Version 3.6 - DATEX II Docs), including their associated namespaces. Additionally, it offers a DATEX II Online Schema Generation Tool[4] which includes a step-by-step guide to help users obtain the appropriate schemas for profiling. Using this tool, one can generate .xsd schemas required for their data modelling. For the DISCO project, the following schemas are utilized:

- DATEX II_3_Common.xsd
- DATEX II_3_CommonExtension.xsd
- DATEX II_3_ControlledZone.xsd
- DATEX II_3_D2Payload.xsd
- DATEX II_3_LocationExtension.xsd
- DATEX II_3_LocationReferencing.xsd
- DATEX II_3_Parking.xsd
- DATEX II_3_Situation.xsd
- DATEX II_3_TrafficManagementPlan.xsd
- DATEX II_3_TrafficRegulation.xsd

Python has a package called xsdata[5] which provides a code generator to generate Python data classes. However, the auto-generation can lead to circular import issues. To prevent this when generating data classes from DATEX II, while running xsdata generate, we set the --structure-style option to single-package. However, you are free to use any structure style.

2.2. Low Emission Zone Mapping to DATEX II

The generated Python `dataclasses` can be utilized to map data from its original fields to the DATEX II 3.6 format, adhering to common programming practices. As an example, we will demonstrate how to map a Low Emission Zone (LEZ). The source data is presented in JSON format as shown below (with some coordinates omitted):

```
"geometry": {
  "type": "Feature",
  "geometry": {
    "coordinates": [
      [
        [3.705964812272827, 51.06470247162831],
        ....
        [3.703127948775252, 51.06425954657684],
        [3.707356564956, 51.064941241256584],
```

Commented [C(3]: @Xueying Deng (imec) Can you also put the same kind of mapping information for the other Ghent urban access rules that were converted to DATEX? I think it is relevant as examples for other people who want to implement it.

Commented [X(3R2]: Ok ! good idea!

[4] https://webtool.datex2.eu/wizard
[5] https://xsdata.readthedocs.io/en/latest/

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```
        [3.705964812272827, 51.06470247162831]
      ]
    ],
    "type": "Polygon"
    },
    "properties": {}
  },
  "gentid": "LEZ2",
  "urid": "milieu/lez12",
  "geo_point_2d": {
  "longitude": 3.7047251774233394,
  "latitude": 51.06074695800349
  }
}
```


The LEZ corresponds to a `ControlledZoneTablePublication` in DATEX II, with fields matching those in the data class. Cross-validation or referential examples can improve mapping accuracy, as mapping heavily relies on the mapper's semantic understanding of the fields.

Table - Low Emission Zone data

Gent Open Data Portaal	DATEX II	Comments
geometry	GmlMultiPolygon. gmlPolygon	Datex II Docs: GML (Linear and area location)
gentid	UvarZone.name	
urid	ControlledZoneSummary.informal_name	No specific identifier could be found in DATEX, closest was to set this in the summary
geo_point_2d	ControlledZoneSummary.location_for_display	

Field Code Changed

The XML output is as follows:


