

August 31/ 2020

Data Encoding Specification of i-Urban Revitalization

- Urban Planning ADE -

ver.1.4

Contents

| | |
|--|-----------|
| Introduction..... | vi |
| Part 1. Urban Object Data Encoding Specification | 1 |
| 1. Scope | 1 |
| 2. Normative references | 1 |
| 3. Conventions | 1 |
| 3.1 Terms and definitions..... | 1 |
| 3.2 Abbreviated terms | 1 |
| 4. Urban Object Data Encoding..... | 1 |
| 4.1 Overview..... | 1 |
| 4.2 Object definition | 2 |
| 4.2.1 Extended properties of Building..... | 2 |
| 4.2.2 Extended properties of LandUse..... | 6 |
| 4.2.3 Extended properties of Transportation..... | 8 |
| 4.2.4 Extended properties of CityObjectGroup..... | 10 |
| Annex A (normative) XMLSchema Definition..... | 11 |
| A.1 XMLSchema | 11 |
| A.2 Sample data (informative) | 14 |
| Annex B (informative) Code lists for Urban Object Data..... | 17 |
| Part 2. Urban Function Data Encoding Specification | 21 |
| 1. Scope | 21 |
| 2. Normative references | 21 |
| 3. Conventions | 21 |
| 3.1 Terms and definitions..... | 21 |
| 3.2 Abbreviated terms | 21 |
| 4. Urban Function Data Encoding..... | 21 |
| 4.1 Overview | 21 |
| 4.2 Object definition | 22 |
| 4.2.1 UrbanFunctionType, _UrbanFunction..... | 22 |
| 4.2.2 LegalGroundsType | 25 |
| 4.2.3 AdministrationType, Administration | 26 |
| 4.2.4 ZoneType, _Zone | 26 |
| 4.2.5 LandUsePlanType, LandUsePlan | 27 |
| 4.2.6 UrbanPlanType, UrbanPlan | 27 |
| 4.2.7 AgreementType, Agreement | 27 |
| 4.2.8 RegulationType, Regulation | 27 |
| 4.2.9 DevelopmentProjectType, DevelopmentProject | 28 |
| 4.2.10 AreaClassificationType, AreaClassification | 28 |
| 4.2.11 DistrictsAndZonesType, DistrictsAndZones | 29 |
| 4.2.12 CensusBlockType, CensusBlock | 29 |
| 4.2.13 DisasterDamageType, DisasterDamage | 30 |
| 4.2.14 PollutionType, Pollution | 31 |
| 4.2.15 DisasterPreventionBaseType, DisasterPreventionBase | 31 |
| 4.2.16 RecreationsType, Recreations | 32 |
| 4.2.17 HubCityType, HubCity..... | 32 |
| 4.2.18 LandUseDiversionType, LandUseDiversion | 32 |
| 4.2.19 UrbanizationType, Urbanization | 33 |

| | |
|--|-----------|
| 4.2.20 PublicTransportationFacilityType, PublicTransportationFacility | 33 |
| 4.2.21 Extended properties of CityObjectGroup..... | 34 |
| Annex A (normative) XMLSchema Definition..... | 35 |
| A.1 XMLSchema | 35 |
| A.2 Sample data (informative) | 42 |
| Annex B (informative) Code lists for Urban Function Data | 44 |
| Annex C (normative) Concept of Extended LOD | 49 |
| C.1 Introduction..... | 49 |
| C.2 Extended LODs for Urban Functions..... | 49 |
| Part 3. Statistical Grid Data Encoding Specification..... | 50 |
| 1. Scope | 50 |
| 2. Normative references | 50 |
| 3. Conventions | 50 |
| 3.1 Terms and definitions..... | 50 |
| 3.2 Abbreviated terms | 50 |
| 4. Statistical Grid Data Encoding..... | 50 |
| 4.1 Overview | 50 |
| 4.2 Object definition | 52 |
| 4.2.1 StatisticalGridType, _StatisticalGrid..... | 52 |
| 4.2.2 PopulationType, Population..... | 54 |
| 4.2.3 PublicTransitAccessibilityType, PublicTransitAccessibility..... | 55 |
| 4.2.4 LandPriceType, LandPrice | 55 |
| 4.2.5 LandUseDiversionType, LandUseDiversion | 56 |
| 4.2.6 HouseholdsType, Households..... | 57 |
| 4.2.7 OfficesAndEmployeesType, OfficesAndEmployees | 58 |
| 4.2.8 GenericGridCellType, GenericGridCell | 59 |
| 4.2.9 Extended properties of CityObjectGroup..... | 61 |
| Annex A (normative) XMLSchema Definition..... | 62 |
| A.1 XMLSchema | 62 |
| A.2 Sample data (informative) | 67 |
| Annex B (informative) Code lists for Statistical Grid Data | 71 |
| Annex C (normative) Concept of Extended LOD | 73 |
| C.1 Introduction..... | 73 |
| C.2 Extended LODs for Statistical Grid | 73 |
| Part 4. Public Transit Data Encoding Specification | 74 |
| 1. Scope | 74 |
| 2. Normative references | 74 |
| 3. Conventions | 74 |
| 3.1 Terms and definitions..... | 74 |
| 3.2 Abbreviated terms | 74 |
| 4. Public Transit Data Encoding..... | 75 |
| 4.1 Overview | 75 |
| 4.2 Object definition | 76 |
| 4.2.1 PublicTransitType, _PublicTransit | 76 |

| | | |
|---|--|-----|
| 4.2.2 | PublicTransitDataTypeType, _PublicTransitDataType | 78 |
| 4.2.3 | RouteType, Route | 79 |
| 4.2.4 | AgencyType, Agency | 81 |
| 4.2.5 | StopType, Stop | 82 |
| 4.2.6 | LevelType, Level | 83 |
| 4.2.7 | TripType, Trip | 84 |
| 4.2.8 | ShapeType, Shape | 86 |
| 4.2.9 | CalendarType, Calendar | 86 |
| 4.2.10 | CalendarDateType, CalendarDate | 87 |
| 4.2.11 | OfficeType, Office | 88 |
| 4.2.12 | FareAttributeType, FareAttribute | 88 |
| 4.2.13 | FareRuleType, FareRule | 90 |
| 4.2.14 | StopTimeType, StopTime | 90 |
| 4.2.15 | FrequencyType, Frequency | 92 |
| 4.2.16 | TransferType, Transfer | 93 |
| 4.2.17 | PathwayType, Pathway | 93 |
| 4.2.18 | TranslationType, Translation | 94 |
| 4.2.19 | TranslationJPType, TranslationJP | 95 |
| 4.2.20 | AttributionType, Attribution | 96 |
| 4.2.21 | FeedInfoType, FeedInfo | 97 |
| 4.2.22 | Extended properties of CityObjectGroup | 98 |
| Annex A (normative) XMLSchema Definition | | 100 |
| A.1 | XMLSchema | 100 |
| A.2 | Sample data (informative) | 110 |
| Annex B (informative) Code lists for Public Transit Data | | 114 |
| Bibliography | | 118 |
| Revision History | | 119 |

Introduction

Urban planning has been contributing to the formation of healthy urban environments, preventing disorganized urban sprawl and encouraging infrastructure development in Japan. However, urban areas in Japan, which is facing depopulation and aging society, are at a big turning point. New social issues such as a rapid increase of empty apartments and lands, and non-universal design of facilities lie heavily on their sustainable development, especially regional area. Efficient urban management is required, and municipalities recognize the significance and importance of compact urban development from the perspective of administrative costs.

From this kind of circumstance, the Japanese government strongly promotes i) formation of a high-quality urban revitalization project for regional hub cities, ii) consensus building among those concerned, and iii) investor's understanding, according to the concepts "*Selection and Concentration*" and "*Respect for Local Intention*".

Recently, the investment climate has changed dramatically with the expansion of the Internet and the development of information communication technologies such as "Fin-Tech". Information-intensive activities are very important to call for investment.

The "i-UR" is an information infrastructure for urban revitalization. It allows people to analyse and to visualize the situation and problems of urban areas according to the future vision of each area using geospatial information and virtual reality technologies. The quantitative analysis and visualization clearly show the cash-flow and spatial plan of the city and promotes understanding and encourages consensus building among relevant players, e.g. investors, citizens, and developers.

This document defines the encoding specification of the data for i-UR (which is called "i-UR Data"), and aims to assist the formation of social agreement and to improve the quality of urban investment in order to contribute to urban revitalization.

The i-UR Data is the combination of following data:

- a) 3-dimentional city objects and city model
- b) Detailed information of city objects for analysis
- c) Constraints/conditions (e.g. regulation) related to urban revitalization
- d) Statistical grid data for global analysis and visualization
- e) Public transit information to consider urban function accumulation in regional planning

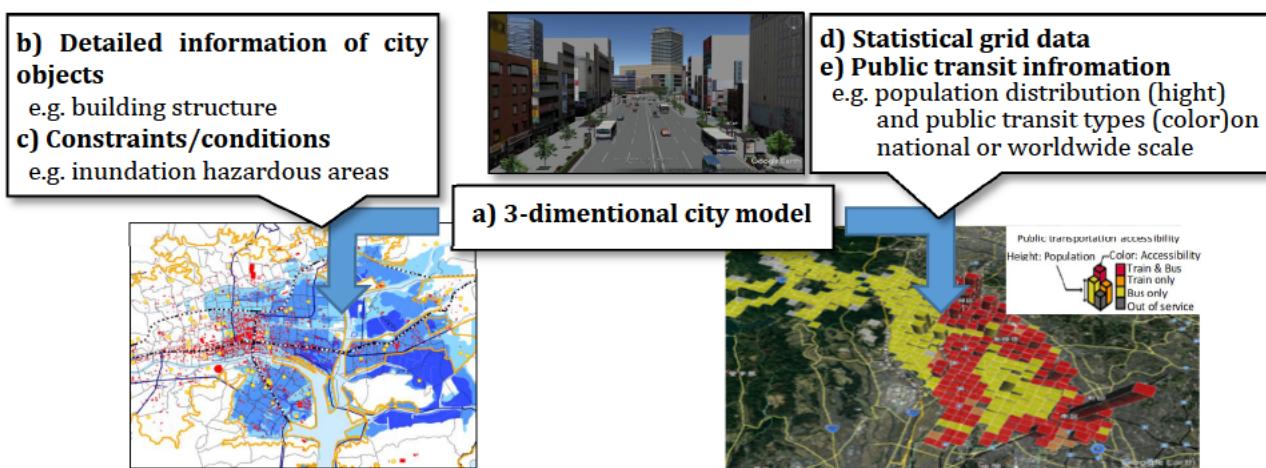


Figure 1 Structure of i-UR Data

The i-UR Data Encoding Specification targets on b) to e) data, as a) is already defined in City Geography Markup Language (CityGML). CityGML is an XML/GML based 3D data standard developed by Open Geospatial Consortium (OGC) for the representation, storage and exchange of 3D city models and is widely used in the application fields related to urban areas.

The i-UR Data Encoding Specification is composed of four parts listed below. Each encoding specification is tied up with each component and is an extension of CityGML according to the rules of the Application Domain Extensions (ADE) to ensure data interoperability. Thus i-UR Data aims to be utilized in various application fields, such as disaster prevention, tourism and to carry out urban revitalization.

Part 1: Urban Object Data Encoding Specification

This document targets on *b) Detailed information of city objects for analysis* and defines them as properties of CityGML object.

Part 2: Urban Function Data Encoding Specification

This document targets on *c) Constraints/conditions related to urban revitalization* and defines constraints and conditions as subclasses of the root class in CityGML.

Part 3: Statistical Grid Data Encoding Specification

This document targets on *d) Statistical grid data for global analysis and visualization*, and defines a statistical grid as subclasses of the root class in CityGML to describe rough city models with a unified unit among cities.

Part 4: Public Transit Data Encoding Specification

This document targets on *e) Public transit information* to consider urban function accumulation in regional planning, and defines a public transit (e.g. bus route, train route) as subclasses of the root class in CityGML.

Figure 2 shows the conceptual structure of the i-UR Data model. The package “UrbanPlanning ADE” is a collection of four modules which are defined in each part of this encoding specification mentioned above.

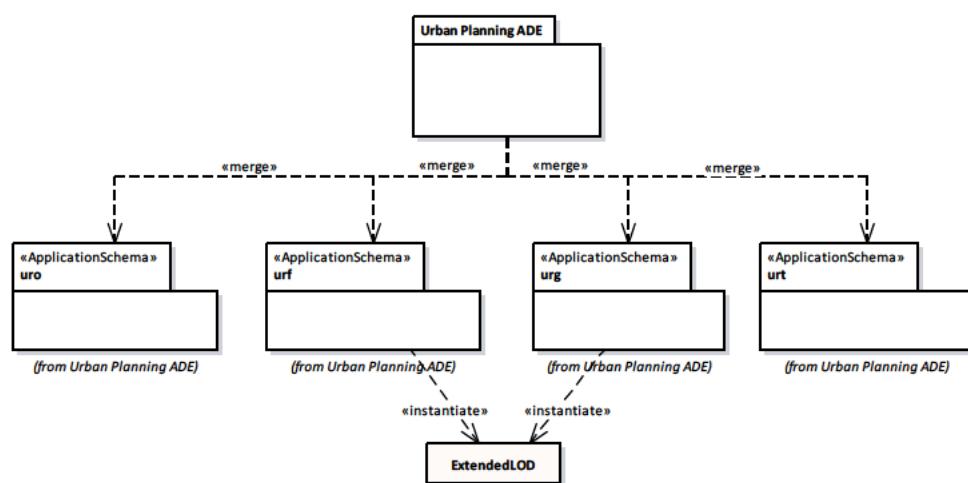


Figure 2 Conceptual strucuture of i-UR Data model

Furthermore, this document defines new Levels of Detail (LOD) for a broad description of city models. These extended LODs enable user to describe rough city models which do not have to be detailed but should be necessary regional or national planning. This ExtendedLOD concept is commonly applied to related modules, and the details of ExtendedLOD is described in Part 2 and Part 3 of this document where this concept is instantiated.

Part 1. Urban Object Data Encoding Specification

1. Scope

Detailed information of buildings, roads, and other objects which constitute urban areas are necessary for the quantitative assessment of the current situation and problems in urban areas.

This document defines additional information of urban objects which is necessary for urban assessment as attributes of urban objects and specifies the encoding format of the information.

2. Normative references

Followings are normative references of this document.

- OpenGIS® OGC City Geography Markup Language (CityGML) Encoding Standard, Version 2.0, OGC document 12-019

3. Conventions

3.1 Terms and definitions

No terms and definitions are listed in this document.

3.2 Abbreviated terms

ADE Application Domain Extensions

CityGML City Geography Markup Language

GML Geography Markup Language

LOD Levels Of Details

OGC Open Geospatial Consortium

UML Unified Modeling Language

4. Urban Object Data Encoding

4.1 Overview

The Urban Object Data Encoding is an extension of CityGML. This document defines the elements and types according to the rules of the Application Domain Extensions (ADE) which are necessary for urban assessment and planning, but not defined in CityGML. Those already defined in CityGML are imported without any inconsistency.

Figure 1-1 shows the structure of Urban Object Data. The Urban Object module imports some modules defined in CityGML, including Core, Building, LandUse, Transportation and CityObjectGroup.

Note: The CityGML extension UtilityNetwork ADE will be imported to this specification in future. The UtilityNetwork ADE defines concepts which allow for modelling different types of networks in the context of 3D city models, such as electricity, freshwater, wastewater, gas or telecommunication networks.

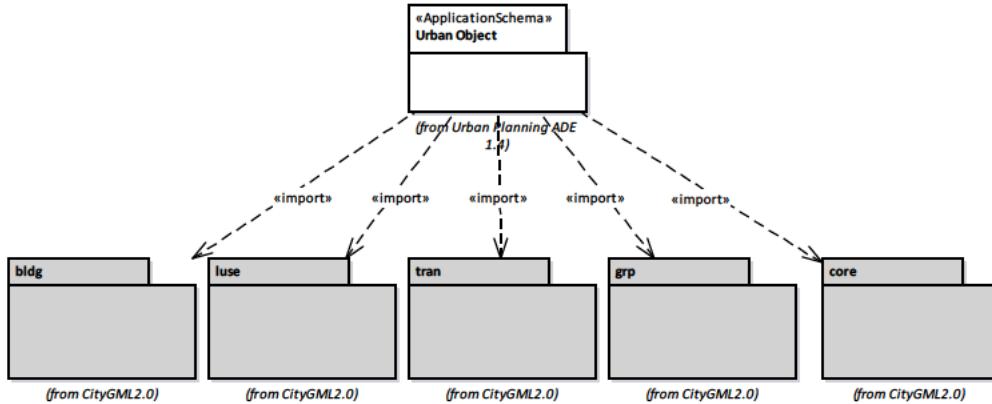


Figure 1-1 Package diagram of Urban Object Data

| | |
|-------------------------------------|---|
| Module name | Urban Object |
| XML namespace identifier | http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/uro/1.4 |
| XMLSchemalocation | http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/schemas/uro/1.4/urbanObject.xsd |
| Recommended namespace prefix | uro |
| Description | This module defines additional thematic and spatial aspects of city objects which enables users to examine and to analyse current situation and issues of urban areas. This module is the extension of the existing modules for city objects such as <i>building</i> , <i>land use</i> , <i>transportation</i> and <i>cityObjectGroup</i> . |

4.2 Object definition

4.2.1 Extended properties of Building

This module defines one abstract class and three datatype classes which are used as types of building properties. Each building property extended in this module is declared as a member of the general property of *bldg::AbstractBuilding* shown in Figure 1-2.

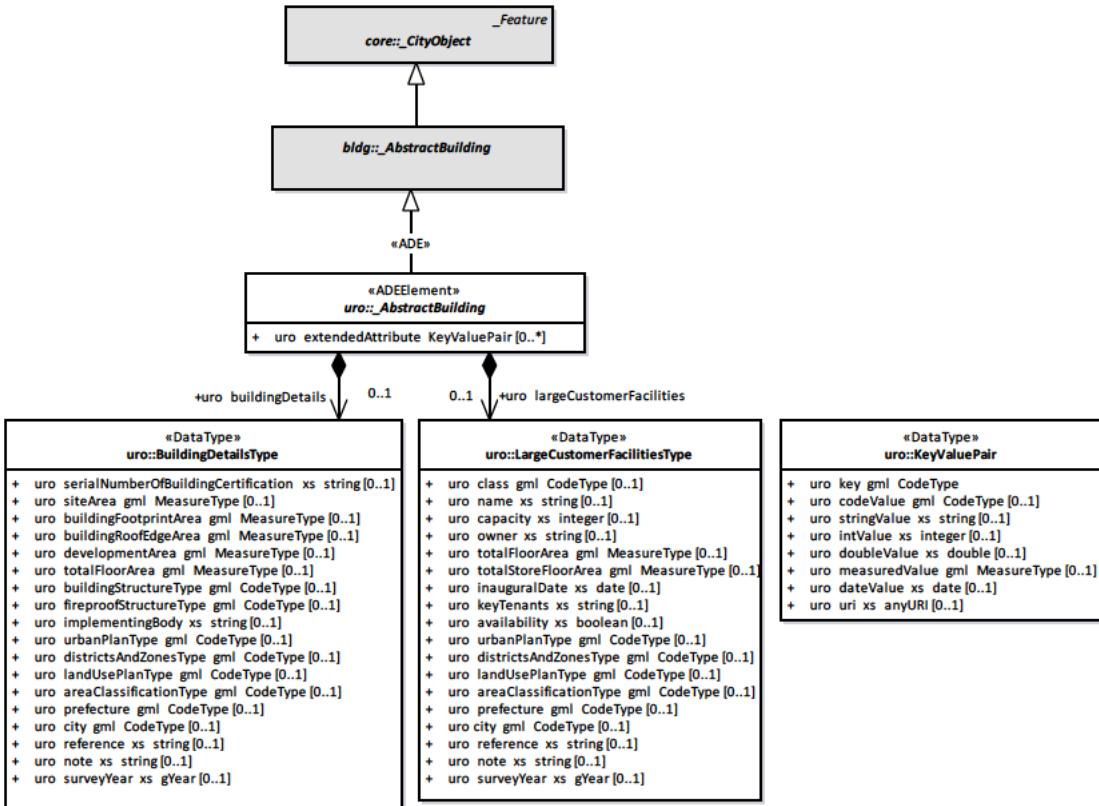


Figure 1-2 UML diagram of extended properties of `AbstractBuilding`. Element names with the prefix `uro` are defined within this module.

Extended properties of `AbstractBuilding`

| Property | Definition |
|---|--|
| <code>uro::buildingDetails</code> | Detailed descriptions of the building, e.g. building structure and total floor area |
| <code>uro::largeCustomerFacilities</code> | Current status of the building when if the building is a large customer facility |
| <code>uro::extendedAttribute</code> | Generic attribute for describing attribute which is not covered by other attributes defined by i-UR and CityGML. |

```

<xs:element name="buildingDetails" type="BuildingDetailsPropertyType"
substitutionGroup="bldg:_GenericApplicationPropertyOfAbstractBuilding"/>
<xs:element name="largeCustomerFacilities" type="LargeCustomerFacilitiesPropertyType"
substitutionGroup="bldg:_GenericApplicationPropertyOfAbstractBuilding"/>
<xs:element name="extendedAttribute" type="KeyValuePairPropertyType"
substitutionGroup="bldg:_GenericApplicationPropertyOfAbstractBuilding"/>

```

A `uro::buildingDetails` contains detailed information of a building. A `uro::largeCustomerFacilities` contains detailed information for large customer facilities, such as shopping malls, hospitals and universities. A `uro::extendedAttribute` can describe detailid information of a building which is not defined in this module and CityGML Building module.