```
<?xml version="1.0" encoding="UTF-8"?>
<ControlledZoneTablePublication
    xmlns:tro="http://datex2.eu/schema/3/trafficRegulation"
    xmlns:loc="http://datex2.eu/schema/3/locationReferencing"
    xmlns:cz="http://datex2.eu/schema/3/controlledZone"
    xmlns:com="http://datex2.eu/schema/3/common"
    xmlns:d2="http://datex2.eu/schema/3/d2Payload"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" lang="nl" modelBaseVersion="3">
    <com:feedType>ControlledZoneTablePublication</com:feedType>
```


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```
    <com:publicationTime>2025-04-07T14:49:40.502558Z</com:publicationTime>
    <com:publicationCreator>
        <com:country>BE</com:country>
        <com:nationalIdentifier>BE</com:nationalIdentifier>
    </com:publicationCreator>
    <cz:controlledZoneTable>
        <cz:tableVersionTime>2025-04-07T14:49:40.502644Z</cz:tableVersionTime>
        <cz:uvarZone>
            <cz:name>
                <com:values>
                    <com:value>LEZ1</com:value>
                </com:values>
            </cz:name>
            <cz:controlledZoneType>lowEmissionZone</cz:controlledZoneType>
            <cz:status>active</cz:status>
            <cz:controlledZoneSummary>
                <cz:cityName>
                    <com:values>
                        <com:value>Gent</com:value>
                    </com:values>
                </cz:cityName>
                <cz:informalName>
                    <com:values>
                        <com:value>milieu/lez11</com:value>
                    </com:values>
                </cz:informalName>
                <cz:locationForDisplay>
                    <loc:latitude>51.052422</loc:latitude>
                    <loc:longitude>3.725227</loc:longitude>
                </cz:locationForDisplay>
            </cz:controlledZoneSummary>
            <cz:trafficRegulationOrder>
                <tro:issuingAuthority>
                    <com:values>
                        <com:value>Stad Gent</com:value>
                    </com:values>
                </tro:issuingAuthority>
                <tro:regulationId>LEZ1</tro:regulationId>
                <tro:status>madeAndImplemented</tro:status>
                <tro:trafficRegulation>
                    <tro:condition xsi:type="tro:ConditionSet">
                        <tro:conditions xsi:type="tro:LocationCondition">
                            <tro:locationByOrder xsi:type="loc:AreaLocation">
                                <loc:gmlMultiPolygon>
                                    <loc:gmlPolygon>
                                        <loc:exterior>
                                            <loc:posList>3.729674 51.067678 3.729302
51.067686 ...</loc:posList>
                                        </loc:exterior>
                                    </loc:gmlPolygon>
                                </loc:gmlMultiPolygon>
                            </tro:locationByOrder>
                        </tro:conditions>
                        <tro:conditions xsi:type="tro:VehicleCondition">
                            <tro:vehicleCharacteristics>
                                <com:vehicleType>anyVehicle</com:vehicleType>
                            </tro:vehicleCharacteristics>
                        </tro:conditions>
                    </tro:condition>
                </tro:trafficRegulation>
            </cz:trafficRegulationOrder>
        </cz:uvarZone>
    </cz:controlledZoneTable>
</ControlledZoneTablePublication>
```


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2.3. Circulation Plan Restrictions Mapping to DATEX II

Commented [C(4]: @Xueying Deng (imec) Can you also put the same kind of mapping information for the other Ghent urban access rules that were converted to DATEX? I think it is relevant as examples for other people who want to implement it.

Commented [X(4R2]: Ok ! good idea!

The source data of Circulation Plan Restrictions is presented in JSON format as shown below (with some coordinates omitted):

```
"geometry": {
        "type": "LineString",
        "coordinates": [
        [3.744528945735961, 51.04586088010989],
        [3.7446984838812, 51.04599642959088]
        ]
},
"properties": {
        "description": "Knip middenberm nieuw "
},
"geo_point_2d": {
        "lon": 3.7446137148085805,
        "lat": 51.045928654850385
}
```

The Circulation Plan Restrictions corresponds to a `TrafficRegulationPublication` in DATEX II, with fields matching those in the data class.

Table - Circulation Plan Restrictions

Gent Open Data Portaal	DATEX II	Comments
geometry	GmlLineString.posList	DATEX II Docs: GML (Linear and area location) DATEX II_3_ControlledZone
description	TrafficRegulationPublication.feedDescription	
geo_point_2d	AreaLocation.coordinatesForDisplay	

The XML output is as follows:

```
<?xml version="1.0" encoding="UTF-8"?>
<TrafficRegulationPublication
    xmlns:tro="http://datex2.eu/schema/3/trafficRegulation"
    xmlns:loc="http://datex2.eu/schema/3/locationReferencing"
    xmlns:cz="http://datex2.eu/schema/3/controlledZone"
    xmlns:comx="http://datex2.eu/schema/3/commonExtension"
    xmlns:com="http://datex2.eu/schema/3/common"
    xmlns:d2="http://datex2.eu/schema/3/d2Payload"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    lang="nl"
    modelBaseVersion="3">
    <com:feedDescription>
        <com:values>
            <com:value lang="nl">Knippen Circulatieplan Gent</com:value>
```


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```
        </com:values>
    </com:feedDescription>
    <com:feedType>Mobiliteit</com:feedType>
    <com:publicationTime>2025-04-07T14:37:18.605655Z</com:publicationTime>
    <com:publicationCreator>
        <com:nationalIdentifier>BE</com:nationalIdentifier>
    </com:publicationCreator>
    <tro:trafficRegulationsFromCompetentAuthorities>
        <tro:trafficRegulationOrder>
            <tro:description>
                <com:values>
                    <com:value lang="nl">Knip middenberm nieuw</com:value>
                </com:values>
            </tro:description>
            <tro:issuingAuthority>
                <com:values>
                    <com:value lang="nl">Mobiliteitsbedrijf Gent</com:value>
                </com:values>
            </tro:issuingAuthority>
            <tro:reason>trafficOrder</tro:reason>
            <tro:reason>trafficSafety</tro:reason>
            <tro:status>madeAndImplemented</tro:status>
            <tro:trafficRegulation xsi:type="cz:ControlledZoneRegulation">
                <tro:status>active</tro:status>
                <tro:condition xsi:type="tro:LocationCondition">
                    <tro:implementedLocation xsi:type="loc:LinearLocation">
                        <loc:coordinatesForDisplay>
                            <loc:latitude>51.062682643332735</loc:latitude>
                            <loc:longitude>3.703543141565572</loc:longitude>
                        </loc:coordinatesForDisplay>
                        <loc:gmlLineString>
                            <loc:posList xsi:type="GmlPosList">
                                3.703501767409373 51.062723199354345 3.703584515721771
51.06264208731113
                            </loc:posList>
                        </loc:gmlLineString>
                    </tro:implementedLocation>
                </tro:condition>
                <cz:enforcementMethodType>other</cz:enforcementMethodType>
            </tro:trafficRegulation>
        </tro:trafficRegulationOrder>
    </tro:trafficRegulationsFromCompetentAuthorities>
</TrafficRegulationPublication>
```


2.4. Loading and Unloading Points Mapping to DATEX II

The source data of Loading and Unloading Points is presented in JSON format as shown below (with some coordinates omitted):


```
{
  "geometry": {
    "type": "Feature",
    "geometry": {
      "type": "Polygon",
      "coordinates": [
        [
          [3.718601223830008, 51.04165280243418],
          [3.718705750898138, 51.04174169661648],
          [3.718682846553343, 51.04175240559054],
          [3.718661818789186, 51.041734531317346],
          [3.718578313197001, 51.04166350747502],
          [3.718601223830008, 51.04165280243418]
        ]
```


Commented [C(5]: @Xueying Deng (imec) Can you also put the same kind of mapping information for the other Ghent urban access rules that were converted to DATEX? I think it is relevant as examples for other people who want to implement it.

Commented [X(5R2]: Ok ! good idea!

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```
        ]
      },
      "properties": {}
    },
    "pregime": "Voorbehouden",
    "ptype": 815,
    "opmerkingen": null,
    "type": null,
    "capaciteit": 2,
    "lopendemeter": "12.31000000",
    "zone": "TARGEEL",
    "straatcode": 70779,
    "straatnaam": "Kortrijksesteenweg",
    "datum": "2024-05-23T22:00:00Z",
    "pcapcode": 337,
    "geo_point_2d": {
      "lon": 3.7186420329727152,
      "lat": 51.04170260468722
    }
}
```


The Loading and Unloading Points corresponds to a `TrafficRegulationPublication` in DATEX II , with fields matching those in the data class.