BuildingDetailsType

| Type | Definition |
|--|---|
| <code>uro::BuildingDetailsType</code> | Detailed information of a building |
| Property | Definition |
| <code>uro::serialNumberOfBuildingC ertification</code> | Serial number of the building certification |

| | |
|-----------------------------|---|
| uro::siteArea | Site area of a building |
| uro::buildingFootprintArea | Building area of a footprint polygon |
| uro::buildingRoofEdgeArea | Building area of a roof edge polygon |
| uro::developmentArea | Development area |
| uro::totalFloorArea | Total floor area |
| uro::buildingStructureType | Structure type of the building |
| uro::fireproofStructureType | Fireproof structure type of the building |
| uro::implementingBody | Implement body of the building |
| uro::urbanPlanType | Type of the building location designated by Urban Plan |
| uro::districtAndZoneType | Type of the building location designated by Districts and Zones |
| uro::landUsePlanType | Type of the building location designated by Land Use Plan |
| uro::areaClassificationType | Type of the building location designated by Area classification |
| uro::prefecture | Prefecture name of the building location |
| uro::city | City name of the building location |
| uro::reference | Reference information of the building |
| uro::note | Additional information of the building |
| uro::surveyYear | Year of the survey |

```

<xs:complexType name="BuildingDetailsType">
  <xs:sequence>
    <xs:element name="serialNumberOfBuildingCertification" type="xs:string" minOccurs="0"/>
    <xs:element name="siteArea" type="gml:MeasureType" minOccurs="0"/>
    <xs:element name="buildingFootprintArea" type="gml:MeasureType" minOccurs="0"/>
    <xs:element name="buildingRoofEdgeArea" type="gml:MeasureType" minOccurs="0"/>
    <xs:element name="developmentArea" type="gml:MeasureType" minOccurs="0"/>
    <xs:element name="totalFloorArea" type="gml:MeasureType" minOccurs="0"/>
    <xs:element name="buildingStructureType" type="gml:CodeType" minOccurs="0"/>
    <xs:element name="fireproofStructureType" type="gml:CodeType" minOccurs="0"/>
    <xs:element name="implementingBody" type="xs:string" minOccurs="0"/>
    <xs:element name="urbanPlanType" type="gml:CodeType" minOccurs="0"/>
    <xs:element name="districtsAndZonesType" type="gml:CodeType" minOccurs="0"/>
    <xs:element name="landUsePlanType" type="gml:CodeType" minOccurs="0"/>
    <xs:element name="areaClassificationType" type="gml:CodeType" minOccurs="0"/>
    <xs:element name="prefecture" type="gml:CodeType" minOccurs="0"/>
    <xs:element name="city" type="gml:CodeType" minOccurs="0"/>
    <xs:element name="reference" type="xs:string" minOccurs="0"/>
    <xs:element name="note" type="xs:string" minOccurs="0"/>
    <xs:element name="surveyYear" type="xs:gYear" minOccurs="0"/>
  </xs:sequence>
</xs:complexType>
<!-- ===== -->
<xs:element name="BuildingDetails" type="BuildingDetailsType"/>
<!-- ===== -->
<xs:complexType name="BuildingDetailsPropertyType">
  <xs:sequence>
    <xs:element ref="BuildingDetails" />
  </xs:sequence>
</xs:complexType>

```

LargeCustomerFacilitiesType

| Type | Definition |
|-----------------------------------|--|
| uro:: LargeCustomerFacilitiesType | Detailed information of large-scale facilities which draw attention of customers |
| Property | Definition |

| | |
|-----------------------------|---|
| uro::class | Type of the facilities |
| uro::name | Name of the facilities |
| uro::capacity | Capacity of the facilities |
| uro::owner | Name of the facilities' owner |
| uro::totalFloorArea | Total floor area |
| uro::totalStoreFloorArea | Total store floor area |
| uro::inauguralDate | Inaugural date of the facilities |
| uro::keyTenants | Name of the key tenants in the facilities |
| uro::availability | Service availability of the facilities |
| uro::urbanPlanType | Type of the facilities location designated by Urban Plan |
| uro::districtAndZoneType | Type of the facilities location designated by Districts and Zones |
| uro::landUsePlanType | Type of the facilities location designated by Land Use Plan |
| uro::areaClassificationType | Type of the facilities location designated by Area classification |
| uro::prefecture | Prefecture name of the facilities location |
| uro::city | City name of the facilities location |
| uro::reference | Reference information of the building |
| uro::note | Additional information of the building |
| uro::surveyYear | Year of the survey |

```

<xs:complexType name="LargeCustomerFacilitiesType">
  <xs:sequence>
    <xs:element name="class" type="gml:CodeType" minOccurs="0"/>
    <xs:element name="name" type="xs:string" minOccurs="0"/>
    <xs:element name="capacity" type="xs:integer" minOccurs="0"/>
    <xs:element name="owner" type="xs:string" minOccurs="0"/>
    <xs:element name="totalFloorArea" type="gml:MeasureType" minOccurs="0"/>
    <xs:element name="totalStoreFloorArea" type="gml:MeasureType" minOccurs="0"/>
    <xs:element name="inauguralDate" type="xs:date" minOccurs="0"/>
    <xs:element name="keyTenants" type="xs:string" minOccurs="0"/>
    <xs:element name="availability" type="xs:boolean" minOccurs="0"/>
    <xs:element name="urbanPlanType" type="gml:CodeType" minOccurs="0"/>
    <xs:element name="districtsAndZonesType" type="gml:CodeType" minOccurs="0"/>
    <xs:element name="landUsePlanType" type="gml:CodeType" minOccurs="0"/>
    <xs:element name="areaClassificationType" type="gml:CodeType" minOccurs="0"/>
    <xs:element name="prefecture" type="gml:CodeType" minOccurs="0"/>
    <xs:element name="city" type="gml:CodeType" minOccurs="0"/>
    <xs:element name="reference" type="xs:string" minOccurs="0"/>
    <xs:element name="note" type="xs:string" minOccurs="0"/>
    <xs:element name="surveyYear" type="xs:gYear" minOccurs="0"/>
  </xs:sequence>
</xs:complexType>
<!-- ===== -->
<xs:element name="LargeCustomerFacilities" type="LargeCustomerFacilitiesType"/>
<!-- ===== -->
<xs:complexType name="LargeCustomerFacilitiesPropertyType">
  <xs:sequence>
    <xs:element ref="LargeCustomerFacilities"/>
  </xs:sequence>
</xs:complexType>

```

KeyValuePair

| Type | Definition |
|-------------------|--|
| uro::KeyValuePair | A pair of attribute name and attribute value, which is an extension mechanism for additional information of a building which is not defined in this module |

| | and CityGML Building module. Either <code>uro::codeValue</code> , <code>uro::stringValue</code> , <code>uro::intValue</code> , <code>uro::doubleValue</code> , <code>uro::measuredValue</code> , <code>uro::dateValue</code> or <code>uro::uriValue</code> be specified. |
|---------------------------------|--|
| Property | Definition |
| <code>uro::key</code> | Name of an attribute |
| <code>uro::codeValue</code> | Code value of the attribute |
| <code>uro::stringValue</code> | String value of the attribute |
| <code>uro::intValue</code> | Integer value of the attribute |
| <code>uro::doubleValue</code> | Double value of the attribute |
| <code>uro::measuredValue</code> | Measured value of the attribute |
| <code>uro::dateValue</code> | Date value of the attribute |
| <code>uro::uriValue</code> | URI value of the attribute |

```

<xs:complexType name="KeyValuePairType">
  <xs:sequence>
    <xs:element name="key" type="gml:CodeType"/>
    <xs:choice>
      <xs:element name="stringValue" type="xs:string"/>
      <xs:element name="intValue" type="xs:integer"/>
      <xs:element name="doubleValue" type="xs:double"/>
      <xs:element name="codeValue" type="gml:CodeType"/>
      <xs:element name="measuredValue" type="gml:MeasureType"/>
      <xs:element name="dateValue" type="xs:date"/>
      <xs:element name="uriValue" type="xs:anyURI"/>
    </xs:choice>
  </xs:sequence>
</xs:complexType>
<!-- ===== -->
<xs:element name="KeyValuePair" type="uro:KeyValuePairType"/>
<!-- ===== -->
<xs:complexType name="KeyValuePairPropertyType">
  <xs:sequence>
    <xs:element ref="uro:KeyValuePair"/>
  </xs:sequence>
</xs:complexType>

```

4.2.2 Extended properties of LandUse

This module defines one extended attribute of `luse::LandUse` as a member of the substitution group `luse::_GenericApplicationPropertyOfLandUse`. Figure 1-3 shows the extended properties for LandUse module and the XMLSchema Definition is attached in Annex A.

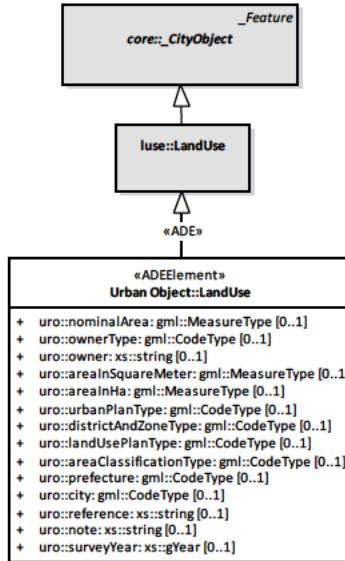


Figure 1-3 UML diagram of LandUse. An element name with the prefix uro is defined within this module.

Extended property of LandUse

| Property | Definition |
|--|---|
| <code>uro::nominalArea</code> | Nominal area of the land |
| <code>uro::ownerType</code> | Type of the land owner |
| <code>uro::owner</code> | Name of the land owner |
| <code>uro::areaInSquareMeter</code> | Area of the land (m ²) |
| <code>uro::areaInHa</code> | Area of the land (ha) |
| <code>uro::urbanPlanType</code> | Type of the land location designated by Urban Plan |
| <code>uro::districtAndZoneType</code> | Type of the land location designated by Districts and Zones |
| <code>uro::landUsePlanType</code> | Type of the land location designated by Land Use Plan |
| <code>uro::areaClassificationType</code> | Type of the land location designated by Area classification |
| <code>uro::prefecture</code> | Prefecture name of the land location |
| <code>uro::city</code> | City name of the land location |
| <code>uro::reference</code> | Reference information of the landuse |
| <code>uro::note</code> | Additional information of the land |
| <code>uro::surveyYear</code> | Year of the survey |

```

<xs:element name="nominalArea" type="gml:MeasureType"
substitutionGroup="luse:_GenericApplicationPropertyOfLandUse"/>
<xs:element name="ownerType" type="gml:CodeType"
substitutionGroup="luse:_GenericApplicationPropertyOfLandUse"/>
<xs:element name="owner" type="xs:string" substitutionGroup="luse:_GenericApplicationPropertyOfLandUse"/>
<xs:element name="areaInSquareMeter" type="gml:MeasureType"
substitutionGroup="luse:_GenericApplicationPropertyOfLandUse"/>
<xs:element name="areaInHa" type="gml:MeasureType"
substitutionGroup="luse:_GenericApplicationPropertyOfLandUse"/>
<xs:element name="urbanPlanType" type="gml:CodeType"
substitutionGroup="luse:_GenericApplicationPropertyOfLandUse"/>
<xs:element name="districtsAndZonesType" type="gml:CodeType"
substitutionGroup="luse:_GenericApplicationPropertyOfLandUse"/>
<xs:element name="landUsePlanType" type="gml:CodeType"
substitutionGroup="luse:_GenericApplicationPropertyOfLandUse"/>

```

```

<xs:element name="areaClassificationType" type="gml:CodeType"
substitutionGroup="luse:_GenericApplicationPropertyOfLandUse"/>
<xs:element name="prefecture" type="gml:CodeType"
substitutionGroup="luse:_GenericApplicationPropertyOfLandUse"/>
<xs:element name="city" type="gml:CodeType" substitutionGroup="luse:_GenericApplicationPropertyOfLandUse"/>
<xs:element name="reference" type="xs:string" substitutionGroup="luse:_GenericApplicationPropertyOfLandUse"/>
<xs:element name="note" type="xs:string" substitutionGroup="luse:_GenericApplicationPropertyOfLandUse"/>
<xs:element name="surveyYear" type="xs:gYear" substitutionGroup="luse:_GenericApplicationPropertyOfLandUse"/>

```

4.2.3 Extended properties of Transportation

Transportation objects in i-UR describe a linear network of transportation. Therefore transportation features in the CityGML Transportation module with LOD0 geometry are applied. Some elements are added as members of the substitution group *tran::_GenericApplicationPropertyOfRoad* to describe detailed information of roads. The data structure of the transportation objects is shown in Figure 1-4 and the XMLSchema Definition is attached in Annex A.

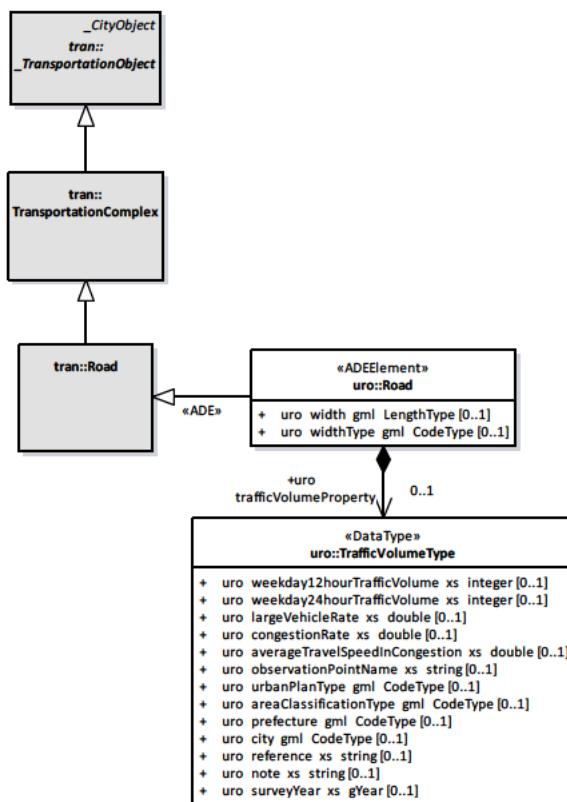


Figure 1-4 UML diagram of Transportation. Element names with the prefix `uro` are defined within this module.

Extended Properties of Road

| Property | Definition |
|---|-----------------------------|
| <code>uro::width</code> | Typical road width |
| <code>uro::widthType</code> | Code allotted to road width |
| <code>uro::trafficVolumeProperty</code> | Traffic volume |

```

<xs:element name="width" type="gml:LengthType" substitutionGroup="tran::_GenericApplicationPropertyOfRoad"/>
<xs:element name="widthType" type="gml:CodeType" substitutionGroup="tran::_GenericApplicationPropertyOfRoad"/>

```

```

<xs:element name="trafficVolume" type="TrafficVolumePropertyType"
substitutionGroup="tran:_GenericApplicationPropertyOfRoad"/>

```

A type *uro::TrafficVolumeType* is a class which describes the number of vehicles crossing a section of road per unit time.

TrafficVolumeType

| Type | Definition |
|-------------------------------------|---|
| uro::TrafficVolumeType | The number of vehicles crossing a section of road per unit time |
| Property | Definition |
| uro::weekday12hourTrafficVolume | The number of vehicles crossing a section of road per 12 hours on average weekday |
| uro::weekday24hourTrafficVolume | The number of vehicles crossing a section of road per 24 hours on average weekday |
| uro::largeVehicleRate | The percentage of the number of large vehicles within the total traffic volume |
| uro::congestionRate | The ratio of 24-hour traffic volume to the design criteria |
| uro::averageTravelSpeedInCongestion | Average travel speed during the congestion period. |
| uro::observationPointName | Name of the observation location. |
| uro::urbanPlanType | Type of the road location designated by Urban Plan |
| uro::areaClassificationType | Type of the road location designated by Area classification |
| uro::prefecture | Prefecture name of the road location |
| uro::city | City name of the road location |
| uro::reference | Reference information of the observation point |
| uro::note | Other additional information |
| uro::surveyYear | The year when the traffic survey was performed. |

```

<xs:complexType name="TrafficVolumeType">
  <xs:sequence>
    <xs:element name="weekday12hourTrafficVolume" type="xs:integer" minOccurs="0"/>
    <xs:element name="weekday24hourTrafficVolume" type="xs:integer" minOccurs="0"/>
    <xs:element name="largeVehicleRate" type="xs:double" minOccurs="0"/>
    <xs:element name="congestionRate" type="xs:double" minOccurs="0"/>
    <xs:element name="averageTravelSpeedInCongestion" type="xs:double" minOccurs="0"/>
    <xs:element name="observationPointName" type="xs:string" minOccurs="0"/>
    <xs:element name="urbanPlanType" type="gml:CodeType" minOccurs="0"/>
    <xs:element name="areaClassificationType" type="gml:CodeType" minOccurs="0"/>
    <xs:element name="prefecture" type="gml:CodeType" minOccurs="0"/>
    <xs:element name="city" type="gml:CodeType" minOccurs="0"/>
    <xs:element name="reference" type="xs:string" minOccurs="0"/>
    <xs:element name="note" type="xs:string" minOccurs="0"/>
    <xs:element name="surveyYear" type="xs:gYear" minOccurs="0"/>
  </xs:sequence>
</xs:complexType>
<!-- ===== -->
<xs:element name="TrafficVolume" type="TrafficVolumeType"/>
<!-- ===== -->
<xs:complexType name="TrafficVolumePropertyType">
  <xs:sequence>
    <xs:element ref="TrafficVolume"/>
  </xs:sequence>
</xs:complexType>

```

4.2.4 Extended properties of CityObjectGroup

CityObjectGroups are defined as special *CityObjects* and aggregate *CityObjects* as shown in Figure 1-5. A *grp::CityObjectGroup* inherits attributes from the parent class *core::_CityObject*. The attribute *core::creationDate* shows the date of dataset creation.

The *groupMember* property of *grp::CityObjectGroup* may contain a *core::_CityObject* element inline or an XLink reference to a remote *core::_CityObject* element, therefore extended city objects defined in this module may also be contained in or referred from a *grp::CityObjectGroup*. XLink reference prevents data duplication and enables multiple use of the *CityObjects*. The attribute *grp::usage* which is inherited from *grp::CityObjectGroup* can represent that this object group is for the use of urban planning.

Two elements, *uro::fiscalYearOfPublication* and *uro::language* are added as members of the substitution group *grp::_GenericApplicationPropertyOfCityObjectGroup*. A *uro::fiscalYear* is used to describe the year when the result of data collection has been published and a *uro::language* clarifies the language used in the city objects.

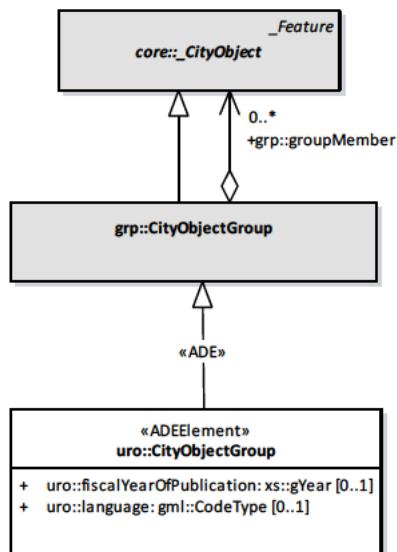


Figure 1-5 UML diagram of City Object Group

Extended properties of CityObjectGroup

| Property | Definition |
|-------------------------------------|---|
| <i>uro::fiscalYearOfPublication</i> | Fiscal year when the group has been published |
| <i>uro::language</i> | Language used in the group |

```

<xs:element name="fiscalYearOfPublication" type="xs:gYear"
substitutionGroup="grp:_GenericApplicationPropertyOfCityObjectGroup"/>
<xs:element name="language" type="gml:CodeType"
substitutionGroup="grp:_GenericApplicationPropertyOfCityObjectGroup"/>
  
```

Annex A (normative)

XMLSchema Definition

A.1 XMLSchema

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:uro="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/uro/1.4" xmlns:core="http://www.opengis.net/citygml/2.0" xmlns:luse="http://www.opengis.net/citygml/landuse/2.0" xmlns:bldg="http://www.opengis.net/citygml/building/2.0" xmlns:tran="http://www.opengis.net/citygml/transportation/2.0" xmlns:grp="http://www.opengis.net/citygml/cityobjectgroup/2.0" xmlns:xs="http://www.w3.org/2001/XMLSchema" xmlns:gml="http://www.opengis.net/gml" targetNamespace="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/uro/1.4" elementFormDefault="qualified" attributeFormDefault="unqualified" version="1.4">
  <xs:annotation>
    <xs:documentation>XML Schema for Urban Object module</xs:documentation>
  </xs:annotation>
  <xs:import namespace="http://www.opengis.net/gml" schemaLocation="http://schemas.opengis.net/gml/3.1.1/base/gml.xsd"/>
  <xs:import namespace="http://www.opengis.net/citygml/2.0" schemaLocation="http://schemas.opengis.net/citygml/2.0/cityGMLBase.xsd"/>
  <xs:import namespace="http://www.opengis.net/citygml/transportation/2.0" schemaLocation="http://schemas.opengis.net/citygml/transportation/2.0/transportation.xsd"/>
  <xs:import namespace="http://www.opengis.net/citygml/building/2.0" schemaLocation="http://schemas.opengis.net/citygml/building/2.0/building.xsd"/>
  <xs:import namespace="http://www.opengis.net/citygml/landuse/2.0" schemaLocation="http://schemas.opengis.net/citygml/landuse/2.0/landUse.xsd"/>
  <xs:import namespace="http://www.opengis.net/citygml/cityobjectgroup/2.0" schemaLocation="http://schemas.opengis.net/citygml/cityobjectgroup/2.0/cityObjectGroup.xsd"/>
  <!-- ===== Extended attribute for Building ===== -->
  <xs:element name="buildingDetails" type="uro:BuildingDetailsPropertyType" substitutionGroup="bldg:_GenericApplicationOfAbstractBuilding"/>
  <xs:element name="BuildingDetails" type="uro:BuildingDetailsType"/>
  <xs:complexType name="BuildingDetailsType">
    <xs:sequence>
      <xs:element name="serialNumberOfBuildingCertification" type="xs:string" minOccurs="0"/>
      <xs:element name="siteArea" type="gml:MeasureType" minOccurs="0"/>
      <xs:element name="buildingFootprintArea" type="gml:MeasureType" minOccurs="0"/>
      <xs:element name="buildingRoofEdgeArea" type="gml:MeasureType" minOccurs="0"/>
      <xs:element name="developmentArea" type="gml:MeasureType" minOccurs="0"/>
      <xs:element name="totalFloorArea" type="gml:MeasureType" minOccurs="0"/>
      <xs:element name="buildingStructureType" type="gml:CodeType" minOccurs="0"/>
      <xs:element name="fireproofStructureType" type="gml:CodeType" minOccurs="0"/>
      <xs:element name="implementingBody" type="xs:string" minOccurs="0"/>
      <xs:element name="urbanPlanType" type="gml:CodeType" minOccurs="0"/>
      <xs:element name="districtsAndZonesType" type="gml:CodeType" minOccurs="0"/>
      <xs:element name="landUsePlanType" type="gml:CodeType" minOccurs="0"/>
      <xs:element name="areaClassificationType" type="gml:CodeType" minOccurs="0"/>
      <xs:element name="prefecture" type="gml:CodeType" minOccurs="0"/>
      <xs:element name="city" type="gml:CodeType" minOccurs="0"/>
      <xs:element name="reference" type="xs:string" minOccurs="0"/>
      <xs:element name="note" type="xs:string" minOccurs="0"/>
      <xs:element name="surveyYear" type="xs:gYear" minOccurs="0"/>
    </xs:sequence>
  </xs:complexType>
  <xs:complexType name="BuildingDetailsPropertyType">
    <xs:sequence>
```

```

<xs:element ref="uro:BuildingDetails"/>
</xs:sequence>
</xs:complexType>
<!-- ===== -->
<xs:element name="largeCustomerFacilities" type="uro:LargeCustomerFacilitiesPropertyType" substitutionGroup="bldg:_GenericApplicationPropertyOfAbstractBuilding"/>
<!-- ===== -->
<xs:element name="LargeCustomerFacilities" type="uro:LargeCustomerFacilitiesType"/>
<xs:complexType name="LargeCustomerFacilitiesType">
<xs:sequence>
<xs:element name="class" type="gml:CodeType" minOccurs="0"/>
<xs:element name="name" type="xs:string" minOccurs="0"/>
<xs:element name="capacity" type="xs:integer" minOccurs="0"/>
<xs:element name="owner" type="xs:string" minOccurs="0"/>
<xs:element name="totalFloorArea" type="gml:MeasureType" minOccurs="0"/>
<xs:element name="totalStoreFloorArea" type="gml:MeasureType" minOccurs="0"/>
<xs:element name="inauguralDate" type="xs:date" minOccurs="0"/>
<xs:element name="keyTenants" type="xs:string" minOccurs="0"/>
<xs:element name="availability" type="xs:boolean" minOccurs="0"/>
<xs:element name="urbanPlanType" type="gml:CodeType" minOccurs="0"/>
<xs:element name="districtsAndZonesType" type="gml:CodeType" minOccurs="0"/>
<xs:element name="landUsePlanType" type="gml:CodeType" minOccurs="0"/>
<xs:element name="areaClassificationType" type="gml:CodeType" minOccurs="0"/>
<xs:element name="prefecture" type="gml:CodeType" minOccurs="0"/>
<xs:element name="city" type="gml:CodeType" minOccurs="0"/>
<xs:element name="reference" type="xs:string" minOccurs="0"/>
<xs:element name="note" type="xs:string" minOccurs="0"/>
<xs:element name="surveyYear" type="xs:gYear" minOccurs="0"/>
</xs:sequence>
</xs:complexType>
<xs:complexType name="LargeCustomerFacilitiesPropertyType">
<xs:sequence>
<xs:element ref="uro:LargeCustomerFacilities"/>
</xs:sequence>
</xs:complexType>
<!-- ===== -->
<xs:element name="extendedAttribute" type="uro:KeyValuePairPropertyType" substitutionGroup="bldg:_GenericApplicationPropertyOfAbstractBuilding"/>
<!-- ===== -->
<xs:complexType name="KeyValuePairType">
<xs:sequence>
<xs:element name="key" type="gml:CodeType"/>
<xs:choice>
<xs:element name="stringValue" type="xs:string"/>
<xs:element name="intValue" type="xs:integer"/>
<xs:element name="doubleValue" type="xs:double"/>
<xs:element name="codeValue" type="gml:CodeType"/>
<xs:element name="measuredValue" type="gml:MeasureType"/>
<xs:element name="dateValue" type="xs:date"/>
<xs:element name="uriValue" type="xs:anyURI"/>
</xs:choice>
</xs:sequence>
</xs:complexType>
<!-- ===== -->
<xs:element name="KeyValuePair" type="uro:KeyValuePairType"/>
<!-- ===== -->
<xs:complexType name="KeyValuePairPropertyType">
<xs:sequence>
<xs:element ref="uro:KeyValuePair"/>
</xs:sequence>

```

```

</xs:complexType>
<!-- ===== Extended attribute for Land Use ===== -->
<xs:element name="nominalArea" type="gml:MeasureType" substitutionGroup="luse:_GenericApplicationPropertyOfLandUse"/>
<xs:element name="ownerType" type="gml:CodeType" substitutionGroup="luse:_GenericApplicationPropertyOfLandUse"/>
<xs:element name="owner" type="xs:string" substitutionGroup="luse:_GenericApplicationPropertyOfLandUse"/>
<xs:element name="areaInSquareMeter" type="gml:MeasureType" substitutionGroup="luse:_GenericApplicationPropertyOfLandUse"/>
<xs:element name="areaInHa" type="gml:MeasureType" substitutionGroup="luse:_GenericApplicationPropertyOfLandUse"/>
<xs:element name="urbanPlanType" type="gml:CodeType" substitutionGroup="luse:_GenericApplicationPropertyOfLandUse"/>
<xs:element name="districtsAndZonesType" type="gml:CodeType" substitutionGroup="luse:_GenericApplicationPropertyOfLandUse"/>
<xs:element name="landUsePlanType" type="gml:CodeType" substitutionGroup="luse:_GenericApplicationPropertyOfLandUse"/>
<xs:element name="areaClassificationType" type="gml:CodeType" substitutionGroup="luse:_GenericApplicationPropertyOfLandUse"/>
<xs:element name="prefecture" type="gml:CodeType" substitutionGroup="luse:_GenericApplicationPropertyOfLandUse"/>
<xs:element name="city" type="gml:CodeType" substitutionGroup="luse:_GenericApplicationPropertyOfLandUse"/>
<xs:element name="reference" type="xs:string" substitutionGroup="luse:_GenericApplicationPropertyOfLandUse"/>
<xs:element name="note" type="xs:string" substitutionGroup="luse:_GenericApplicationPropertyOfLandUse"/>
<xs:element name="surveyYear" type="xs:gYear" substitutionGroup="luse:_GenericApplicationPropertyOfLandUse"/>
<!-- ===== Extended attribute for Road ===== -->
<xs:element name="width" type="gml:LengthType" substitutionGroup="tran:_GenericApplicationPropertyOfRoad"/>
<xs:element name="widthType" type="gml:CodeType" substitutionGroup="tran:_GenericApplicationPropertyOfRoad"/>
<xs:element name="trafficVolume" type="uro:TrafficVolumePropertyType" substitutionGroup="tran:_GenericApplicationPropertyOfRoad"/>
<!-- ===== Extended attribute for TrafficVolumeType ===== -->
<xs:element name="TrafficVolume" type="uro:TrafficVolumeType"/>
<xs:complexType name="TrafficVolumeType">
<xs:sequence>
<xs:element name="weekday12hourTrafficVolume" type="xs:integer" minOccurs="0"/>
<xs:element name="weekday24hourTrafficVolume" type="xs:integer" minOccurs="0"/>
<xs:element name="largeVehicleRate" type="xs:double" minOccurs="0"/>
<xs:element name="congestionRate" type="xs:double" minOccurs="0"/>
<xs:element name="averageTravelSpeedInCongestion" type="xs:double" minOccurs="0"/>
<xs:element name="observationPointName" type="xs:string" minOccurs="0"/>
<xs:element name="urbanPlanType" type="gml:CodeType" minOccurs="0"/>
<xs:element name="areaClassificationType" type="gml:CodeType" minOccurs="0"/>
<xs:element name="prefecture" type="gml:CodeType" minOccurs="0"/>
<xs:element name="city" type="gml:CodeType" minOccurs="0"/>
<xs:element name="reference" type="xs:string" minOccurs="0"/>
<xs:element name="note" type="xs:string" minOccurs="0"/>
<xs:element name="surveyYear" type="xs:gYear" minOccurs="0"/>
</xs:sequence>
</xs:complexType>
<xs:complexType name="TrafficVolumePropertyType">
<xs:sequence>
<xs:element ref="uro:TrafficVolume"/>
</xs:sequence>
</xs:complexType>
<!-- ===== Extended attribute for CityObjectGroup ===== -->
<xs:element name="fiscalYearOfPublication" type="xs:gYear" substitutionGroup="grp:_GenericApplicationPropertyOfCityObjectGroup"/>
<xs:element name="language" type="gml:CodeType" substitutionGroup="grp:_GenericApplicationPropertyOfCityObjectGroup"/>

```

```
</xs:schema>
```

A.2 Sample data (informative)

```
<?xml version="1.0" encoding="UTF-8"?>
<!-- sample data edited by i-Urban Revitalization Promotion Committe Specification WG / source Fundamental Geospatial Data of GSI -->
<core:CityModel xmlns:uro="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/uro/1.4" xmlns:core="http://www.opengis.net/citygml/2.0" xmlns:luse="http://www.opengis.net/citygml/landuse/2.0" xmlns:bldg="http://www.opengis.net/citygml/building/2.0" xmlns:tran="http://www.opengis.net/citygml/transportation/2.0" xmlns:grp="http://www.opengis.net/citygml/cityobjectgroup/2.0" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns:gml="http://www.opengis.net/gml" xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/uro/1.4 http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/schemas/uro/1.4/urbanObject.xsd http://www.opengis.net/citygml/2.0 http://schemas.opengis.net/citygml/2.0/cityGMLBase.xsd http://www.opengis.net/citygml/landuse/2.0 http://schemas.opengis.net/citygml/landuse/2.0/landUse.xsd http://www.opengis.net/citygml/building/2.0 http://schemas.opengis.net/citygml/building/2.0/building.xsd http://www.opengis.net/citygml/transportation/2.0 http://schemas.opengis.net/citygml/transportation/2.0/transportation.xsd http://www.opengis.net/citygml/cityobjectgroup/2.0 http://schemas.opengis.net/citygml/cityobjectgroup/2.0/cityObjectGroup.xsd http://www.opengis.net/gml http://schemas.opengis.net/gml/3.1.1/base/gml.xsd">
<gml:boundedBy>
<gml:Envelope srsName="http://www.opengis.net/def/crs/EPSG/0/6697">
<gml:lowerCorner srsDimension="3">33.80 130.54 0</gml:lowerCorner>
<gml:upperCorner srsDimension="3">33.81 130.55 20</gml:upperCorner>
</gml:Envelope>
</gml:boundedBy>
<core:cityObjectMember>
<bldg:Building gml:id="building503063191001">
<bldg:class codeSpace="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Building_class.xml">2000</bldg:class>
<bldg:function>公益施設用地</bldg:function>
<bldg:usage>小・中・高等学校等</bldg:usage>
<bldg:yearOfConstruction>1997</bldg:yearOfConstruction>
<bldg:storeysAboveGround>3</bldg:storeysAboveGround>
<bldg:storeysBelowGround>1</bldg:storeysBelowGround>
<bldg:lod1Solid>
<gml:Solid>
<gml:exterior>
<gml:CompositeSurface>
<gml:surfaceMember>
<gml:Polygon>
<gml:exterior>
<gml:LinearRing>
<gml:pos>33.8055255 130.5452343 17.9</gml:pos>
<gml:pos>33.80541022 130.5452004 17.9</gml:pos>
<gml:pos>33.80539897 130.5452553 17.9</gml:pos>
<gml:pos>33.80541694 130.5452606 17.9</gml:pos>
<gml:pos>33.80539922 130.545347 17.9</gml:pos>
<gml:pos>33.80549653 130.5453755 17.9</gml:pos>
<gml:pos>33.8055255 130.5452343 17.9</gml:pos>
</gml:LinearRing>
</gml:exterior>
</gml:Polygon>
</gml:surfaceMember>
<gml:surfaceMember>
<gml:Polygon>
<gml:exterior>
<gml:LinearRing>
<gml:pos>33.8055255 130.5452343 17.9</gml:pos>
<gml:pos>33.80549653 130.5453755 17.9</gml:pos>
```

```

<gml:pos>33.80549653 130.5453755 5.9</gml:pos>
<gml:pos>33.8055255 130.5452343 5.9</gml:pos>
<gml:pos>33.8055255 130.5452343 17.9</gml:pos>
</gml:LinearRing>
</gml:exterior>
</gml:Polygon>
</gml:surfaceMember>
<!-- omitted -->
<gml:surfaceMember>
<gml:Polygon>
<gml:exterior>
<gml:LinearRing>
<gml:pos>33.8055255 130.5452343 5.9</gml:pos>
<gml:pos>33.80549653 130.5453755 5.9</gml:pos>
<gml:pos>33.80539922 130.545347 5.9</gml:pos>
<gml:pos>33.80541694 130.5452606 5.9</gml:pos>
<gml:pos>33.80539897 130.5452553 5.9</gml:pos>
<gml:pos>33.80541022 130.5452004 5.9</gml:pos>
<gml:pos>33.8055255 130.5452343 5.9</gml:pos>
</gml:LinearRing>
</gml:exterior>
</gml:Polygon>
</gml:surfaceMember>
</gml:CompositeSurface>
</gml:exterior>
</gml:Solid>
</bldg:lod1Solid>
<uro:buildingDetails>
<uro:BuildingDetails>
<uro:siteArea uom="m2">3300</uro:siteArea>
<uro:buildingFootprintArea uom="m2">50</uro:buildingFootprintArea>
<uro:buildingRoofEdgeArea uom="m2">56.3</uro:buildingRoofEdgeArea>
<uro:developmentArea uom="m2">10.5</uro:developmentArea>
<uro:buildingStructureType codeSpace="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Building_buildingStructureType.xml">9020</uro:buildingStructureType>
<uro:fireproofStructureType codeSpace="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Building_fireproofStructureType.xml">9020</uro:fireproofStructureType>
<uro:urbanPlanType codeSpace="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Common_urbanPlanType.xml">1010</uro:urbanPlanType>
<uro:districtsAndZonesType codeSpace="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Common_districtsAndZones.xml">1000</uro:districtsAndZonesType>
<uro:landUsePlanType codeSpace="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Common_landUsePlanType.xml">5070</uro:landUsePlanType>
<uro:areaClassificationType codeSpace="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Common_areaClassification.xml">1030</uro:areaClassificationType>
<uro:prefecture codeSpace="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Common_prefecture.xml">40</uro:prefecture>
<uro:city codeSpace="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Common_localPublicAuthorities.xml">40220</uro:city>
<uro:reference>ア 1</uro:reference>
<uro:note>なし</uro:note>
<uro:surveyYear>2016</uro:surveyYear>
</uro:BuildingDetails>
</uro:buildingDetails>
<uro:extendedAttribute>
<uro:KeyValuePair>
<uro:key codeSpace="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/test.xml">1020</uro:key>

```