Gent Open Data Portaal	DATEX II	Comments
geometry	GmlMultiPolygon.gml_polygons	✗ Datex II Docs: GML (Linear and area location)
streetnaam + straatcode	GmlMultiPolygon.gml_area_name	No specific identifier could be found in DATEX, closest was to append these values and set as the area name
opmerkingen	TrafficRegulationOrder.description	

ptype	if 814:
	StandingOrParkingControl.STANDING_AND_PARKING_PROHIBITED
	if 815:
	StandingOrParkingControl.
	permittedParkingTime
		• Dedicated plaatsen voor laden en lossen (Ptype 814)
		• Shop & Go parkeerplaatsen met een parkeersensor (Ptype 815)

capaciteit	PermitInformation.description	No specific parking regulation characteristics could be found for capacity metric, closest chosen

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lopendemeter	PermitInformation.description	No specific parking regulation characteristics could be found for length metric, closest chosen
pregime	OtherAccessRestriction.value	
datum	LegalBasis.date	Registration date
zone	IsoNamedArea.areaName	
pcapcode	IsoNamedArea.subdivisionCode	
geo_point_2d	AreaLocation. coordinatesForDisplay	

The XML output is as follows:

```
<?xml version="1.0" encoding="UTF-8"?>
<TrafficRegulationPublication
    xmlns:tro="http://datex2.eu/schema/3/trafficRegulation"
    xmlns:loc="http://datex2.eu/schema/3/locationReferencing"
    xmlns:cz="http://datex2.eu/schema/3/controlledZone"
    xmlns:comx="http://datex2.eu/schema/3/commonExtension"
    xmlns:com="http://datex2.eu/schema/3/common"
    xmlns:d2="http://datex2.eu/schema/3/d2Payload"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    lang="nl"
    modelBaseVersion="3">
    <com:feedDescription>
        <com:values>
            <com:value lang="nl">Laad en losplaatsen Gent</com:value>
        </com:values>
    </com:feedDescription>
    <com:feedType>Mobiliteit</com:feedType>
    <com:publicationTime>2025-04-07T14:44:03.449622Z</com:publicationTime>
    <com:publicationCreator>
        <com:nationalIdentifier>BE</com:nationalIdentifier>
    </com:publicationCreator>
    <tro:trafficRegulationsFromCompetentAuthorities>
        <tro:trafficRegulationOrder>
            <tro:issuingAuthority>
                <com:values>
                    <com:value lang="nl">Mobiliteitsbedrijf Gent</com:value>
                </com:values>
            </tro:issuingAuthority>
            <tro:reason>trafficOrder</tro:reason>
            <tro:reason>trafficSafety</tro:reason>
            <tro:status>madeAndImplemented</tro:status>
            <tro:trafficRegulation>
                <tro:status>active</tro:status>
                <tro:typeOfRegulation xsi:type="tro:StandingOrParkingControl">
                    <tro:permittedParkingTime>PT30M</tro:permittedParkingTime>
                </tro:typeOfRegulation>
                <tro:condition xsi:type="tro:AccessCondition">
                    <tro:legalBasis>
```