```
<uro:codeValue codeSpace="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/test_value.xml">2020</uro:codeValue>
  </uro:KeyValuePair>
</uro:extendedAttribute>
<uro:extendedAttribute>
  <uro:KeyValuePair>
    <uro:key codeSpace="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/test.xml">1030</uro:key>
      <uro:intValue>3</uro:intValue>
    </uro:KeyValuePair>
  </uro:extendedAttribute>
</bldg:Building>
</core:cityObjectMember>
</core:CityModel>
```

Annex B (informative)

Code lists for Urban Object Data

This annex exemplifies the specification of code lists for enumerative attributes of type *gml:CodeType* in Urban Planning ADE and provides proposals for selected attributes. Please note that this annex is non-normative and the presented code lists are neither mandatory nor complete.

Some of code lists in this annex extends the code lists proposed by the SIG 3D shown in Annex C of CityGML.

Code lists for Building

| Code list for the <i>AbstractBuilding</i> attribute class | | | |
|---|--------------------|------|-------------------------------------|
| http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Building_class.xml | | | |
| 1000 | habitation | 1090 | agriculture, forestry |
| 1001 | house | 1091 | agriculture, forestry and fisheries |
| 1002 | apartment | 1100 | school, education, research |
| 1003 | dwelling with shop | 1110 | maintenance and waste management |
| 1004 | apartment withshop | 1120 | healthcare |
| 1005 | office with whop | 1130 | communicating |
| 1010 | sanitation | 1140 | security |
| 1020 | administration | 1150 | storage |
| 1030 | business, trade | 1160 | industry |
| 1031 | business | 1170 | traffic |
| 1032 | commercial | 1180 | function |
| 1033 | commercial complex | | |
| 1034 | hotel | 2000 | education, welfare |
| 1040 | catering | 2010 | Transportation |
| 1050 | recreation | | |
| 1060 | sport | 8000 | other |
| 1070 | culture | 9000 | unexamined |
| 1080 | church institution | 9010 | exception |
| | | 9020 | unknown |

Code values in grey cells are defined in the Code lists proposed by the SIG 3D in CityGML.

| Code list of the <i>BuildingDetails</i> attribute <i>buildingStructureType</i> | | | |
|---|---------------------|------|------------|
| http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Building_buildingStructureType.xml | | | |
| 1010 | wooden | 9000 | unexamined |
| 1020 | non-wooden | 9010 | exception |
| 1030 | reinforced concrete | 9020 | unknown |

| Code list of the <i>BuildingDetails</i> attribute <i>fireproofStructureType</i> | | | |
|---|----------------|------|------------|
| http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Building_fireproofStructureType.xml | | | |
| 1010 | fireproof | 9000 | unexamined |
| 1020 | semi-fireproof | 9010 | exception |
| 1030 | others | 9020 | unknown |

| Code list for the <i>LargeCustomerFacilities</i> attribute class | | | |
|---|---|------|----------|
| http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/LargeCustomerFacilities_class.xml | | | |
| 1010 | large entertainment and commercial facilities | 1040 | hospital |

| | | | |
|------|--|------|------------------------|
| 1020 | middle sized entertainment and commercial facilities | 1050 | welfare facilities |
| 1030 | public facilities | 1060 | university and college |

Code list of the *BuildingDetails* and the *LargeCustomerFacilities* attribute *urbanPlanType*

See Code list for the *UrbanPlan* attribute *class* in part 2

Code list of the *BuildingDetails* and the *LargeCustomerFacilities* attribute *districtsAndZonesType*

See Code list for the *DistrictsAndZones* attribute *class* in part 2

Code list of the *BuildingDetails* and the *LargeCustomerFacilities* attribute *landUsePlanType*

See Code list for the *LandUsePlan* attribute *class* in part 2

Code list of the *BuildingDetails* and the *LargeCustomerFacilities* attribute *areaClassificationType*

See Code list for the *AreaClassification* attribute *class* in part 2

Code list of the *BuildingDetails* and the *LargeCustomerFacilities* attribute *prefecture*

See Code list for the *Administration* attribute *prefecture* in part 2

Code list of the *BuildingDetails* and the *LargeCustomerFacilities* attribute *city*

See Code list for the *Administration* attribute *city* in part 2

Code lists for LandUse

| Code list of the <i>LandUse</i> attributes <i>function</i> | | | |
|---|--------------------------------|------|-------------------------------------|
| http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/LandUse_function.xml | | | |
| 1010 | Residential | 2050 | Track |
| 1020 | Industry and business | 2060 | Square |
| 1030 | MixedUse | 2010 | Grassland |
| 1040 | Special Function Area | 3020 | Agriculture |
| 1050 | Monument | 3030 | Forest |
| 1060 | Dump | 3040 | Grove |
| 1070 | Mining | 3050 | heath |
| 1100 | Park | 3060 | Moor |
| 1120 | Cemetery | 3070 | Marsh |
| 1130 | Sports, leisure and recreation | 3080 | Untilled land |
| 1140 | Open pit, quarry | 4010 | River |
| 2010 | Road | 4020 | Standing Waterbody |
| 2020 | Railway | 4030 | Harbour |
| 2030 | Airfield | 4040 | Sea |
| 2040 | Shipping | | |
| 5010 | Industry | 5110 | Public land |
| 5020 | Business (retail) | 5120 | Public open space 1 |
| 5030 | Business (other) | 5130 | Public open space 2 |
| 5040 | Water | 5140 | Other communal facilities |
| 5050 | Natural area 1 | 5150 | Other open space |
| 5060 | Natural area 2 | 5160 | Residential not in use |
| 5070 | Communal facilities | 5170 | Agriculture, Forestry and Fisheries |
| 5080 | Rice paddy | 9000 | Unexamined |
| 5090 | Field | 9010 | Exception |
| 5100 | Transportation | 9020 | Unknown |

Code values in grey cells are defined in the Code lists proposed by the SIG 3D in CityGML.

Code list of the *LandUse* attributes *ownerType*

http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/LandUse_ownerType.xml

| | | | |
|------|------------------------|------|------------|
| 1010 | National government | 9000 | Unexamined |
| 1020 | prefectural government | 9010 | Exception |
| 1030 | Municipality | 9020 | Unknown |
| 1040 | Public corporation | | |

Code list of the *LandUse* attribute *urbanPlanType*

See Code list for the *UrbanPlan* attribute *class* in part 2

Code list of the *LandUse* attribute *districtsAndZonesType*

See Code list for the *DistrictsAndZones* attribute *class* in part 2

Code list of the *LandUse* attribute *landUsePlanType*

See Code list for the *LandUsePlan* attribute *class* in part 2

Code list of the *LandUse* attribute *areaClassificationType*

See Code list for the *AreaClassification* attribute *class* in part 2

Code list of the *LandUse* attribute *prefecture*

See Code list for the *Administration* attribute *prefecture* in part 2

Code list of the *LandUse* attribute *city*

See Code list for the *Administration* attribute *city* in part 2

Code lists for Transportation service and Road

Code list of the *Road* attributes *function*

http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Road_function.xml

| | | | |
|------|-------------------------------|------|----------------|
| 1010 | freeway/motorway | 1050 | municipal road |
| 1020 | highway/national primary road | 2700 | others |
| 3010 | prefectural road | | |

Code values in grey cells are defined in the Code lists proposed by the SIG 3D in CityGML.

Code list of the *Road* attributes *widthType*

http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Road_widthType.xml

| | | | |
|------|----------|------|------------|
| 1010 | 12m - | 9000 | Unexamined |
| 1020 | 4m - 12m | 9010 | Exception |
| 1030 | - 4m | 9020 | Unknown |

Code list of the *TransportationService* and *Road* attribute *urbanPlanType*

See Code list for the *UrbanPlan* attribute *class*

Code list of the *TransportationSrvce* and *Road* attribute *districtsAndZonesType*

See Code list for the *DistrictsAndZones* attribute class

Code list of the *TransportationSrvce* and *Road* attribute *landUsePlanType*

See Code list for the *LandUsePlan* attribute class in part 2

Code list of the *TransportationSrvce* and *Road* attribute *areaClassificationType*

See Code list for the *AreaClassification* attribute class in part 2

Code list of the *TransportationSrvce* and *Road* attribute *prefecture*

See Code list for the *Administration* attribute *prefecture* in part 2

Code lists for CityObjectGroup

Code list of the *CityObjectGroup* attribute *usage*

http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/CityObjectGroup_usage.xml

| | | | |
|------|------------|------|----------------|
| 1000 | lod1Storey | 2000 | urban planning |
| 1010 | lod2Storey | | |
| 1020 | lod3Storey | | |
| 1040 | lod4Storey | | |

Code values in grey cells are defined in the Code lists proposed by the SIG 3D in CityGML.

Code list of the *CityObjectGroup* attribute *language*

http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Common_language.xml

ISO 639-1:2002, Codes for the representation of names of languages — Part 1: Alpha-2 code

Part 2. Urban Function Data Encoding Specification

1. Scope

Plans and regulations are important information in urban development, landscape preservation, and disaster management. Information related to plans and regulation, such as administrative boundaries and zoning works, are conditions or constraints for spatial planning and are conceptual and virtual objects in urban areas.

This document defines conceptual and virtual objects in urban areas as “urban function objects” and specifies the encoding format of these objects.

2. Normative references

Followings are normative references of this document.

- OpenGIS® OGC City Geography Markup Language (CityGML) Encoding Standard, Version 2.0, OGC document 12-019

3. Conventions

3.1 Terms and definitions

No terms and definitions are listed in this document.

3.2 Abbreviated terms

ADE Application Domain Extensions

CityGML City Geography Markup Language

GML Geography Markup Language

OGC Open Geospatial Consortium

UML Unified Modeling Language

4. Urban Function Data Encoding

4.1 Overview

The Urban Function Data Encoding is an extension of CityGML. This document defines the elements and types according to the rules of the Application Domain Extensions (ADE) which are necessary for describing urban functions but not defined in CityGML. Those already defined in CityGML are imported without any inconsistency.

Figure 2-1 shows the structure of the Urban Function Data and the XMLSchema Definition is attached in Annex A.

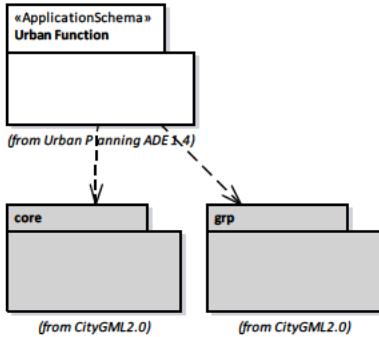


Figure 2-1 Package diagram of Urban Function Data

Urban function module defines conceptual and virtual objects such as administrative boundaries and zoning in urban areas. These objects (hereafter “urban function objects”) are not visible in the real world, but guide and lead city objects such as land use and building to what they should be. The urban function objects have associations with visible city object/objects to add them new functions.

| | |
|-------------------------------------|---|
| Module name | Urban Function |
| XML namespace identifier | http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/urf/1.4 |
| XMLSchema location | http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/schemas/urf/1.4/urbanFunction.xsd |
| Recommended namespace prefix | urf |
| Description | This module defines conceptual or virtual objects in the urban areas which give a meaning to specific area, boundary or position. e.g. Administration area, Urban planning area |

4.2 Object definition

4.2.1 UrbanFunctionType, _UrbanFunction

A *urf::UrbanFunction* is a root class of this module and inherits from *core::CityObjects*. The *urf::UrbanFunction* and its child elements can obtain its geometry directly or indirectly through associations. When it has an association with a city object, the city object is added enriched with a new function. For example, a substantial well-constructed public building (e.g. school) is designated as an evacuation shelter when a disaster occurs. Figure 2-2 shows the structure of *urf::UrbanFunction*.

A *uro::UrbanFunction* is represented in three levels of Levels of Detail (LOD): LOD-2 (minus two), LOD-1(minus one) and LOD0. The LOD-2 and LOD-1 are new LOD for a broad description of city models. These extended LODs enable user to describe rough city models which do not have to be detailed but should be necessary regional or national planning. This ExtendedLOD concept is described in Annex C of this document.

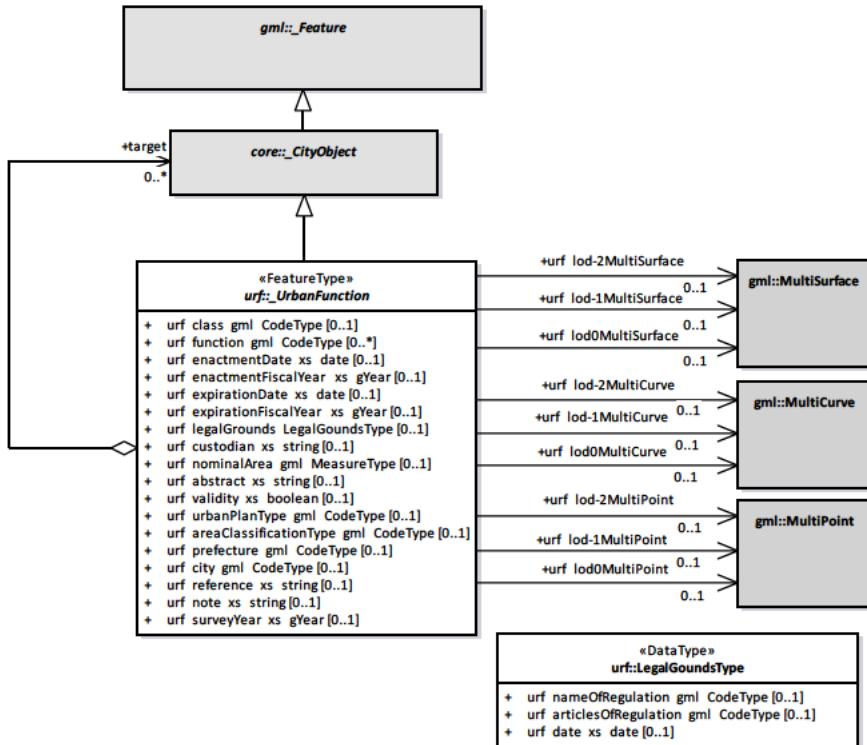


Figure 2-2 UML diagram of `urf::_UrbanFunction`

| Object | Definition |
|--|--|
| <code>urf::_UrbanFunction</code> | Conceptual and virtual objects which give a function to city objects. |
| Property | Definition |
| <code>urf::class</code> | Type of urban function |
| <code>urf::function</code> | Usage of urban function |
| <code>urf::enactmentDate</code> | Enactment date |
| <code>urf::enactmentFiscalYear</code> | Fiscal year of enactment |
| <code>urf::expirationDate</code> | Expiration date |
| <code>urf::expirationFiscalYear</code> | Fiscal year of expiration |
| <code>urf::legalGrounds</code> | Legal basis of the designation |
| <code>urf::custodian</code> | name of the party who designated the urban function |
| <code>urf::nominalArea</code> | nominal area of the designated area |
| <code>urf::abstract</code> | abstract description of the designated area |
| <code>urf::validity</code> | validity of the designation; valid, lapse or abolish valid : true, lapse or abolish : false |
| <code>urf::urbanPlanType</code> | Type of the location designated by Urban Plan |
| <code>urf::areaClassificationType</code> | Type of the location designated by Area classification |
| <code>urf::prefecture</code> | Prefecture name of the location |
| <code>urf::city</code> | City name of the location |
| <code>urf::reference</code> | reference information of the urban function |
| <code>urf::note</code> | Additional remarks |
| <code>urf::surveyYear</code> | The year when the traffic survey was performed. |
| <code>urf::lod0MultiSurface</code> | A specific area which someone may find useful or interesting at LOD0 level. |
| <code>urf::lod-1MultiSurface</code> | A specific area which someone may find useful or interesting at LOD-1 level. |
| <code>urf::lod-2MultiSurface</code> | A specific area which someone may find useful or interesting at LOD-2 level. |

| | |
|----------------------|---|
| urf::lod0MultiCurve | A specific linear location which someone may find useful or interesting at LOD0 level. |
| urf::lod-1MultiCurve | A specific linear location which someone may find useful or interesting at LOD-1 level. |
| urf::lod-2MultiCurve | A specific linear location which someone may find useful or interesting at LOD-2 level. |
| urf::lod0MultiPoint | A specific location which someone may find useful or interesting at LOD0 level. |
| urf::lod-1MultiPoint | A specific location which someone may find useful or interesting at LOD-1 level. |
| urf::lod-2MultiPoint | A specific location which someone may find useful or interesting at LOD-2 level. |
| urf::target | Reference to more than one city object. |

```

<xs:complexType name="UrbanFunctionType" abstract="true">
  <xs:complexContent>
    <xs:extension base="core:AbstractCityObjectType">
      <xs:sequence>
        <xs:element name="class" type="gml:CodeType" minOccurs="0"/>
        <xs:element name="function" type="gml:CodeType" minOccurs="0" maxOccurs="unbounded"/>
        <xs:element name="enactmentDate" type="xs:date" minOccurs="0"/>
        <xs:element name="enactmentFiscalYear" type="xs:gYear" minOccurs="0"/>
        <xs:element name="expirationDate" type="xs:date" minOccurs="0"/>
        <xs:element name="expirationFiscalYear" type="xs:gYear" minOccurs="0"/>
        <xs:element name="legalGrounds" type="LegalGroundsPropertyType" minOccurs="0"/>
        <xs:element name="custodian" type="xs:string" minOccurs="0"/>
        <xs:element name="nominalArea" type="gml:MeasureType" minOccurs="0"/>
        <xs:element name="abstract" type="xs:string" minOccurs="0"/>
        <xs:element name="validity" type="xs:boolean" minOccurs="0"/>
        <xs:element name="urbanPlanType" type="gml:CodeType" minOccurs="0"/>
        <xs:element name="areaClassificationType" type="gml:CodeType" minOccurs="0"/>
        <xs:element name="prefecture" type="gml:CodeType" minOccurs="0"/>
        <xs:element name="city" type="gml:CodeType" minOccurs="0"/>
        <xs:element name="reference" type="xs:string" minOccurs="0"/>
        <xs:element name="note" type="xs:string" minOccurs="0"/>
        <xs:element name="surveyYear" type="xs:gYear" minOccurs="0"/>
        <xs:element name="lod0MultiSurface" type="gml:MultiSurfacePropertyType" minOccurs="0"/>
        <xs:element name="lod-1MultiSurface" type="gml:MultiSurfacePropertyType" minOccurs="0"/>
        <xs:element name="lod-2MultiSurface" type="gml:MultiSurfacePropertyType" minOccurs="0"/>
        <xs:element name="lod0MultiCurve" type="gml:MultiCurvePropertyType" minOccurs="0"/>
        <xs:element name="lod-1CurveSurface" type="gml:MultiCurvePropertyType" minOccurs="0"/>
        <xs:element name="lod-2CurveSurface" type="gml:MultiCurvePropertyType" minOccurs="0"/>
        <xs:element name="lod0MultiPoint" type="gml:MultiPointPropertyType" minOccurs="0"/>
        <xs:element name="lod-1MultiPoint" type="gml:MultiPointPropertyType" minOccurs="0"/>
        <xs:element name="lod-2MultiPoint" type="gml:MultiPointPropertyType" minOccurs="0"/>
        <xs:element name="target" type="TargetPropertyType" minOccurs="0" maxOccurs="unbounded"/>
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>

<xs:element name="_UrbanFunction" type="UrbanFunctionType" abstract="true"
substitutionGroup="core:_CityObject"/>

<xs:complexType name="TargetPropertyType">
  <xs:sequence minOccurs="0">
    <xs:element ref="core:_CityObject"/>
  </xs:sequence>
  <xs:attributeGroup ref="gml:AssociationAttributeGroup"/>

```

```
</xs:complexType>
<!-- ===== -->
```

The type “TargetPropertyType” is used for an association with a *core:CityObject*.

4.2.2 LegalGroundsType

| Type | Definition |
|---------------------------|-------------------------------------|
| urf::LegalGroundsType | Legal grounds of the urban function |
| Property | Definition |
| urf::nameOfRegulation | Name of the related regulation |
| urf::articlesOfRegulation | Articles number of the regulation |
| urf::date | Issued date |

```
<xs:complexType name="LegalGroundsType">
<xs:sequence>
  <xs:element name="nameOfRegulation" type="gml:CodeType" minOccurs="0"/>
  <xs:element name="articlesOfRegulation" type="gml:CodeType" minOccurs="0"/>
  <xs:element name="date" type="xs:date" minOccurs="0"/>
</xs:sequence>
</xs:complexType>
<!-- ===== -->
<xs:element name="LegalGrounds" type="LegalGroundsType"/>
<!-- ===== -->
<xs:complexType name="LegalGroundsPropertyType">
<xs:sequence minOccurs="0">
  <xs:element ref="LegalGrounds"/>
</xs:sequence>
</xs:complexType>
```

Specific objects such as administrative boundary and land use regulation are defined as subclasses of *urf:UrbanFunction* (Figure 2-3).

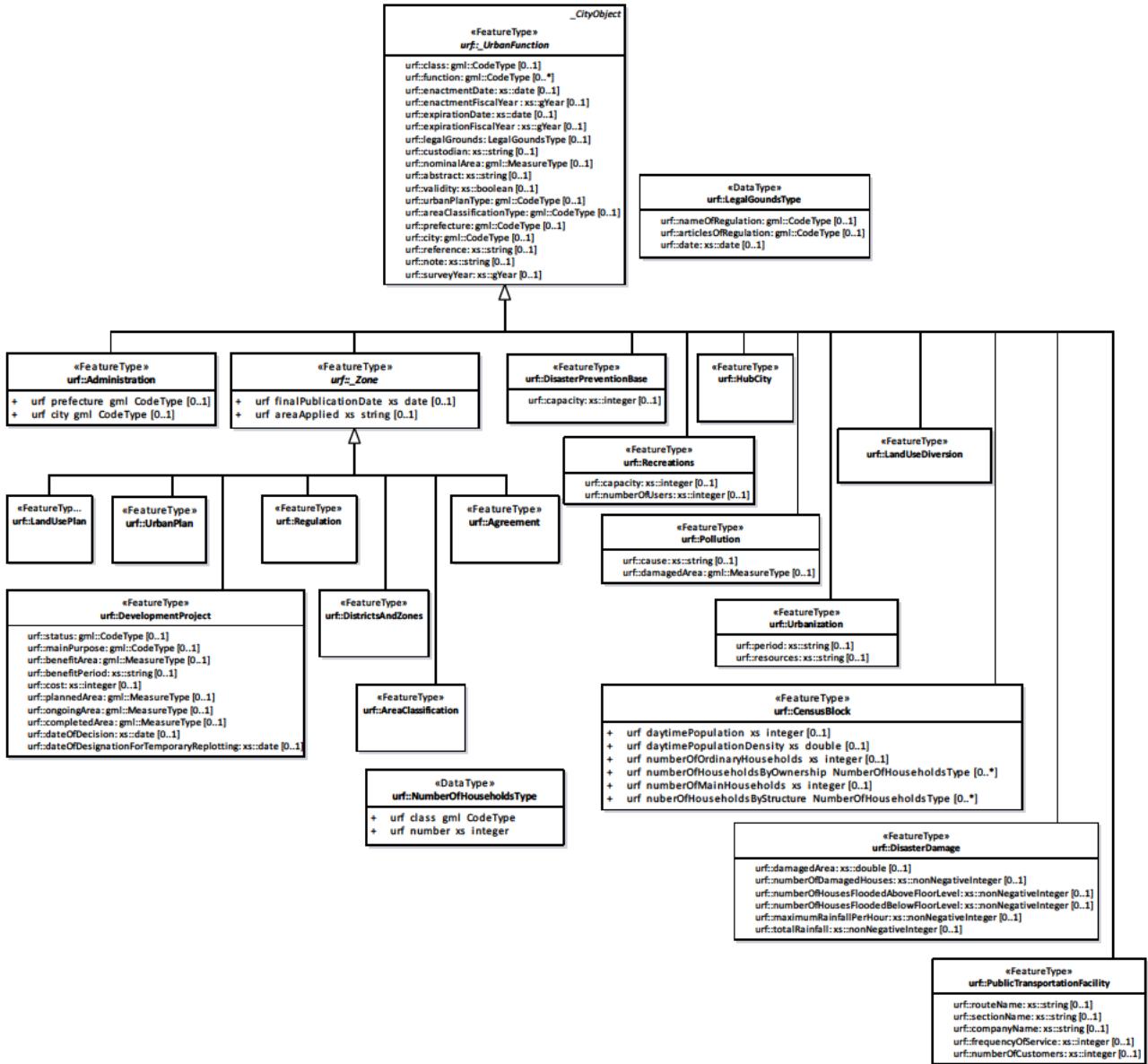


Figure 2-3 Subclasses of *urf::_UrbanFunction*

4.2.3 AdministrationType, Administration

| Object | Definition |
|---------------------|---|
| urf::Administration | Territorial units which an administrative section is divided into |

```

<xs:complexType name="AdministrationType">
  <xs:complexContent>
    <xs:extension base="UrbanFunctionType" />
  </xs:complexContent>
</xs:complexType>
<xs:element name="Administration" type="AdministrationType" substitutionGroup="_UrbanFunction" />

```

4.2.4 ZoneType, Zone

| Object | Definition |
|---------------------------|--|
| urf::_Zone | Root class of designated area |
| Property | Definition |
| urf::finalPublicationDate | Final publication date of the zone designation |

| | |
|------------------|--------------------------|
| urf::areaApplied | Name of the area applied |
|------------------|--------------------------|

```

<xs:complexType name="ZoneType" abstract="true">
<xs:annotation>
  <xs:documentation>zoning district</xs:documentation>
</xs:annotation>
<xs:complexContent>
  <xs:extension base="UrbanFunctionType">
    <xs:sequence>
      <xs:element name="finalPublicationDate" type="xs:date" minOccurs="0"/>
      <xs:element name="areaApplied" type="xs:string" minOccurs="0"/>
    </xs:sequence>
  </xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:element name="_Zone" type="ZoneType" abstract="true" substitutionGroup="_UrbanFunction"/>
```

4.2.5 LandUsePlanType, LandUsePlan

| Object | Definition |
|------------------|---|
| urf::LandUsePlan | Land use plan designated in accordance with land use regulation |

```

<xs:complexType name="LandUsePlanType">
<xs:complexContent>
  <xs:extension base="ZoneType"/>
</xs:complexContent>
</xs:complexType>
<xs:element name="LandUsePlan" type="LandUsePlanType" substitutionGroup="_Zone"/>
```

4.2.6 UrbanPlanType, UrbanPlan

| Object | Definition |
|----------------|---|
| urf::UrbanPlan | An area designated in accordance with City Planning Act |

```

<xs:complexType name="UrbanPlanType">
<xs:complexContent>
  <xs:extension base="ZoneType"/>
</xs:complexContent>
</xs:complexType>
<xs:element name="UrbanPlan" type="UrbanPlanType" substitutionGroup="_Zone"/>
```

4.2.7 AgreementType, Agreement

| Object | Definition |
|-----------------|--|
| urf:: Agreement | An area specified by the agreement between the parties upon negotiated in order to avoid conflict, competition, etc. |

```

<xs:complexType name="AgreementType" abstract="true">
<xs:complexContent>
  <xs:extension base="ZoneType"/>
</xs:complexContent>
</xs:complexType>
<xs:element name="Agreement" type="AgreementType" substitutionGroup="_Zone"/>
```

4.2.8 RegulationType, Regulation

| Object | Definition |
|------------------|--|
| urf:: Regulation | A specified area or location which is regulated. |

```

<xs:complexType name="RegulationType" abstract="true">
  <xs:complexContent>
    <xs:extension base="ZoneType"/>
  </xs:complexContent>
</xs:complexType>
<xs:element name="Regulation" type="RegulationType" substitutionGroup="_Zone"/>

```

4.2.9 DevelopmentProjectType, DevelopmentProject

| Object | Definition |
|--|---|
| urf:: DevelopmentProject | Scheduled or developed areas by development project |
| Property | Definition |
| urf::status | Status of the project |
| urf::mainPurpose | Purpose of the project |
| urf::benefitArea | Benefit area by the project |
| urf::benefitPeriod | Benefit period by the project |
| urf::cost | Project cost |
| urf::plannedArea | Planned area in the project |
| urf::ongoingArea | Ongoing area in the project |
| urf::completedArea | Completed area in the project |
| urf::dateOfDecision | Date on which project implementation was decided |
| urf::dateOfDesignationForTemporaryReplotting | Date on which temporary replotting was designated |

```

<xs:complexType name="DevelopmentProjectType">
  <xs:complexContent>
    <xs:extension base="ZoneType">
      <xs:sequence>
        <xs:element name="status" type="gml:CodeType" minOccurs="0"/>
        <xs:element name="mainPurpose" type="gml:CodeType" minOccurs="0"/>
        <xs:element name="benefitArea" type="gml:MeasureType" minOccurs="0"/>
        <xs:element name="benefitPeriod" type="xs:string" minOccurs="0"/>
        <xs:element name="cost" type="xs:integer" minOccurs="0"/>
        <xs:element name="plannedArea" type="gml:MeasureType" minOccurs="0"/>
        <xs:element name="ongoingArea" type="gml:MeasureType" minOccurs="0"/>
        <xs:element name="completedArea" type="gml:MeasureType" minOccurs="0"/>
        <xs:element name="dateOfDecision" type="xs:date" minOccurs="0"/>
        <xs:element name="dateOfDesignationForTemporaryReplotting" type="xs:date" minOccurs="0"/>
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>
<xs:element name="DevelopmentProject" type="DevelopmentProjectType" substitutionGroup="_Zone"/>
<xs:complexType name="DevelopmentProjectPropertyType">
  <xs:sequence minOccurs="0">
    <xs:element ref="DevelopmentProject"/>
  </xs:sequence>
  <xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>

```

4.2.10 AreaClassificationType, AreaClassification

| Object | Definition |
|-------------------------|--|
| urf::AreaClassification | Classification between urbanization promotion areas and urbanization control areas |

```

<xs:complexType name="AreaClassificationType">

```

```

<xs:complexContent>
  <xs:extension base="ZoneType"/>
</xs:complexContent>
</xs:complexType>
<xs:element name="AreaClassification" type="AreaClassificationType" substitutionGroup="_Zone"/>

```

4.2.11 DistrictsAndZonesType, DistrictsAndZones

| Object | Definition |
|------------------------|--|
| urf::DistrictsAndZones | Districts, zones and blocks established as necessary regarding urban planning area |

```

<xs:complexType name="DistrictsAndZonesType">
  <xs:complexContent>
    <xs:extension base="ZoneType"/>
  </xs:complexContent>
</xs:complexType>
<!-- ===== -->
<xs:element name="DistrictsAndZones" type="DistrictsAndZonesType" substitutionGroup="_Zone"/>

```

4.2.12 CensusBlockType, CensusBlock

| Object | Definition |
|------------------------------------|--|
| urf::CensusBlock | Census survey unit |
| Property | Definition |
| urf::daytimePopulation | Daytime population |
| urf::daytimePopulationDensity | Daytime population density |
| urf::numberOfOrdinaryHouseholds | Total number of ordinary households those who dwell under the same roof and compose a family |
| urf::numberOfHouseholdsByOwnership | Number of households by house ownership |
| urf::numberOfMainHouseholds | Number of main households except households living in lodgings |
| urf::numberOfHouseholdsByStructure | Number of households by house structure |

```

<xs:complexType name="CensusBlockType">
  <xs:annotation>
    <xs:documentation>Block for census survey</xs:documentation>
  </xs:annotation>
  <xs:complexContent>
    <xs:extension base="UrbanFunctionType">
      <xs:sequence>
        <xs:element name="daytimePopulation" type="xs:integer" minOccurs="0"/>
        <xs:element name="daytimePopulationDensity" type="xs:double" minOccurs="0"/>
        <xs:element name="numberOfOrdinaryHouseholds" type="xs:integer" minOccurs="0"/>
        <xs:element name="numberOfHouseholdsByOwnership" type="NumberOfHouseholdsPropertyType" minOccurs="0"
maxOccurs="unbounded"/>
          <xs:element name="numberOfMainHouseholds" type="xs:integer" minOccurs="0"/>
          <xs:element name="numberOfHouseholdsByStruture" type="NumberOfHouseholdsPropertyType" minOccurs="0"
maxOccurs="unbounded"/>
        </xs:sequence>
      </xs:extension>
    </xs:complexContent>
  </xs:complexType>
<!-- ===== -->
<xs:element name="CensusBlock" type="CensusBlockType" substitutionGroup="_UrbanFunction"/>
<xs:complexType name="CensusBlockPropertyType">
  <xs:sequence minOccurs="0">

```

```

<xs:element ref="CensusBlock"/>
</xs:sequence>
<xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>

```

NumberOfHouseholdsType

| Type | Definition |
|------------------------------|------------------------------------|
| urf:: NumberOfHouseholdsType | Number of households by house type |
| Property | Definition |
| urf::class | Type of house ownership |
| urf::number | Number of households |

```

<xs:element name="NumberOfHouseholds" type="NumberOfHouseholdsType"/>
<xs:complexType name="NumberOfHouseholdsType">
<xs:sequence>
  <xs:element name="class" type="gml:CodeType"/>
  <xs:element name="number" type="xs:integer"/>
</xs:sequence>
</xs:complexType>
<xs:complexType name="NumberOfHouseholdsPropertyType">
<xs:sequence>
  <xs:element ref="NumberOfHouseholds"/>
</xs:sequence>
</xs:complexType>

```

4.2.13 DisasterDamageType, DisasterDamage

| Object | Definition |
|---|--|
| urf::DisasterDamage | Damaged area or location of disaster |
| Property | Definition |
| urf::damagedArea | Area of the disaster affected area |
| urf::numberOfDamagedHouses | Number of houses damaged by the disaster |
| urf::numberOfHousesFloodedAboveFloorLevel | Number of houses flooded above floor level |
| urf::numberOfHousesFloodedBelowFloorLevel | Number of houses flooded below floor level |
| urf::maximumRainfallPerHour | Maximum rainfall per hour |
| urf::totalRainfall | Total rainfall |

```

<xs:complexType name="DisasterDamageType">
<xs:complexContent>
  <xs:extension base="UrbanFunctionType">
    <xs:sequence>
      <xs:element name="damagedArea" type="gml:MeasureType" minOccurs="0"/>
      <xs:element name="numberOfDamagedHouses" type="xs:nonNegativeInteger" minOccurs="0"/>
      <xs:element name="numberOfHousesFloodedAboveFloorLevel" type="xs:nonNegativeInteger" minOccurs="0"/>
      <xs:element name="numberOfHousesFloodedBelowFloorLevel" type="xs:nonNegativeInteger" minOccurs="0"/>
      <xs:element name="maximumRainfallPerHour" type="xs:nonNegativeInteger" minOccurs="0"/>
      <xs:element name="totalRainfall" type="xs:nonNegativeInteger" minOccurs="0"/>
    </xs:sequence>
  </xs:extension>
</xs:complexContent>
</xs:complexType>
<!-- ===== -->
<xs:element name="DisasterDamage" type="DisasterDamageType" substitutionGroup="_UrbanFunction"/>

```

4.2.14 PollutionType, Pollution

| Object | Definition |
|------------------|-------------------------------------|
| urf::Pollution | Pollution source |
| Property | Definition |
| urf::cause | Description of the pollution source |
| urf::damagedArea | Area of the disaster affected area |

```

<xs:complexType name="PollutionType">
  <xs:annotation>
    <xs:documentation>Source of pollution</xs:documentation>
  </xs:annotation>
  <xs:complexContent>
    <xs:extension base="UrbanFunctionType">
      <xs:sequence>
        <xs:element name="damagedArea" type="gml:MeasureType" minOccurs="0"/>
        <xs:element name="cause" type="xs:string" minOccurs="0"/>
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>
<!-- ===== -->
<xs:element name="Pollution" type="PollutionType" substitutionGroup="_UrbanFunction"/>
<xs:complexType name="PollutionPropertyType">
  <xs:sequence minOccurs="0">
    <xs:element ref="Pollution"/>
  </xs:sequence>
  <xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>

```

4.2.15 DisasterPreventionBaseType, DisasterPreventionBase

| Object | Definition |
|-----------------------------|--|
| urf::DisasterPreventionBase | Off-site center and shelter during disaster |
| Property | Definition |
| urf::capacity | Maximum number of people who can be accommodated |

```

<xs:complexType name="DisasterPreventionBaseType">
  <xs:complexContent>
    <xs:extension base="UrbanFunctionType">
      <xs:sequence>
        <xs:element name="capacity" type="xs::integer" minOccurs="0"/>
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>
<!-- ===== -->
<xs:element name="DisasterPreventionBase" type="DisasterPreventionBaseType" substitutionGroup="_UrbanFunction"/>
<!-- ===== -->
<xs:complexType name="DisasterPreventionBasePropertyType">
  <xs:sequence minOccurs="0">
    <xs:element ref="DisasterPreventionBase"/>
  </xs:sequence>
  <xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>

```

4.2.16 RecreationsType, Recreations

| Object | Definition |
|--------------------|--|
| urf::Recreations | Facilities for recreation |
| Property | Definition |
| urf::capacity | Total area of the facilities |
| urf::numberOfUsers | Number of annual users of the facilities |

```

<xs:complexType name="RecreationsType">
  <xs:complexContent>
    <xs:extension base="urf:UrbanFunctionType">
      <xs:sequence>
        <xs:element name="capacity" type="xs:integer" minOccurs="0"/>
        <xs:element name="numberOfUsers" type="xs:integer" minOccurs="0"/>
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>
<!-- ===== -->
<xs:element name="Recreations" type="urf:RecreationsType" substitutionGroup="urf:_UrbanFunction"/>
<xs:complexType name="Recreations.PropertyType">
  <xs:sequence minOccurs="0">
    <xs:element ref="urf:Recreations"/>
  </xs:sequence>
  <xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>

```

4.2.17 HubCityType, HubCity

| Object | Definition |
|---------------|-------------------------------------|
| urf:: HubCity | Regional core urban areas or cities |

```

<xs:complexType name="HubCityType">
  <xs:complexContent>
    <xs:extension base="UrbanFunctionType"/>
  </xs:complexContent>
</xs:complexType>
<!-- ===== -->
<xs:element name="HubCity" type="HubCityType" substitutionGroup="_UrbanFunction"/>
<!-- ===== -->
<xs:complexType name="HubCity.PropertyType">
  <xs:sequence minOccurs="0">
    <xs:element ref="HubCity"/>
  </xs:sequence>
  <xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>

```

4.2.18 LandUseDiversionType, LandUseDiversion

| Object | Definition |
|-----------------------|-----------------------|
| urf::LandUseDiversion | Change of the landuse |

```

<xs:complexType name="LandUseDiversionType">
  <xs:complexContent>
    <xs:extension base="UrbanFunctionType"/>
  </xs:complexContent>
</xs:complexType>
<!-- ===== -->

```

```

<xs:element name="LandUseDiversion" type="LandUseDiversionType" substitutionGroup="_UrbanFunction"/>
<xs:complexType name="LandUseDiversionPropertyType">
<xs:sequence minOccurs="0">
  <xs:element ref="LandUseDiversion"/>
</xs:sequence>
<xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>

```

4.2.19 UrbanizationType, Urbanization

| Object | Definition |
|-------------------|--------------------------------------|
| urf::Urbanization | Change of the urban area |
| Property | Definition |
| urf::period | Name of ege or era of the urban area |
| urf::resources | Name of the resources |

```

<xs:complexType name="UrbanizationType">
<xs:complexContent>
  <xs:extension base="UrbanFunctionType">
    <xs:sequence>
      <xs:element name="period" type="xs:string" minOccurs="0"/>
      <xs:element name="resources" type="xs:string" minOccurs="0"/>
    </xs:sequence>
  </xs:extension>
</xs:complexContent>
</xs:complexType>
<!-- ===== -->
<xs:element name="Urbanization" type="UrbanizationType" substitutionGroup="_UrbanFunction"/>
<xs:complexType name="UrbanizationPropertyType">
<xs:sequence minOccurs="0">
  <xs:element ref="Urbanization"/>
</xs:sequence>
<xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>

```

4.2.20 PublicTransportationFacilityType, PublicTransportationFacility

| Type | Definition |
|------------------------------------|--|
| urf:: PublicTransportationFacility | Information for public transportation facility |
| Property | Definition |
| urf::routeName | Name of the route |
| urf::sectionName | Name of the section |
| urf::companyName | Name of the operating company |
| urf::frequencyOfService | Number of times for operation per day |
| urf::numberOfCustomers | Total number of customers per day |

```

<xs:complexType name="PublicTransportationFacilityType">
<xs:complexContent>
  <xs:extension base="urf:UrbanFunctionType">
    <xs:sequence>
      <xs:element name="routeName" type="xs:string" minOccurs="0"/>
      <xs:element name="sectionName" type="xs:string" minOccurs="0"/>
      <xs:element name="companyName" type="xs:string" minOccurs="0"/>
      <xs:element name="frequencyOfService" type="xs:integer" minOccurs="0"/>
      <xs:element name="numberOfCustomers" type="xs:double" minOccurs="0"/>
    </xs:sequence>
  </xs:extension>
</xs:complexContent>

```

```

</xs:complexContent>
</xs:complexType>
<!-- ===== -->
<xs:element name="PublicTransportationFacility" type="urf:PublicTransportationFacilityType"/>
<!-- ===== -->
<xs:complexType name="PublicTransportationFacilityPropertyType">
<xs:sequence minOccurs="0">
<xs:element ref="urf:PublicTransportationFacility"/>
</xs:sequence>
<xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>

```

4.2.21 Extended properties of CityObjectGroup

A *grp::CityObjectGroup* inherits attributes from the parent class *core::_CityObject*. The attribute *core::creationDate* shows the date of dataset creation.

The *groupMember* property of *grp::CityObjectGroup* may contain a *core::_CityObject* element inline or an XLink reference to a remote *core::_CityObject* element, therefore extended city objects defined in this specification may also be contained in or referred from a *grp::CityObjectGroup*. XLink reference prevents data duplication and enables multiple use of the *CityObjects*. The attribute *grp::usage* which is inherited from *grp::CityObjectGroup* can represent that this object group is for the use of urban planning.

Two elements, *urf::fiscalYearOfPublication* and *urf::language* are added as members of the substitution group *grp::_GenericApplicationPropertyOfCityObjectGroup*. A *urf::fiscalYear* is used to describe the year when the result of data collection has been published and a *urf::language* clarifies the language used in the city objects.

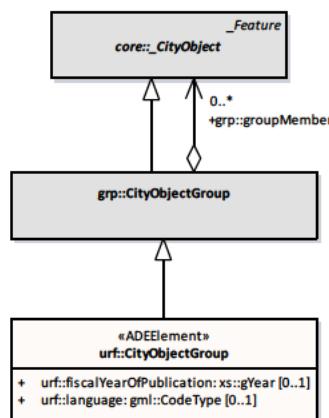


Figure 2-4 Extension of grp::CityObjectGroup

Extended properties of CityObjectGroup

| Property | Definition |
|------------------------------|---|
| urf::fiscalYearOfPublication | Fiscal year when the group has been published |
| urf::language | Language used in the group |

```

<xs:element name="fiscalYearOfPublication" type="xs:gYear"
substitutionGroup="grp::_GenericApplicationPropertyOfCityObjectGroup"/>
<xs:element name="language" type="gml:CodeType"
substitutionGroup="grp::_GenericApplicationPropertyOfCityObjectGroup"/>

```

Annex A (normative)

XMLSchema Definition

A.1 XMLSchema

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:urf="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/urf/1.4"
  xmlns:core="http://www.opengis.net/citygml/2.0" xmlns:grp="http://www.opengis.net/citygml/cityobjectgroup/2.0"
  xmlns:xs="http://www.w3.org/2001/XMLSchema" xmlns:gml="http://www.opengis.net/gml"
  targetNamespace="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/urf/1.4"
  elementFormDefault="qualified" attributeFormDefault="unqualified" version="1.4">
  <xs:annotation>
    <xs:documentation>XML Schema for Urban Function module</xs:documentation>
  </xs:annotation>
  <xs:import namespace="http://www.opengis.net/gml"
    schemaLocation="http://schemas.opengis.net/gml/3.1.1/base/gml.xsd"/>
  <xs:import namespace="http://www.opengis.net/citygml/2.0"
    schemaLocation="http://schemas.opengis.net/citygml/2.0/cityGMLBase.xsd"/>
  <xs:import namespace="http://www.opengis.net/citygml/cityobjectgroup/2.0"
    schemaLocation="http://schemas.opengis.net/citygml/cityobjectgroup/2.0/cityObjectGroup.xsd"/>
  <!-- ===== -->
  <!-- ===== CityGML UrbanFunction module ===== -->
  <!-- ===== -->
  <xs:complexType name="UrbanFunctionType" abstract="true">
    <xs:annotation>
      <xs:documentation>The root type for urban function. As subclass of _CityObject, an
        _UrbanFunction inherits all attributes and relations, in particular description, an
        id, names and description from _AbstractFeature. </xs:documentation>
    </xs:annotation>
    <xs:complexContent>
      <xs:extension base="core:AbstractCityObjectType">
        <xs:sequence>
          <xs:element name="class" type="gml:CodeType" minOccurs="0"/>
          <xs:element name="function" type="gml:CodeType" minOccurs="0" maxOccurs="unbounded"/>
          <xs:element name="enactmentDate" type="xs:date" minOccurs="0"/>
          <xs:element name="enactmentFiscalYear" type="xs:gYear" minOccurs="0"/>
          <xs:element name="expirationDate" type="xs:date" minOccurs="0"/>
          <xs:element name="expirationFiscalYear" type="xs:gYear" minOccurs="0"/>
          <xs:element name="legalGrounds" type="urf:LegalGroundsPropertyType" minOccurs="0"/>
          <xs:element name="custodian" type="xs:string" minOccurs="0"/>
          <xs:element name="nominalArea" type="gml:MeasureType" minOccurs="0"/>
          <xs:element name="abstract" type="xs:string" minOccurs="0"/>
          <xs:element name="validity" type="xs:boolean" minOccurs="0"/>
          <xs:element name="urbanPlanType" type="gml:CodeType" minOccurs="0"/>
          <xs:element name="areaClassificationType" type="gml:CodeType" minOccurs="0"/>
          <xs:element name="prefecture" type="gml:CodeType" minOccurs="0"/>
          <xs:element name="city" type="gml:CodeType" minOccurs="0"/>
          <xs:element name="reference" type="xs:string" minOccurs="0"/>
          <xs:element name="note" type="xs:string" minOccurs="0"/>
          <xs:element name="surveyYear" type="xs:gYear" minOccurs="0"/>
          <xs:element name="lod0MultiSurface" type="gml:MultiSurfacePropertyType" minOccurs="0"/>
          <xs:element name="lod-1MultiSurface" type="gml:MultiSurfacePropertyType" minOccurs="0"/>
          <xs:element name="lod-2MultiSurface" type="gml:MultiSurfacePropertyType" minOccurs="0"/>
          <xs:element name="lod0MultiCurve" type="gml:MultiCurvePropertyType" minOccurs="0"/>
          <xs:element name="lod-1MultiCurve" type="gml:MultiCurvePropertyType" minOccurs="0"/>
```

```

<xs:element name="lod-2MultiCurve" type="gml:MultiCurvePropertyType" minOccurs="0"/>
<xs:element name="lod0MultiPoint" type="gml:MultiPointPropertyType" minOccurs="0"/>
<xs:element name="lod-1MultiPoint" type="gml:MultiPointPropertyType" minOccurs="0"/>
<xs:element name="lod-2MultiPoint" type="gml:MultiPointPropertyType" minOccurs="0"/>
<xs:element name="target" type="urf:TargetPropertyType" minOccurs="0" maxOccurs="unbounded"/>
</xs:sequence>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<!-- ===== -->
<xs:element name="_UrbanFunction" type="urf:UrbanFunctionType" abstract="true"
substitutionGroup="core:_CityObject"/>
<!-- ===== -->
<xs:element name="LegalGrounds" type="urf:LegalGroundsType"/>
<xs:complexType name="LegalGroundsType">
<xs:sequence>
<xs:element name="nameOfRegulation" type="gml:CodeType" minOccurs="0"/>
<xs:element name="articlesOfRegulation" type="gml:CodeType" minOccurs="0"/>
<xs:element name="date" type="xs:date" minOccurs="0"/>
</xs:sequence>
</xs:complexType>
<!-- ===== -->
<xs:complexType name="LegalGrounds.PropertyType">
<xs:sequence minOccurs="0">
<xs:element ref="urf:LegalGrounds"/>
</xs:sequence>
</xs:complexType>
<!-- ===== -->
<xs:complexType name="Target.PropertyType">
<xs:sequence minOccurs="0">
<xs:element ref="core:_CityObject"/>
</xs:sequence>
<xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>
<!-- ===== -->
<xs:complexType name="AdministrationType">
<xs:complexContent>
<xs:extension base="urf:UrbanFunctionType"/>
</xs:complexContent>
</xs:complexType>
<!-- ===== -->
<xs:element name="Administration" type="urf:AdministrationType" substitutionGroup="urf:_UrbanFunction"/>
<!-- ===== -->
<xs:complexType name="ZoneType" abstract="true">
<xs:annotation>
<xs:documentation>zoning district</xs:documentation>
</xs:annotation>
<xs:complexContent>
<xs:extension base="urf:UrbanFunctionType">
<xs:sequence>
<xs:element name="finalPublicationDate" type="xs:date" minOccurs="0"/>
<xs:element name="areaApplied" type="xs:string" minOccurs="0"/>
</xs:sequence>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<!-- ===== -->
<xs:element name="_Zone" type="urf:ZoneType" abstract="true" substitutionGroup="urf:_UrbanFunction"/>
<!-- ===== -->
<xs:complexType name="LandUsePlanType">