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```
                    <tro:date>2024-05-06Z</tro:date>
                </tro:legalBasis>
                <tro:accessConditionType>loadingAndUnloading</tro:accessConditionType>
                <tro:otherAccessRestriction>
                    <com:values>
                        <com:value lang="nl">Voorbehouden</com:value>
                    </com:values>
                </tro:otherAccessRestriction>
                <tro:applicableLocation xsi:type="loc:AreaLocation">
                    <loc:coordinatesForDisplay>
                        <loc:latitude>51.03687330650958</loc:latitude>
                        <loc:longitude>3.7265317473319737</loc:longitude>
                    </loc:coordinatesForDisplay>
                    <loc:namedArea xsi:type="loc:IsoNamedArea">
                        <loc:areaName>
                            <com:values>
                                <com:value lang="nl">TARGEEL</com:value>
                            </com:values>
                        </loc:areaName>
                        <loc:namedAreaType>carParkArea</loc:namedAreaType>
                        <loc:country>BE</loc:country>
                        <loc:subdivisionType>district</loc:subdivisionType>
                        <loc:subdivisionCode>22193</loc:subdivisionCode>
                    </loc:namedArea>
                    <loc:gmlMultiPolygon>
                        <loc:gmlAreaName>
                            <com:values>
                                <com:value lang="nl">Zwijnaardsesteenweg 72118</com:value>
                            </com:values>
                        </loc:gmlAreaName>
                        <loc:gmlPolygon>
                            <loc:exterior>
                                <loc:_gmlLinearRingExtension>
                                    3.726502652355531 51.03682199367616 3.726530764234032
51.036818556385214
                                    3.726533265143784 51.03682739222782 3.726535734612505
51.0368361235661
                                    3.726538208572778 51.036844854902725 3.726540682533084
51.03685358849726
                                    3.726543156493357 51.03686232209011 3.726545624165451
51.03687105116229
                                    3.726548093634172 51.0368797762787 3.726550563102892
51.03688849800417
                                    3.72655303346991 51.0368972248119 3.726555506531886
51.03690595218285
                                    3.72655797510231 51.03691468294147 3.726559150997011
51.03691883140692
                                    3.726560788625753 51.036924618018546 3.726532840240657
51.036928203299716
                                    3.726502652355531 51.03682199367616
                                </loc:_gmlLinearRingExtension>
                            </loc:exterior>
                        </loc:gmlPolygon>
                    </loc:gmlMultiPolygon>
                </tro:applicableLocation>
            </tro:condition>
            <tro:permitInformation>
                <tro:description>
                    <com:values>
                        <com:value lang="nl">2</com:value>
                    </com:values>
                </tro:description>
            </tro:permitInformation>
            <tro:permitInformation>
                <tro:description>
                    <com:values>
                        <com:value lang="nl">12.02000000</com:value>
                    </com:values>
```


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```
                </tro:description>
            </tro:permitInformation>
        </tro:trafficRegulation>
    </tro:trafficRegulationOrder>
</tro:trafficRegulationsFromCompetentAuthorities>
</TrafficRegulationPublication>
```

2.5. Sectors, Pedestrian Streets, and Car-Free Areas Mapping to DATEX II

Commented [C(6]: @Xueying Deng (imec) Can you also put the same kind of mapping information for the other Ghent urban access rules that were converted to DATEX? I think it is relevant as examples for other people who want to implement it.

Commented [X(6R2]: Ok ! good idea!

The source data of Sectors, Pedestrian Streets, and Car-Free Areas is presented in JSON format as shown below (with some coordinates omitted):

```
{
  "type": "FeatureCollection",
  "features": [
    {
      "type": "Feature",
      "geometry": {
        "type": "Polygon",
        "coordinates": [
          [
            [3.725599, 51.05739],
            …
          ]
        ]
      },
      "properties": {
        "naam": "Kuip_VGG_Vrijdagsmarkt",
        "zone": "Autovrij Nieuw",
        "urid": "mob/sect63",
        "autovrijgebied": "Autovrij gebied 1",
        "autovrijgebied_codedvalue": "AV10",
        "geo_point_2d": {
          "lon": 3.725621,
          "lat": 51.057726
        }
      }
    }
  ]
}
```

The Sectors, Pedestrian Streets, and Car-Free Areas correspond to a `ControlledZoneTablePublication` in DATEX II, with fields matching those in the data class.