```

```

<xs:complexContent>
  <xs:extension base="urf:ZoneType"/>
</xs:complexContent>
</xs:complexType>
<!-- ===== -->
<xs:element name="LandUsePlan" type="urf:LandUsePlanType" substitutionGroup="urf:_Zone"/>
<xs:complexType name="LandUsePlanPropertyType">
  <xs:sequence minOccurs="0">
    <xs:element ref="urf:LandUsePlan"/>
  </xs:sequence>
  <xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>
<!-- ===== -->
<xs:complexType name="UrbanPlanType">
  <xs:annotation>
    <xs:documentation>Urban planning area</xs:documentation>
  </xs:annotation>
  <xs:complexContent>
    <xs:extension base="urf:ZoneType">
      <xs:sequence/>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>
<!-- ===== -->
<xs:element name="UrbanPlan" type="urf:UrbanPlanType" substitutionGroup="urf:_Zone"/>
<xs:complexType name="UrbanPlanPropertyType">
  <xs:sequence minOccurs="0">
    <xs:element ref="urf:UrbanPlan"/>
  </xs:sequence>
  <xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>
<!-- ===== -->
<xs:complexType name="AgreementType">
  <xs:annotation>
    <xs:documentation>Area specified area by the agreement between the parties agreed upon
      and negotiated in order to avoid conflict, competition, etc.,</xs:documentation>
  </xs:annotation>
  <xs:complexContent>
    <xs:extension base="urf:ZoneType">
      <xs:sequence/>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>
<!-- ===== -->
<xs:element name="Agreement" type="urf:AgreementType" substitutionGroup="urf:_Zone"/>
<xs:complexType name="AgreementPropertyType">
  <xs:sequence minOccurs="0">
    <xs:element ref="urf:Agreement"/>
  </xs:sequence>
  <xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>
<!-- ===== -->
<xs:complexType name="RegulationType">
  <xs:complexContent>
    <xs:extension base="urf:ZoneType">
      <xs:sequence/>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>

```

```

<!-- ===== -->
<xs:element name="Regulation" type="urf:RegulationType" substitutionGroup="urf:_Zone"/>
<xs:complexType name="Regulation.PropertyType">
<xs:sequence minOccurs="0">
<xs:element ref="urf:Regulation"/>
</xs:sequence>
<xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>
<!-- ===== -->
<xs:complexType name="AreaClassificationType">
<xs:complexContent>
<xs:extension base="urf:ZoneType">
<xs:sequence/>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<!-- ===== -->
<xs:element name="AreaClassification" type="urf:AreaClassificationType" substitutionGroup="urf:_Zone"/>
<xs:complexType name="AreaClassification.PropertyType">
<xs:sequence minOccurs="0">
<xs:element ref="urf:AreaClassification"/>
</xs:sequence>
<xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>
<!-- ===== -->
<xs:complexType name="DistrictsAndZonesType">
<xs:complexContent>
<xs:extension base="urf:ZoneType">
<xs:sequence/>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<!-- ===== -->
<xs:element name="DistrictsAndZones" type="urf:DistrictsAndZonesType" substitutionGroup="urf:_Zone"/>
<xs:complexType name="DistrictsAndZones.PropertyType">
<xs:sequence minOccurs="0">
<xs:element ref="urf:DistrictsAndZones"/>
</xs:sequence>
<xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>
<!-- ===== -->
<xs:complexType name="DevelopmentProjectType">
<xs:complexContent>
<xs:extension base="urf:ZoneType">
<xs:sequence>
<xs:element name="status" type="gml:CodeType" minOccurs="0"/>
<xs:element name="mainPurpose" type="gml:CodeType" minOccurs="0"/>
<xs:element name="benefitArea" type="gml:MeasureType" minOccurs="0"/>
<xs:element name="benefitPeriod" type="xs:string" minOccurs="0"/>
<xs:element name="cost" type="xs:integer" minOccurs="0"/>
<xs:element name="plannedArea" type="gml:MeasureType" minOccurs="0"/>
<xs:element name="ongoingArea" type="gml:MeasureType" minOccurs="0"/>
<xs:element name="completedArea" type="gml:MeasureType" minOccurs="0"/>
<xs:element name="dateOfDecision" type="xs:date" minOccurs="0"/>
<xs:element name="dateOfDesignationForTemporaryReplotting" type="xs:date" minOccurs="0"/>
</xs:sequence>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<!-- ===== -->

```

```

<xs:element name="DevelopmentProject" type="urf:DevelopmentProjectType" substitutionGroup="urf:_Zone"/>
<xs:complexType name="DevelopmentProjectPropertyType">
<xs:sequence minOccurs="0">
<xs:element ref="urf:DevelopmentProject"/>
</xs:sequence>
<xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>
<!-- ===== -->
<xs:complexType name="CensusBlockType">
<xs:annotation>
<xs:documentation>Block for census survey</xs:documentation>
</xs:annotation>
<xs:complexContent>
<xs:extension base="urf:UrbanFunctionType">
<xs:sequence>
<xs:element name="daytimePopulation" type="xs:integer" minOccurs="0"/>
<xs:element name="daytimePopulationDensity" type="xs:double" minOccurs="0"/>
<xs:element name="numberOfOrdinaryHouseholds" type="xs:integer" minOccurs="0"/>
<xs:element name="numberOfHouseholdsByOwnership" type="urf:NumberOfHouseholdsPropertyType"
minOccurs="0" maxOccurs="unbounded"/>
<xs:element name="numberOfMainHouseholds" type="xs:integer" minOccurs="0"/>
<xs:element name="numberOfHouseholdsByStruture" type="urf:NumberOfHouseholdsPropertyType" minOccurs="0"
maxOccurs="unbounded"/>
</xs:sequence>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<!-- ===== -->
<xs:element name="CensusBlock" type="urf:CensusBlockType" substitutionGroup="urf:_UrbanFunction"/>
<xs:complexType name="CensusBlockPropertyType">
<xs:sequence minOccurs="0">
<xs:element ref="urf:CensusBlock"/>
</xs:sequence>
<xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>
<!-- ===== -->
<xs:element name="NumberOfHouseholds" type="urf:NumberOfHouseholdsType"/>
<xs:complexType name="NumberOfHouseholdsType">
<xs:sequence>
<xs:element name="class" type="gml:CodeType"/>
<xs:element name="number" type="xs:integer"/>
</xs:sequence>
</xs:complexType>
<xs:complexType name="NumberOfHouseholdsPropertyType">
<xs:sequence>
<xs:element ref="urf:NumberOfHouseholds"/>
</xs:sequence>
</xs:complexType>
<!-- ===== -->
<xs:complexType name="DisasterDamageType">
<xs:complexContent>
<xs:extension base="urf:UrbanFunctionType">
<xs:sequence>
<xs:element name="damagedArea" type="gml:MeasureType" minOccurs="0"/>
<xs:element name="numberOfDamagedHouses" type="xs:nonNegativeInteger" minOccurs="0"/>
<xs:element name="numberOfHousesFloodedAboveFloorLevel" type="xs:nonNegativeInteger" minOccurs="0"/>
<xs:element name="numberOfHousesFloodedBelowFloorLevel" type="xs:nonNegativeInteger" minOccurs="0"/>
<xs:element name="maximumRainfallPerHour" type="xs:nonNegativeInteger" minOccurs="0"/>
<xs:element name="totalRainfall" type="xs:nonNegativeInteger" minOccurs="0"/>

```

```

        </xs:sequence>
    </xs:extension>
</xs:complexContent>
</xs:complexType>
<!-- ===== -->
<xs:element name="DisasterDamage" type="urf:DisasterDamageType" substitutionGroup="urf:_UrbanFunction"/>
<xs:complexType name="DisasterDamagePropertyType">
<xs:sequence minOccurs="0">
    <xs:element ref="urf:DisasterDamage"/>
</xs:sequence>
<xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>
<!-- ===== -->
<xs:complexType name="PollutionType">
<xs:annotation>
    <xs:documentation>Source of pollution</xs:documentation>
</xs:annotation>
<xs:complexContent>
<xs:extension base="urf:UrbanFunctionType">
    <xs:sequence>
        <xs:element name="damagedArea" type="gml:MeasureType" minOccurs="0"/>
        <xs:element name="cause" type="xs:string" minOccurs="0"/>
    </xs:sequence>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<!-- ===== -->
<xs:element name="Pollution" type="urf:PollutionType" substitutionGroup="urf:_UrbanFunction"/>
<xs:complexType name="PollutionPropertyType">
<xs:sequence minOccurs="0">
    <xs:element ref="urf:Pollution"/>
</xs:sequence>
<xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>
<!-- ===== -->
<xs:complexType name="DisasterPreventionBaseType">
<xs:complexContent>
<xs:extension base="urf:UrbanFunctionType">
    <xs:sequence>
        <xs:element name="capacity" type="xs:integer" minOccurs="0"/>
    </xs:sequence>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<!-- ===== -->
<xs:element name="DisasterPreventionBase" type="urf:DisasterPreventionBaseType"
substitutionGroup="urf:_UrbanFunction"/>
<xs:complexType name="DisasterPreventionBasePropertyType">
<xs:sequence minOccurs="0">
    <xs:element ref="urf:DisasterPreventionBase"/>
</xs:sequence>
<xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>
<!-- ===== -->
<xs:complexType name="RecreationsType">
<xs:complexContent>
<xs:extension base="urf:UrbanFunctionType">
    <xs:sequence>
        <xs:element name="capacity" type="xs:integer" minOccurs="0"/>
        <xs:element name="numberOfUsers" type="xs:integer" minOccurs="0"/>
    </xs:sequence>
</xs:extension>
</xs:complexContent>

```

```

        </xs:sequence>
    </xs:extension>
</xs:complexContent>
</xs:complexType>
<!-- ===== -->
<xs:element name="Recreations" type="urf:RecreationsType" substitutionGroup="urf:_UrbanFunction"/>
<xs:complexType name="RecreationsPropertyType">
<xs:sequence minOccurs="0">
    <xs:element ref="urf:Recreations"/>
</xs:sequence>
<xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>
<!-- ===== -->
<xs:complexType name="HubCityType">
<xs:complexContent>
    <xs:extension base="urf:UrbanFunctionType">
        <xs:sequence/>
    </xs:extension>
</xs:complexContent>
</xs:complexType>
<!-- ===== -->
<xs:element name="HubCity" type="urf:HubCityType" substitutionGroup="urf:_UrbanFunction"/>
<xs:complexType name="HubCityPropertyType">
<xs:sequence minOccurs="0">
    <xs:element ref="urf:HubCity"/>
</xs:sequence>
<xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>
<!-- ===== -->
<xs:complexType name="LandUseDiversionType">
<xs:complexContent>
    <xs:extension base="urf:UrbanFunctionType">
        <xs:sequence/>
    </xs:extension>
</xs:complexContent>
</xs:complexType>
<!-- ===== -->
<xs:element name="LandUseDiversion" type="urf:LandUseDiversionType" substitutionGroup="urf:_UrbanFunction"/>
<xs:complexType name="LandUseDiversionPropertyType">
<xs:sequence minOccurs="0">
    <xs:element ref="urf:LandUseDiversion"/>
</xs:sequence>
<xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>
<!-- ===== -->
<xs:complexType name="UrbanizationType">
<xs:complexContent>
    <xs:extension base="urf:UrbanFunctionType">
        <xs:sequence>
            <xs:element name="period" type="xs:string" minOccurs="0"/>
            <xs:element name="resources" type="xs:string" minOccurs="0"/>
        </xs:sequence>
    </xs:extension>
</xs:complexContent>
</xs:complexType>
<!-- ===== -->
<xs:element name="Urbanization" type="urf:UrbanizationType" substitutionGroup="urf:_UrbanFunction"/>
<xs:complexType name="UrbanizationPropertyType">
<xs:sequence minOccurs="0">

```

```

<xs:element ref="urf:Urbanization"/>
</xs:sequence>
<xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>
<!-- ===== -->
<xs:complexType name="PublicTransportationFacilityType">
<xs:sequence>
<xs:element name="routeName" type="xs:string" minOccurs="0"/>
<xs:element name="sectionName" type="xs:string" minOccurs="0"/>
<xs:element name="companyName" type="xs:string" minOccurs="0"/>
<xs:element name="frequencyOfService" type="xs:integer" minOccurs="0"/>
<xs:element name="numberOfCustomers" type="xs:double" minOccurs="0"/>
</xs:sequence>
</xs:complexType>
<!-- ===== -->
<xs:element name="PublicTransportationFacility" type="urf:PublicTransportationFacilityType"/>
<!-- ===== -->
<xs:complexType name="PublicTransportationFacilityType">
<xs:complexContent>
<xs:extension base="urf:UrbanFunctionType">
<xs:sequence>
<xs:element name="routeName" type="xs:string" minOccurs="0"/>
<xs:element name="sectionName" type="xs:string" minOccurs="0"/>
<xs:element name="companyName" type="xs:string" minOccurs="0"/>
<xs:element name="frequencyOfService" type="xs:integer" minOccurs="0"/>
<xs:element name="numberOfCustomers" type="xs:double" minOccurs="0"/>
</xs:sequence>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<!-- ===== Extended attribute for CityObjectGroup ===== -->
<xs:element name="fiscalYearOfPublication" type="xs:gYear"
substitutionGroup="grp:_GenericApplicationPropertyOfCityObjectGroup"/>
<xs:element name="language" type="gml:CodeType"
substitutionGroup="grp:_GenericApplicationPropertyOfCityObjectGroup"/>
</xs:schema>

```

A.2 Sample data (informative)

```

<?xml version="1.0" encoding="UTF-8"?>
<core:CityModel xmlns:urf="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/urf/1.4" xmlns:core="http://www.opengis.net/citygml/2.0" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns:gml="http://www.opengis.net/gml" xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/urf/1.4 http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/schemas/urf/1.4/urbanFunction.xsd http://www.opengis.net/citygml/2.0 http://schemas.opengis.net/citygml/2.0/cityGMLBase.xsd http://www.opengis.net/gml http://schemas.opengis.net/gml/3.1.1/base/gml.xsd">
<gml:boundedBy>
<gml:Envelope srsName="http://www.opengis.net/def/crs/EPSG/0/6697" srsDimension="3">
<gml:lowerCorner>33.8 130.48 0</gml:lowerCorner>
<gml:upperCorner>33.9 130.56 0</gml:upperCorner>
</gml:Envelope>
</gml:boundedBy>
<core:cityObjectMember>
<urf:Administration gml:id="admin001">
<urf:prefecture codeSpace="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Common_prefecture.xml">40</urf:prefecture>
<urf:city codeSpace="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Common_localPublicAuthorities.xml">40220</urf:city>
<urf:surveyYear>2017</urf:surveyYear>

```

```

<urf:lod0MultiSurface>
  <gml:MultiSurface srsName="http://www.opengis.net/def/crs/EPSG/0/6697">
    <gml:surfaceMember>
      <gml:Polygon>
        <gml:exterior>
          <gml:LinearRing>
            <gml:pos>33.84252833 130.4901808 0</gml:pos>
            <gml:pos>33.84259361 130.4903153 0</gml:pos>
    <!-- omitted -->
      <gml:pos>33.84251389 130.4900461 0</gml:pos>
      <gml:pos>33.84252833 130.4901808 0</gml:pos>
    </gml:LinearRing>
    </gml:exterior>
  </gml:Polygon>
  </gml:surfaceMember>
  <gml:surfaceMember>
    <gml:Polygon>
      <gml:exterior>
        <gml:LinearRing>
          <gml:pos>33.8638502 130.4732692 0</gml:pos>
          <gml:pos>33.86385347 130.473259 0</gml:pos>
    <!-- omitted -->
      <gml:pos>33.86384941 130.4732781 0</gml:pos>
      <gml:pos>33.8638502 130.4732692 0</gml:pos>
    </gml:LinearRing>
    </gml:exterior>
  </gml:Polygon>
  </gml:surfaceMember>
</gml:MultiSurface>
</urf:lod0MultiSurface>
</urf:Administration>
</core:cityObjectMember>
</core:CityModel>

```

Annex B (informative)

Code lists for Urban Function Data

This annex exemplifies the specification of code lists for enumerative attributes of type *gml:CodeType* in Urban Planning ADE and provides proposals for selected attributes. Please note that this annex is non-normative and the presented code lists are neither mandatory nor complete.

Code lists for UrbanFunction

| |
|--|
| Code list of the subclasses of <i>UrbanFunction</i> attribute <i>urbanPlanType</i> |
|--|

| |
|---|
| See Code list for the <i>UrbanPlan</i> attribute <i>class</i> |
|---|

| |
|---|
| Code list of the subclasses of <i>UrbanFunction</i> attribute <i>areaClassificationType</i> |
|---|

| |
|--|
| See Code list for the <i>AreaClassification</i> attribute <i>class</i> |
|--|

| |
|---|
| Code list of the subclasses of <i>UrbanFunction</i> attribute <i>prefecture</i> |
|---|

| |
|---|
| See Code list for the <i>Administration</i> attribute <i>prefecture</i> in Part 2 |
|---|

| |
|---|
| Code list of the subclasses of <i>UrbanFunction</i> attribute <i>city</i> |
|---|

| |
|--|
| See Code list of the <i>Administration</i> attribute <i>city</i> in Part 2 |
|--|

Code lists for Administration

| |
|--|
| Code list of the <i>Administration</i> attribute <i>prefecture</i> |
|--|

| |
|---|
| http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Common_prefecture.xml |
|---|

| |
|--|
| Prefecture code defined in international/domestic standard should be used. |
|--|

| |
|--|
| e.g. JIS X 0401:1973 – Todofuken (prefecture) identification code (in Japan) |
|--|

| |
|--|
| Code list of the <i>Administration</i> attribute <i>city</i> |
|--|

| |
|---|
| http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Common_localPublicAuthorities.xml |
|---|

| |
|--|
| Municipality code defined in international/domestic standard should be used. |
|--|

| |
|---|
| e.g. JIS X0402:2010 – Identification code for cities, towns and villages (in Japan) |
|---|

Code lists for LandUsePlan

| |
|---|
| Code list for the <i>LandUsePlan</i> attribute <i>class</i> |
|---|

| |
|---|
| http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Common_landUsePlanType.xml |
|---|

| | | | |
|------|---|------|--|
| 1010 | special use districts | 1140 | scenic district |
| 1020 | exceptional floor area ratio district | 1150 | parking place development zone |
| 1030 | special use restriction districts | 1160 | port zone |
| 1040 | high-rise residential attraction district | 1170 | special historic natural features conservation zone |
| 1050 | height control district | 1180 | category 1 special historic natural features conservation zone |

| | | | |
|------|--|------|--|
| 1060 | high-level use district | 1190 | category 2 special historic natural features conservation zone |
| 1070 | specified blocks | 1200 | special green space conservation district |
| 1080 | special urban renaissance district | 1210 | distribution business zone |
| 1090 | fire prevention district | 1220 | productive green zone |
| 1100 | quasi-fire prevention district | 1230 | conservation zone for clusters of traditional structures |
| 1110 | specified disaster prevention block improvement zone | 1240 | aircraft noise control zone |
| 1120 | landscape zone | 1250 | aircraft noise control special zone |
| 1130 | quasi-landscape zone | | |

Code lists for UrbanPlan

| | | | |
|---|---------------------------|------|-------------------------------------|
| Code list for the <i>UrbanPlan</i> attribute <i>class</i> | | | |
| http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Common_urbanPlanType.xml | | | |
| 1010 | urban planning area | 1090 | area outside of urban planning area |
| 1020 | quasi urban planning area | | |

Code lists for Agreement

| | | | |
|---|-----------------------|------|---------------------|
| Code list for the <i>Agreement</i> attribute <i>class</i> | | | |
| http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Agreement_class.xml | | | |
| 1010 | building agreement | 1030 | landscape agreement |
| 1020 | green space agreement | 1040 | development permit |

Code lists for DevelopmentProject

| | | | |
|---|-------------------------|------|------------------|
| Code list for the <i>DevelopmentProject</i> attribute <i>class</i> | | | |
| http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/DevelopmentProject_class.xml | | | |
| 1010 | housing | 1030 | urban facilities |
| 1020 | agricultural facilities | | |

| | | | |
|---|---|------|------------------------|
| Code list for the <i>DevelopmentProject</i> attribute <i>function</i> | | | |
| http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/DevelopmentProject_function.xml | | | |
| 1010 | urban redevelopment project | 3010 | urban highway |
| 1020 | residential area improvement project | 3020 | road |
| 1030 | land readjustment project | 3030 | water supply |
| 1040 | new residential urban development project | 3040 | sewage |
| 1050 | industrial construction project | 3050 | park |
| 1060 | distribution business complex reclamation project | 3060 | river |
| 1070 | housing facility construction project | 3070 | other urban facilities |
| 1080 | public water surface landfill project | | |
| 1090 | new urban infrastructure development project | | |
| 1100 | residential area development project | | |
| 1110 | disaster control area development project | | |
| 1120 | other public residential development project | | |
| 2010 | irrigation and drainage project | | |
| 2020 | field development project | 9000 | unexamined |
| 2030 | farm road improvement project | 9010 | exception |
| 2040 | other agricultural project | 9020 | unknown |

| | | | |
|---|--|--|--|
| Code list for the <i>DevelopmentProject</i> attribute <i>usage</i> | | | |
| http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/DevelopmentProject_usage.xml | | | |

| | | | |
|------|-------------------------------------|------|------------|
| 1010 | residential | 9000 | unexamined |
| 1020 | commercial | 9010 | exception |
| 1030 | industrial | 9020 | unknown |
| 1040 | agriculture, forestry and fisheries | | |
| 1050 | public | | |
| 1060 | other | | |

| | | | |
|---|--------------------------------|------|------------|
| Code list for the <i>DevelopmentProject</i> attribute <i>status</i> | | | |
| http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/DevelopmentProject_status.xml | | | |
| 1010 | completed | 9000 | unexamined |
| 1020 | under construction or approved | 9010 | exception |
| | | 9020 | unknown |

Code lists for AreaClassification

| | | | |
|---|--|------|-------------------------------------|
| Code list for AreaClassification attribute <i>class</i> | | | |
| http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Common_areaClassification.xml | | | |
| 1010 | undesignated area within an undivided use district | 1040 | undivided use district |
| 1020 | urbanization area | 1050 | quasi- urban planning area |
| 1003 | urbanization control area | 1090 | area outside of urban planning area |

Code lists for DistrictsAndZones

| | | | |
|---|---|------|-----------------------------------|
| Code list for the <i>DistrictsAndZones</i> attribute <i>class</i> | | | |
| http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Common_districtsAndZones.xml | | | |
| 1000 | undesignated area | 1070 | quasi-residential district |
| 1010 | category 1 low-rise exclusive residential district | 1080 | neighbourhood commercial district |
| 1020 | category 2 low-rise exclusive residential district | 1090 | commercial district |
| 1030 | category 1 medium-to-high-rise exclusive residential district | 1100 | quasi-industrial district |
| 1040 | category 2 medium-to-high-rise exclusive residential district | 1110 | industrial district |
| 1050 | category 1 residential district | 1120 | exclusive industrial district |
| 1060 | category 2 residential district | 1130 | rural residential district |

Code lists for CensusBlock

| | | | |
|---|------------------------|------|--------------|
| Code list for the <i>CensusBlock</i> attribute <i>numberOfHouseholdsByOwnership</i> (attribute <i>class</i> of the datatype <i>NumberOfHouseholdsType</i>) | | | |
| http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Households_ownershipType.xml | | | |
| 1000 | own occupation | 1030 | issued house |
| 1010 | leased house (public) | 1040 | lodging |
| 1020 | leased house (private) | 1050 | others |

| | | | |
|---|------------------------|------|---------------------------------|
| Code list for the <i>CensusBlock</i> attribute <i>numberOfHouseholdsByStructure</i> (attribute <i>class</i> of the datatype <i>NumberOfHouseholdsType</i>) | | | |
| http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Households_houseType.xml | | | |
| 1000 | single-familiy home | 1040 | apartment (6-10 floors) |
| 1010 | tenement house | 1050 | apartment (more than 11 floors) |
| 1020 | apartment (1-2 floors) | 1060 | others |
| 1030 | apartment (3-5 floors) | | |

Code lists for DisasterDamage

| | | | |
|---|-------|------|-----------|
| Code list for the <i>DisasterDamage</i> attribute class | | | |
| http://www.kantei.go.jp/jp/singi/tiki/toshisaisei/itoshisaisei/iur/codelists/1.4/DisasterDamage_class.xml | | | |
| 1010 | flood | 1020 | landslide |

| | | | |
|---|----------------------------|------|------------|
| Code list for the <i>DisasterDamage</i> attribute function | | | |
| http://www.kantei.go.jp/jp/singi/tiki/toshisaisei/itoshisaisei/iur/codelists/1.4/DisasterDamage_function xml | | | |
| 1000 | external water damage area | 2010 | rock slide |
| 1020 | internal water damage area | 2020 | landslide |
| | | 2030 | mudflow |

Code lists for Pollution

| | | | |
|---|-------------------------------|------|--------------------|
| Code list for <i>Pollution</i> attribute class | | | |
| http://www.kantei.go.jp/jp/singi/tiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Pollution_class.xml | | | |
| 1010 | air pollution | 1050 | ground subsidence |
| 1020 | water pollution | 1060 | odious smell |
| 1030 | noise | 1070 | soil contamination |
| 1040 | shocks, tremors or vibrations | 1080 | other |

Code lists for DisasterPreventionBase

| | | | |
|---|---------------------------------------|------|-------------------------------|
| Code list for the <i>DisasterPreventionBase</i> attribute class | | | |
| http://www.kantei.go.jp/jp/singi/tiki/toshisaisei/itoshisaisei/iur/codelists/1.4/DisasterPreventionBase_class.xml | | | |
| 1010 | designated emergency evacuation place | 1030 | disaster prevention base |
| 1020 | designated evacuation place | 1040 | water supply for fire defense |

Code lists for Recreations

| | | | |
|---|-------------------|------|------------------|
| Code list for the <i>Recreations</i> attribute class | | | |
| http://www.kantei.go.jp/jp/singi/tiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Recreation_class.xml | | | |
| 1010 | nature | 1100 | life / industry |
| 1020 | history / culture | 1120 | view |
| | | 2000 | other recreation |

| | | | |
|---|--------------------------------|------|-----------------------|
| Code list for the <i>Recreations</i> attribute function | | | |
| http://www.kantei.go.jp/jp/singi/tiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Recreation_function.xml | | | |
| 1010 | baseball stadium | 1110 | pleasure land |
| 1020 | athletic field | 1120 | zoo |
| 1030 | soccer field, rugby playground | 1130 | botanical garden |
| 1040 | tennis court | 1140 | cycling stadium, turf |
| 1050 | golf course | 1150 | sightseeing toll road |
| 1060 | swimming pool | 1160 | cycling course |
| 1070 | other sports facilities | 1170 | hiking trail, trail |
| 1080 | speedboat racecourse | 1180 | nature trail |
| 1090 | yacht basin | 1190 | camping ground |
| 1100 | beach, clam digging area | 1200 | others |

Code lists for HubCity

| | | | |
|---|-------------------|------|----------|
| Code list for the <i>HubCity</i> attribute <i>class</i> | | | |
| http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/HubCity_class.xml | | | |
| 1010 | Regional hub city | 1020 | Hub city |

Code lists for LandUseDiversion

| | | | |
|---|---------------------------------|------|--------------|
| Code list for the <i>LandUseDiversion</i> attribute <i>class</i> | | | |
| http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/LandUseDiversion_class.xml | | | |
| 1010 | conversion of agricultural land | 1030 | new building |
| 1020 | conversion of forestry | | |

Code list for the *LandUseDiversion* attribute *usage*

See Code list for the *DevelopmentProject* attribute *usage*

Code lists for Urbanization

| | | | |
|---|---------------------------|------|----------------------------|
| Code list for the <i>Urbanization</i> attribute <i>class</i> | | | |
| http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Urbanization_class.xml | | | |
| 1010 | mid-Meiji era (1880's) | 1040 | befor World War II |
| 1020 | early Taisho era (1910's) | 1050 | after World War II |
| 1030 | early Showa era (1930's) | 1060 | 30's of Showa era (1950's) |

Code lists for CityObjectGroup

| | | | |
|---|------------|------|----------------|
| Code list of the <i>CityObjectGroup</i> attribute <i>usage</i> | | | |
| http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/CityObjectGroup_usage.xml | | | |
| 1000 | lod1Storey | 2000 | urban planning |
| 1010 | lod2Storey | | |
| 1020 | lod3Storey | | |
| 1040 | lod4Storey | | |

Code values in grey cells are defined in the Code lists proposed by the SIG 3D in CityGML.

Code list of the *CityObjectGroup* attribute *language*

http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Common_language.xml

ISO 639-1:2002, Codes for the representation of names of languages — Part 1: Alpha-2 code

Annex C (normative)

Concept of Extended LOD

C.1 Introduction

In city planning, it is necessary to harmonize with its higher plans, e.g. the national spatial strategy and the regional plan. These higher plans require rough city models which can be applied on a national or worldwide level for comparison and analysis of cities. For this purpose, this module defines two extended LODs for urban functions. The LOD-1 (minus one) for nationwide city models and the LOD-2 (minus two) for worldwide city models without inconsistency between LOD 0 to 4 as shown in Figure C-1. These extended LODs allow users to employ global 3D city models in policy making phases.

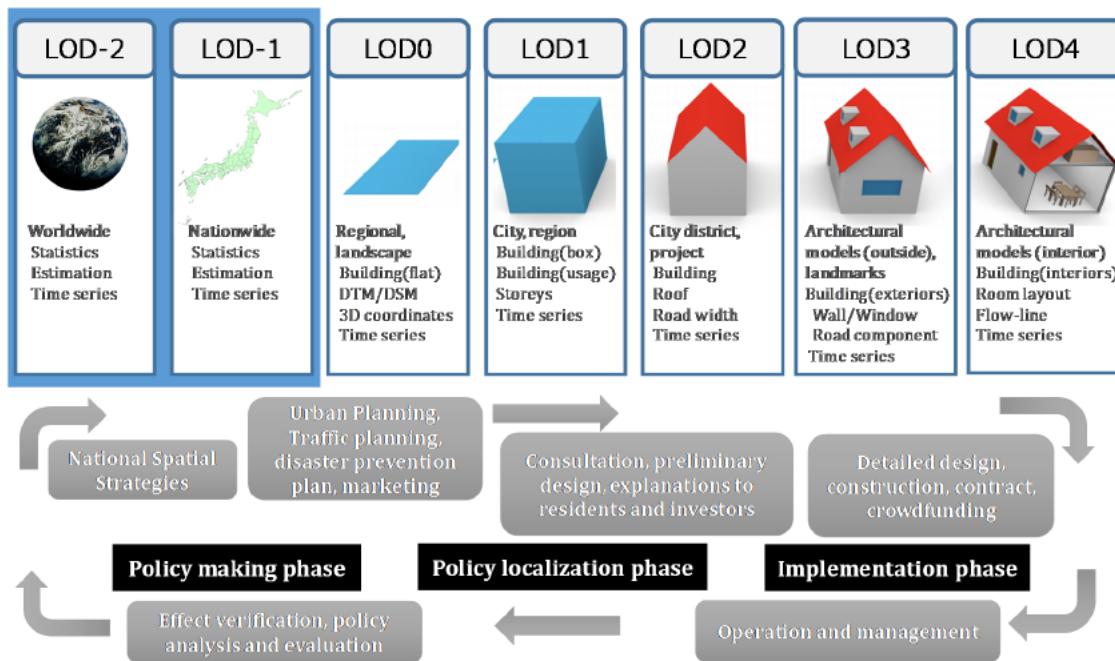


Figure C-1 Extended LOD for global city models

C.2 Extended LODs for Urban Functions

The mechanism of Extended LOD in Urban Function module is implemented as associations of *urf::UrbanFunction*, the root class of this module. To provide an overview of the real world using conceptual and virtual objects, this module defines *urf::lod-1MultiGeometry* and *urf::lod-2MultiGeometry* as shown in Figure C-1 to declare explicitly that these objects described in LOD-1 or LOD-2 represent the global city model.



Figure C-2 Extended LOD applied to Urban Function module

Part 3. Statistical Grid Data Encoding Specification

1. Scope

To grasp the current situation and issues of urban areas, comparing urban growth from the past to the present and also comparing between cities of the same urban scale are necessary to simplify complex situations.

This document defines statistical grid for time-series comparison and regional comparison, and specifies the encoding format of statistical grid.

In addition, global city model of national or world is necessary for comparing cities and understanding the relationships between cities through quantitative assessment. This is necessary in order to clarify the current situation and problems in urban areas.

The Levels of Detail (LOD) defined in CityGML do not cover such a rough description, therefore this document defines the mechanism to describe the global city model and specifies the encoding format of the information.

2. Normative references

Followings are normative references of this document.

- OpenGIS® OGC City Geography Markup Language (CityGML) Encoding Standard, Version 2.0, OGC document 12-019

3. Conventions

3.1 Terms and definitions

No terms and definitions are listed in this document.

3.2 Abbreviated terms

ADE Application Domain Extensions

CityGML City Geography Markup Language

GML Geography Markup Language

LOD Levels Of Detail

OGC Open Geospatial Consortium

UML Unified Modeling Language

4. Statistical Grid Data Encoding

4.1 Overview

In city planning, characteristics of features are abstracted and mapped into statistical units for global representation and analysis. An Administrative boundary is often used as a statistical unit. However, changes of administrative boundaries such as municipal mergers and dissolutions make it difficult to conduct time-series comparison and regional comparison. In addition, different sizes of administrative districts hinder finding regional issues. A Statistical grid which divides cities into grid cells with almost

equal area are useful for such global analysis. Therefore this module extends LODs to describe such rough city models which do not have to be detailed but should be described with a unified unit among cities. This enables users to analyse and visualise cities under the same conditions. Figure 3-1 shows an example of grid cells describing a global city model.

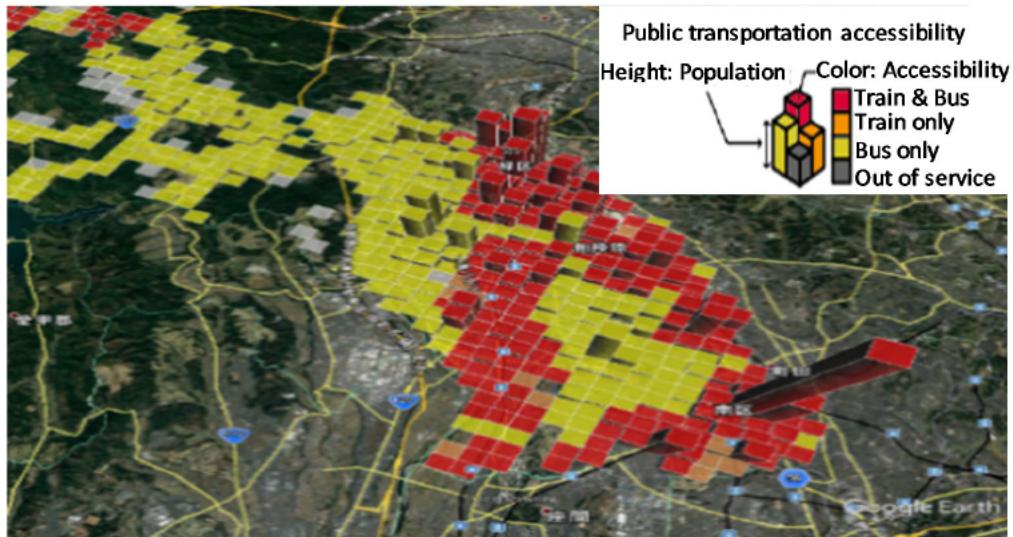


Figure 3-1 Example of grids describing a global city model

This module defines two additional LODs for statistical grids, LOD-1 (minus one) for nationwide city models and LOD-2 (minus two) for worldwide city models (See Annex C.) This extension allows users to compare different times of a city and among different cities with statistical grids without inconsistency between LOD 0 to 4 defined in CityGML.

Based on the above, this document defines the elements and types according to the rules of Application Domain Extensions (ADE) which describe statistical grid for global city models but not defined in CityGML. Those already defined in CityGML are imported without any inconsistency.

Figure 3-2 shows the structure of Statistical Grid Data.

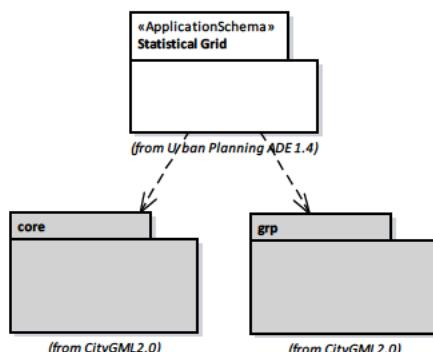


Figure 3-2 Package diagram of Statistical Grid Data

| | |
|---------------------------------|---|
| Module name | Statistical Grid |
| XML namespace identifier | http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/urg/1.4 |
| XMLSchemalocation | http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/schemas/urg/1.4/statisticalGrid.xsd |

| | |
|-------------------------------------|---|
| Recommended namespace prefix | urg |
| Description | This module defines statistical grid which divides specific area to grids. Each grid has its own thematic value, e.g. population, land price. |

4.2 Object definition

4.2.1 StatisticalGridType, _StatisticalGrid

The Statistical grid module enables users with time-series analysis and regional comparison. A grid is a network composed of two or more sets of curves, in which the members of each set intersect the members of the other sets in an algorithmic way, and the curves separate space into grid cells. Statistical grid module gives statistical values to each grid cell.

Figure 3-3 shows the UML diagram of the Statistical grid module, and the XMLSchema Definition is attached in Annex A. A root class of this module is *urg::StatisticalGrid*. A grid cell defined in Coverage schema is not distinguishable and is regarded as a part of a feature, however a statistical grid cell has its identifier. This means a statistical grid cell is a feature rather than a part of a feature, and therefore *urg::StatisticalGrid* inherits from *gml::Feature* via *core::CityObject*.

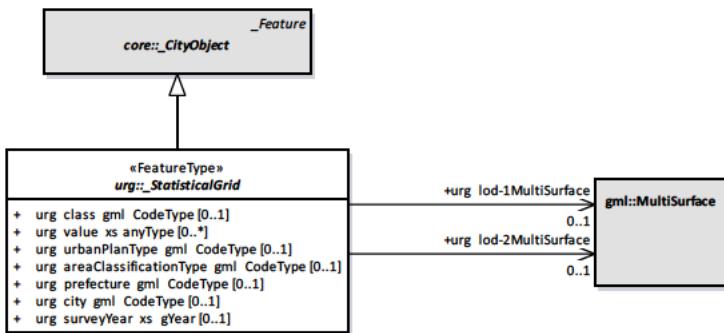


Figure 3-3 UML diagram of Statistical Grid Data

| Object | Definition |
|------------------------------------|---|
| <i>urg::StatisticalGrid</i> | grid cell for statistical data |
| Property | Definition |
| <i>urg::class</i> | type of the grid cell |
| <i>urg::value</i> | value of the grid cell |
| <i>urg::urbanPlanType</i> | Type of the grid location designated by the Urban Plan |
| <i>urg::areaClassificationType</i> | Type of the grid location designated by the Area classification |
| <i>urg::prefecture</i> | Prefecture name of the grid location |
| <i>urg::city</i> | City name of the grid location |
| <i>urg::surveyYear</i> | year of the survey |
| <i>urg::lod-1MultiSurface</i> | geometry of the grid cell at LOD-1 level |
| <i>urg::lod-2MultiSurface</i> | geometry of the grid cell at LOD-2 level |

```

<xs:complexType name="StatisticalGridType" abstract="true">
  <xs:complexContent>
    <xs:extension base="core:AbstractCityObjectType">
      <xs:sequence>
        <xs:element name="class" type="gml:CodeType" minOccurs="0"/>
        ...
    
```

```

<xs:element name="value" type="xs:anyType" minOccurs="0" maxOccurs="unbounded"/>
<xs:element name="urbanPlanType" type="gml:CodeType" minOccurs="0"/>
<xs:element name="areaClassificationType" type="gml:CodeType" minOccurs="0"/>
<xs:element name="prefecture" type="gml:CodeType" minOccurs="0"/>
<xs:element name="city" type="gml:CodeType" minOccurs="0"/>
<xs:element name="surveyYear" type="xs:gYear" minOccurs="0"/>
<xs:element name="lod-1MultiSurface" type="gml:MultiSurfacePropertyType" minOccurs="0"/>
<xs:element name="lod-2MultiSurface" type="gml:MultiSurfacePropertyType" minOccurs="0"/>
</xs:sequence>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:element name="_StatisticalGrid" type="StatisticalGridType" abstract="true" substitutionGroup="core:_CityObject"/>

```

A *urg::_StatisticalGrid* is the root class of this module and is extended for defining specific statistical grid objects. Figure 3-4 shows subclasses of *urg::_StatisticalGrid*.