Gent Open Data Portaal	DATEX II	Comments
geometry	GmlPolygon.exterior._ gmlLinearRingExtension	✗ Datex II Docs: GML (Linear and area location)
naam	ControlledZone.name	
zone	ControlledZone.description	

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urid	ControlledZoneSummary.informalName	No specific identifier could be found in DATEX, closest was to set this in the summary.
autovrijgebied + autovrijgebied_coded value	AreaLocation.gmlMultiPolygon. gmlAreaName	No specific identifier could be found in DATEX II, closest was to append these values and set as the area name
geo_point_2d	ControlledZoneSummary.locationForDisplay	

The XML output is as follows:

```
<?xml version="1.0" encoding="UTF-8"?>
<ControlledZoneTablePublication
    xmlns:tro="http://datex2.eu/schema/3/trafficRegulation"
    xmlns:loc="http://datex2.eu/schema/3/locationReferencing"
    xmlns:cz="http://datex2.eu/schema/3/controlledZone"
    xmlns:comx="http://datex2.eu/schema/3/commonExtension"
    xmlns:com="http://datex2.eu/schema/3/common"
    xmlns:d2="http://datex2.eu/schema/3/d2Payload"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    lang="nl"
    modelBaseVersion="3">
    <com:feedDescription>
        <com:values>
            <com:value lang="nl">Sectoren/Voetgangersstraten/Autovrij Gebied Gent</com:value>
        </com:values>
    </com:feedDescription>
    <com:feedType>Mobiliteit</com:feedType>
    <com:publicationTime>2025-04-07T14:45:37.870605Z</com:publicationTime>
    <com:publicationCreator>
        <com:nationalIdentifier>BE</com:nationalIdentifier>
    </com:publicationCreator>
    <cz:controlledZoneTable>
        <cz:controlledZoneTableName>
            <com:values>
                <com:value lang="nl">Autovrij</com:value>
            </com:values>
        </cz:controlledZoneTableName>
        <cz:controlledZone>
            <cz:name>
                <com:values>
                    <com:value lang="nl">Kuip_VGG_Patershol</com:value>
                </com:values>
            </cz:name>
            <cz:controlledZoneType>limitedTrafficZone</cz:controlledZoneType>
            <cz:description>
                <com:values>
                    <com:value lang="nl">Autovrij Nieuw</com:value>
                </com:values>
            </cz:description>
            <cz:status>active</cz:status>
            <cz:controlledZoneSummary>
                <cz:cityName>
```


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```
                    <com:values>
                        <com:value lang="nl">Gent</com:value>
                    </com:values>
                </cz:cityName>
                <cz:informalName>
                    <com:values>
                        <com:value lang="nl">mob/sect64</com:value>
                    </com:values>
                </cz:informalName>
                <cz:locationForDisplay>
                    <loc:latitude>51.0579257373271</loc:latitude>
                    <loc:longitude>3.7224861407265415</loc:longitude>
                </cz:locationForDisplay>
            </cz:controlledZoneSummary>
            <cz:controlledZoneRegulation>
                <tro:typeOfRegulation xsi:type="tro:AccessRestriction">
                    <tro:accessRestrictionType>noEntry</tro:accessRestrictionType>
                </tro:typeOfRegulation>
                <tro:condition xsi:type="tro:LocationCondition">
                    <tro:implementedLocation xsi:type="loc:AreaLocation">
                        <loc:gmlMultiPolygon>
                            <loc:gmlAreaName>
                                <com:values>
                                    <com:value lang="nl">Autovrij gebied 1 AV10</com:value>
                                </com:values>
                            </loc:gmlAreaName>
                            <loc:gmlPolygon>
                                <loc:exterior>
                                    <loc:_gmlLinearRingExtension>
                                        3.72438063672001 51.059444583212645 3.723656821874795
51.0596680109651 ...
                                    </loc:_gmlLinearRingExtension>
                                </loc:exterior>
                            </loc:gmlPolygon>
                        </loc:gmlMultiPolygon>
                    </tro:implementedLocation>
                </tro:condition>
            </cz:controlledZoneRegulation>
        </cz:controlledZone>
        <cz:controlledZone>
            <cz:name>
                <com:values>
                    <com:value lang="nl">Kuip_VGG_Paddenhoek</com:value>
                </com:values>
            </cz:name>
            <cz:controlledZoneType>limitedTrafficZone</cz:controlledZoneType>
            <cz:description>
                <com:values>
                    <com:value lang="nl">Autovrij Nieuw</com:value>
                </com:values>
            </cz:description>
            <cz:status>active</cz:status>
            <cz:controlledZoneSummary>
                <cz:cityName>
                    <com:values>
                        <com:value lang="nl">Gent</com:value>
                    </com:values>
                </cz:cityName>
                <cz:informalName>
                    <com:values>
                        <com:value lang="nl">mob/sect66</com:value>
                    </com:values>
                </cz:informalName>
                <cz:locationForDisplay>
                    <loc:latitude>51.051727190217754</loc:latitude>
                    <loc:longitude>3.7247820400580776</loc:longitude>
                </cz:locationForDisplay>
            </cz:controlledZoneSummary>
```


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```
            <cz:controlledZoneRegulation>
                <tro:typeOfRegulation xsi:type="tro:AccessRestriction">
                    <tro:accessRestrictionType>noEntry</tro:accessRestrictionType>
                </tro:typeOfRegulation>
                <tro:condition xsi:type="tro:LocationCondition">
                    <tro:implementedLocation xsi:type="loc:AreaLocation">
                        <loc:gmlMultiPolygon>
                            <loc:gmlAreaName>
                                <com:values>
                                    <com:value lang="nl">Autovrij gebied 2 AV20</com:value>
                                </com:values>
                            </loc:gmlAreaName>
                            <loc:gmlPolygon>
                                <loc:exterior>
                                    <loc:_gmlLinearRingExtension>
                                        3.724547646107753 51.052151381493275 3.724525755062584
51.051896952398636 ...
                                    </loc:_gmlLinearRingExtension>
                                </loc:exterior>
                            </loc:gmlPolygon>
                        </loc:gmlMultiPolygon>
                    </tro:implementedLocation>
                </tro:condition>
            </cz:controlledZoneRegulation>
        </cz:controlledZone>
    </cz:controlledZoneTable>
</ControlledZoneTablePublication>
```


2.6. Existing Tools - UVARBox Tool

UVARBox, an EU project described in detail at UVARBox Tool, has already implemented DATEX II for UVAR modelling. This toolbox offers **a user interface for mapping data sources to the DATEX II model and provides validation** methods. However, the toolbox is not designed for machine-to-machine pipelines. It relies on a user interface, allowing only manual input data for DATEX II conversion.

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2.7. Existing DATEX II Mappings

2.7.1. The National Road Traffic Data Portal (NL)

The National Road Traffic Data Portal (NL) represents the Dutch implementation of UVAR mapping. However, it uses its own namespaces as it was developed prior to the release of the official DATEX II version 3.6 schema.

- For the low emission zone, please refer to the schema available at DATEX II_3_Emissiezones-2024.zip via Downloads - NDW Docs. The relevant product can be found at NDW open data.
- For school zones, the schema can be accessed through School Zones - NDW Docs.

2.7.2. Mobilitek (DE)

The German portal at Mobilithek.info - Mobilitätsdaten Deutschland showcases DATEX II mappings. As of the document's date, the majority are based on DATEX II version 2 (224 mappings), with only four mappings utilizing DATEX II version 3. DATEX II version 3.6 is not utilized on the German portal.

Commented [CV7]: @Xueying Deng (imec) Would be good to find also here specific examples of DATEX sources that use the new TrafficRegulation ontology in 3.6. If they don't exist, best to mention it specifically

Commented [X(7R2]: Ok ! good point!

Commented [XD7R3]: The portal number changes, add As of the document's date,

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