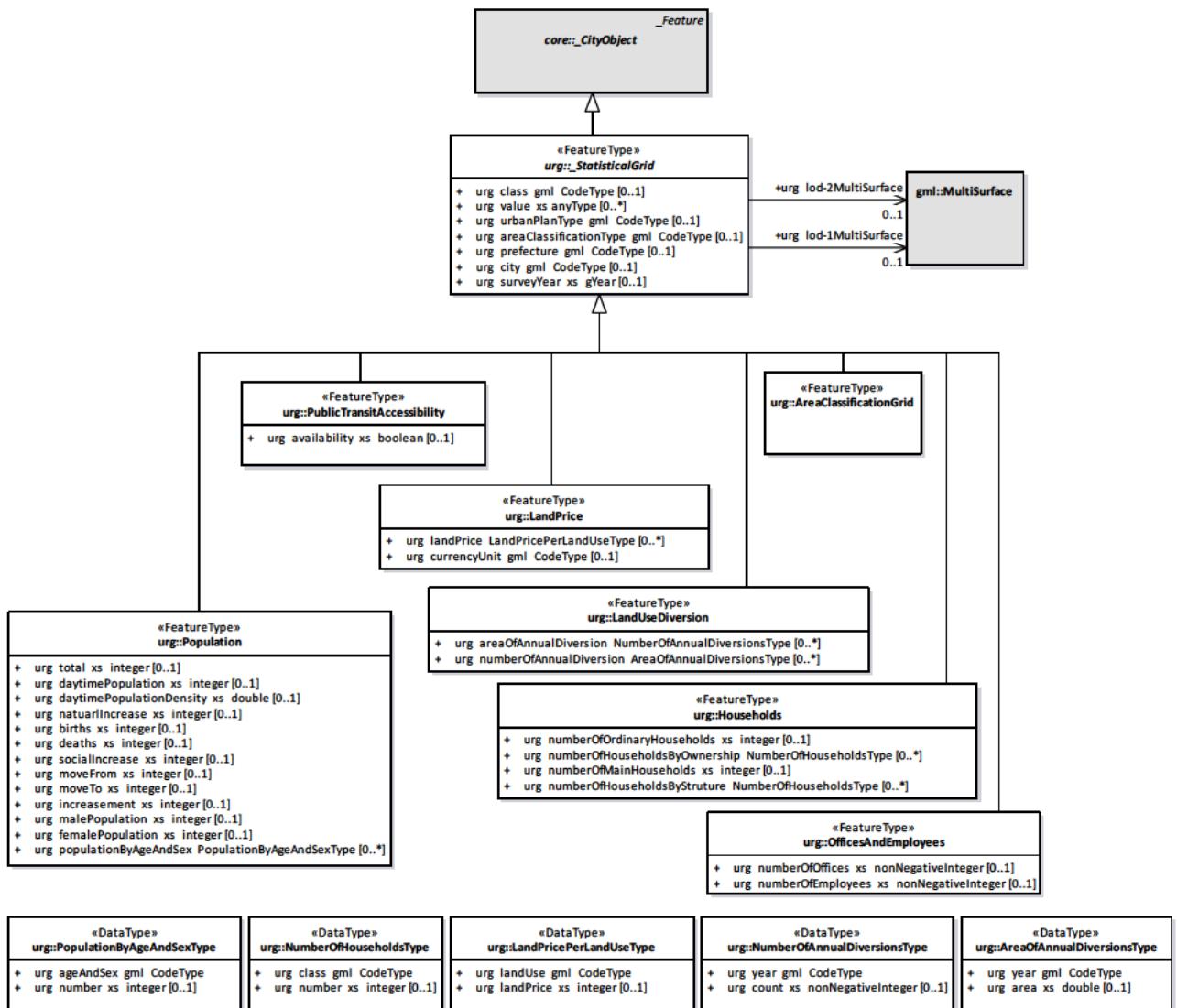


Figure 3-4 Subclasses of *urg::_StatisticalGrid*

4.2.2 PopulationType, Population

| Object | Definition |
|-------------------------------|---------------------------------------|
| urg::Population | Population information in a grid cell |
| Property | Definition |
| urg::total | Total population |
| urg::daytimePopulation | Daytime population |
| urg::daytimePopulationDensity | Daytime population density |
| urg::naturalIncrease | Natural increase per year |
| urg::births | Number of births |
| urg::deaths | Number of deaths |
| urg::socialIncrease | Increase of social community |
| urg::moveFrom | Number of people who move from |
| urg::moveTo | Number of people who move to |
| urg::increasement | Population increase |
| urg::malePopulation | Total male population |
| urg::femalePopulation | Total female population |
| urg::populationByAgeAndSex | Population by age and sex |

```

<xs:complexType name="PopulationType">
  <xs:annotation>
    <xs:documentation>grid cell with population values</xs:documentation>
  </xs:annotation>
  <xs:complexContent>
    <xs:extension base="StatisticalGridType">
      <xs:sequence>
        <xs:element name="total" type="xs:integer" minOccurs="0"/>
        <xs:element name="daytimePopulation" type="xs:integer" minOccurs="0"/>
        <xs:element name="daytimePopulationDensity" type="xs:double" minOccurs="0"/>
        <xs:element name="naturalIncrease" type="xs:integer" minOccurs="0"/>
        <xs:element name="births" type="xs:integer" minOccurs="0"/>
        <xs:element name="deaths" type="xs:integer" minOccurs="0"/>
        <xs:element name="socialIncrease" type="xs:integer" minOccurs="0"/>
        <xs:element name="moveFrom" type="xs:integer" minOccurs="0"/>
        <xs:element name="moveTo" type="xs:integer" minOccurs="0"/>
        <xs:element name="increasement" type="xs:integer" minOccurs="0"/>
        <xs:element name="malePopulation" type="xs:integer" minOccurs="0"/>
        <xs:element name="femalePopulation" type="xs:integer" minOccurs="0"/>
        <xs:element name="populationByAgeAndSex" type="PopulationByAgeAndSexPropertyType" minOccurs="0"
maxOccurs="unbounded"/>
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>
<!-- ===== -->
<xs:element name="Population" type="PopulationType" substitutionGroup="_StatisticalGrid"/>
<xs:complexType name="PopulationPropertyType">
  <xs:sequence minOccurs="0">
    <xs:element ref="Population"/>
  </xs:sequence>
  <xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>

```

PopulationByAgeAndSexType

| Type | Definition |
|------|------------|
| | |

| urg::PopulationByAgeAndSexType | Population by age and sex |
|--------------------------------|---------------------------|
| Property | Definition |
| urg::ageAndSex | Category of age and sex |
| urg::number | population |

```

<xs:element name="PopulationByAgeAndSex" type="PopulationByAgeAndSexType"/>
<xs:complexType name="PopulationByAgeAndSexType">
<xs:sequence>
  <xs:element name="ageAndSex" type="gml:CodeType" minOccurs="0"/>
  <xs:element name="number" type="xs:integer" minOccurs="0"/>
</xs:sequence>
</xs:complexType>
<xs:complexType name="PopulationByAgeAndSexPropertyType">
<xs:sequence>
  <xs:element ref="PopulationByAgeAndSex" />
</xs:sequence>
</xs:complexType>

```

4.2.3 PublicTransitAccessibilityType, PublicTransitAccessibility

| Object | Definition |
|----------------------------------|---|
| urg:: PublicTransitAccessibility | Accessibility of public transit service such as busses and railways |
| Property | Definition |
| urg::availability | Whether the grid cell location is within the specified distance from the bus stop/ train station or not |

```

<xs:complexType name="PublicTransitAccessibilityType">
<xs:complexContent>
  <xs:extension base="StatisticalGridType">
    <xs:sequence>
      <xs:element name="availability" type="xs:boolean" minOccurs="0"/>
    maxOccurs="unbounded"/>
    </xs:sequence>
  </xs:extension>
</xs:complexContent>
</xs:complexType>
<!-- ===== -->
<xs:element name="PublicTransitAccessibility" type="PublicTransitAccessibilityType"
substitutionGroup="_StatisticalGrid"/>
<xs:complexType name="PublicTransitAccessibilityPropertyType">
<xs:sequence minOccurs="0">
  <xs:element ref="PublicTransitAccessibility" />
</xs:sequence>
<xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>

```

4.2.4 LandPriceType, LandPrice

| Object | Definition |
|-------------------|--|
| urg::LandPrice | Average land price in a grid cell |
| Property | Definition |
| urg::landPrice | land price per unit area by land use types |
| urg::currencyUnit | Currency unit of the land price |

```

<xs:complexType name="LandPriceType">
<xs:annotation>
```

```

<xs:documentation>grid cell with land prices</xs:documentation>
</xs:annotation>
<xs:complexContent>
  <xs:extension base="StatisticalGridType">
    <xs:sequence>
      <xs:element name="landPrice" type="LandPricePerLandUsePropertyType" minOccurs="0" maxOccurs="unbounded"/>
      <xs:element name="currencyUnit" type="gml:CodeType" minOccurs="0"/>
    </xs:sequence>
  </xs:extension>
</xs:complexContent>
</xs:complexType>
<!-- ===== -->
<xs:element name="LandPrice" type="LandPriceType" substitutionGroup="_StatisticalGrid"/>
<xs:complexType name="LandPricePropertyType">
  <xs:sequence minOccurs="0">
    <xs:element ref="LandPrice"/>
  </xs:sequence>
  <xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>

```

LandPricePerLandUseType

| Type | Definition |
|-------------------------------|--|
| urg:: LandPricePerLandUseType | Land price per unit area of the specified land use |
| Property | Definition |
| urg::landUse | Land use type |
| urg::landPrice | Land price per unit area |

```

<xs:element name="LandPricePerLandUse" type="LandPricePerLandUseType"/>
<xs:complexType name="LandPricePerLandUseType">
  <xs:sequence>
    <xs:element name="landUse" type="gml:CodeType" minOccurs="0"/>
    <xs:element name="landPrice" type="xs:integer" minOccurs="0"/>
  </xs:sequence>
</xs:complexType>
<xs:complexType name="LandPricePerLandUsePropertyType">
  <xs:sequence>
    <xs:element ref="LandPricePerLandUse"/>
  </xs:sequence>
</xs:complexType>

```

4.2.5 LandUseDiversionType, LandUseDiversion

| Object | Definition |
|------------------------------|---------------------------------|
| urg:: LandUseDiversion | Land use diversion per year |
| Property | Definition |
| urg::numberOfAnnualDiversion | Annual number of land diversion |
| urg::areaOfAnnualDiversion | Annual area of land diversion |

```

<xs:complexType name="LandUseDiversionType">
  <xs:complexContent>
    <xs:extension base="StatisticalGridType">
      <xs:sequence>
        <xs:element name="numberOfAnnualDiversion" type="NumberOfAnnualDiversionsPropertyType" minOccurs="0"/>
        <xs:element name="areaOfAnnualDiversion" type="AreaOfAnnualDivisionsPropertyType" minOccurs="0"/>
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>

```

```

</xs:complexType>
<!-- ===== -->
<xs:element name="LandUseDiversion" type="LandUseDiversionType" substitutionGroup="_StatisticalGrid"/>
<xs:complexType name="LandUseDiversionPropertyType">
<xs:sequence minOccurs="0">
  <xs:element ref="LandUseDiversion"/>
</xs:sequence>
<xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>

```

NumberOfAnnualDiversionsType

| Type | Definition |
|------------------------------------|------------------------------|
| urg:: NumberOfAnnualDiversionsType | Number of diversion per year |
| Property | Definition |
| urg::year | Survey year |
| urg:count | number of land diversion |

```

<xs:element name="NumberOfAnnualDivisions" type="NumberOfAnnualDivisionsType"/>
<xs:complexType name="NumberOfAnnualDivisionsType">
<xs:sequence>
  <xs:element name="year" type="gml:CodeType"/>
  <xs:element name="count" type="xs:nonNegativeInteger" minOccurs="0"/>
</xs:sequence>
</xs:complexType>
<xs:complexType name="NumberOfAnnualDivisionsPropertyType">
<xs:sequence>
  <xs:element ref="NumberOfAnnualDivisions"/>
</xs:sequence>
</xs:complexType>

```

AreaOfAnnualDiversionsType

| Type | Definition |
|----------------------------------|--|
| urg:: AreaOfAnnualDiversionsType | Total area of land diversions per year |
| Property | Definition |
| urg::year | Survey year |
| urg:area | total area of land diversions |

```

<xs:element name="AreaOfAnnualDivisions" type="AreaOfAnnualDivisionsType"/>
<xs:complexType name="AreaOfAnnualDivisionsType">
<xs:sequence>
  <xs:element name="year" type="gml:CodeType"/>
  <xs:element name="area" type="gml:MeasureType" minOccurs="0"/>
</xs:sequence>
</xs:complexType>
<xs:complexType name="AreaOfAnnualDivisionsPropertyType">
<xs:sequence>
  <xs:element ref="AreaOfAnnualDivisions"/>
</xs:sequence>
</xs:complexType>

```

4.2.6 HouseholdsType, Households

| Object | Definition |
|--------|------------|
|--------|------------|

| urg:: Households | Number of households by ownership and building structure |
|------------------------------------|--|
| Property | Definition |
| urg::numberOfOrdinaryHouseholds | Number of ordinary households |
| urg::numberOfMainHouseholds | Number of main households |
| urg::numberOfHouseholdsByOwnership | Number of households by ownership |
| urg::numberOfHouseholdsByStructure | Number of households by building structure |

```

<xs:complexType name="HouseholdsType">
  <xs:annotation>
    <xs:documentation>grid cell with the number of households</xs:documentation>
  </xs:annotation>
  <xs:complexContent>
    <xs:extension base="StatisticalGridType">
      <xs:sequence>
        <xs:element name="numberOfOrdinaryHousehold" type="xs:integer"/>
        <xs:element name="numberOfHouseholdsByOwnership" type="NumberOfHouseholdsPropertyType" minOccurs="0"
maxOccurs="unbounded"/>
        <xs:element name="numberOfHouseholdsByStructure" type="NumberOfHouseholdsPropertyType" minOccurs="0"
maxOccurs="unbounded"/>
        <xs:element name="numberOfMainHousehold" type="xs:integer"/>
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>
<!-- ===== -->
<xs:element name="Households" type="HouseholdsType" substitutionGroup="_StatisticalGrid"/>
<xs:complexType name="HouseholdsPropertyType">
  <xs:sequence minOccurs="0">
    <xs:element ref="Households"/>
  </xs:sequence>
  <xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>

```

NumberOfHouseholdsType

| Type | Definition |
|------------------------------|------------------------------|
| urg:: NumberOfHouseholdsType | Number of households by type |
| Property | Definition |
| urg::class | Type of household |
| urg::number | Number of households |

```

<xs:element name="NumberOfHouseholds" type="NumberOfHouseholdsType"/>
<xs:complexType name="NumberOfHouseholdsType">
  <xs:sequence>
    <xs:element name="class" type="gml:CodeType"/>
    <xs:element name="number" type="xs:integer"/>
  </xs:sequence>
</xs:complexType>
<xs:complexType name="NumberOfHouseholdsPropertyType">
  <xs:sequence>
    <xs:element ref="NumberOfHouseholds"/>
  </xs:sequence>
</xs:complexType>

```

4.2.7 OfficesAndEmployeesType, OfficesAndEmployees

| Object | Definition |
|--------|------------|
|--------|------------|

| | |
|---------------------------|---|
| urg:: OfficesAndEmployees | Number of offices and employees in a mesh |
| Property | Definition |
| urg::numberOfOffices | Number of offices |
| urg::numberOfEmployees | Number of employees |

```

<xs:complexType name="OfficesAndEmployeesType">
  <xs:complexContent>
    <xs:extension base="StatisticalGridType">
      <xs:sequence>
        <xs:element name="numberOfOffices" type="xs:nonNegativeInteger" minOccurs="0"/>
        <xs:element name="numberOfEmployees" type="xs:nonNegativeInteger" minOccurs="0"/>
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>
<xs:element name="OfficesAndEmployees" type="OfficesAndEmployeesType" substitutionGroup="_StatisticalGrid"/>
<xs:complexType name="OfficesAndEmployeesPropertyType">
  <xs:sequence minOccurs="0">
    <xs:element ref="urg:OfficesAndEmployees" />
  </xs:sequence>
  <xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>

```

4.2.8 GenericGridCellType, GenericGridCell

A *urg::GenericGridCell* is used to describe statistical grid data not covered by other classes defined in this module. Figure 3-5 shows the structure of *urg::GenericGridCell*. A *urg::GenericGridCell* can contain more than one pair of a key and a value.

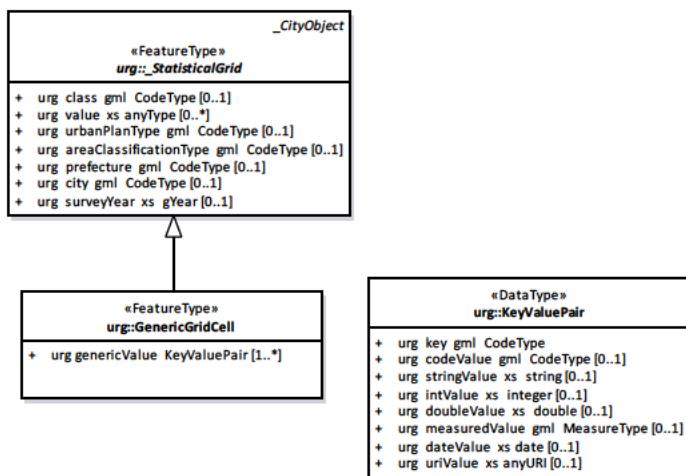


Figure 3-5 *urg::GenericGridCell*

GenericGridCell

| Type | Definition |
|----------------------|---|
| urg::GenericGridCell | Extension mechanism for a grid cell of which value is not defined in this module. |
| Property | Definition |
| urg::genericValue | A pair of user-defined key and value of this grid cell. |

```

<xs:complexType name="GenericGridCellType">
<xs:annotation>
  <xs:documentation>grid cell for various use</xs:documentation>
</xs:annotation>
<xs:complexContent>
  <xs:extension base="urg:StatisticalGridType">
    <xs:sequence>
      <xs:element name="genericValue" type="urg:KeyValuePairPropertyType" maxOccurs="unbounded"/>
    </xs:sequence>
  </xs:extension>
</xs:complexContent>
</xs:complexType>
<!-- ===== -->
<xs:element name="GenericGridCell" type="GenericGridCellType" substitutionGroup="_StatisticalGrid"/>
<!-- ===== -->
<xs:complexType name="GenericGridCellPropertyType">
<xs:sequence minOccurs="0">
  <xs:element ref="urg: GenericGridCell"/>
</xs:sequence>
<xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>

```

KeyValuePair

| Type | Definition |
|--------------------|---|
| urg::KeyValuePair | Extension mechanism for a grid value which is not defined in this module. This type should have two of its properties; "key" and one attribute for its value. |
| Property | Definition |
| urg::key | Key of a value |
| urg::codeValue | Code value |
| urg::stringValue | String value |
| urg::intValue | Integer value |
| urg::doubleValue | Double value |
| urg::measuredValue | Measured value |
| urg::dateValue | Date value |
| urg::uriValue | URI value |

```

<xs:complexType name="KeyValuePairType">
<xs:sequence>
  <xs:element name="key" type="gml:CodeType"/>
  <xs:choice>
    <xs:element name="stringValue" type="xs:string"/>
    <xs:element name="intValue" type="xs:integer"/>
    <xs:element name="doubleValue" type="xs:double"/>
    <xs:element name="codeValue" type="gml:CodeType"/>
    <xs:element name="measuredValue" type="gml:MeasureType"/>
    <xs:element name="dateValue" type="xs:date"/>
    <xs:element name="uriValue" type="xs:anyURI"/>
  </xs:choice>
</xs:sequence>
</xs:complexType>
<!-- ===== -->
<xs:element name="KeyValuePair" type="urg:KeyValuePairType"/>
<!-- ===== -->
<xs:complexType name="KeyValuePairPropertyType">

```

```

<xs:sequence>
  <xs:element ref="urg:KeyValuePair"/>
</xs:sequence>
</xs:complexType>

```

4.2.9 Extended properties of CityObjectGroup

A *grp::CityObjectGroup* inherits attributes from the parent class *core::_CityObject*. The attribute *core::creationDate* shows the date of dataset creation.

The *groupMember* property of *grp::CityObjectGroup* may contain a *core::_CityObject* element inline or an XLink reference to a remote *core::_CityObject* element, therefore extended city objects defined in this specification may also be contained in or referred from a *grp::CityObjectGroup*. XLink reference prevents data duplication and enables multiple use of the *CityObjects*. The attribute *grp::usage* which is inherited from *grp::CityObjectGroup* can represent that this object group is for the use of urban planning

Two elements, *urg::fiscalYearOfPublication* and *urg::language* are added as members of the substitution group *grp::_GenericApplicationPropertyOfCityObjectGroup*. A *urg::fiscalYear* is used to describe the year when the result of data collection has been published and a *urg::language* clarifies the language used in the city objects.

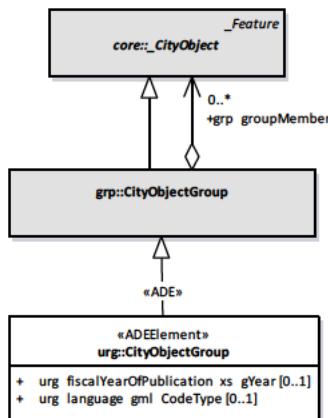


Figure 3-6 Extension of *grp::CityObjectGroup*

Extended properties of CityObjectGroup

| Property | Definition |
|-------------------------------------|---|
| <i>urg::fiscalYearOfPublication</i> | Fiscal year when the group has been published |
| <i>urg::language</i> | Language used in the group |

```

<xs:element name="fiscalYearOfPublication" type="xs:gYear"
substitutionGroup="grp:_GenericApplicationPropertyOfCityObjectGroup"/>
<xs:element name="language" type="gml:CodeType"
substitutionGroup="grp:_GenericApplicationPropertyOfCityObjectGroup"/>

```

Annex A (normative)

XMLSchema Definition

A.1 XMLSchema

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:urg="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/urg/1.4"
  xmlns:core="http://www.opengis.net/citygml/2.0" xmlns:grp="http://www.opengis.net/citygml/cityobjectgroup/2.0"
  xmlns:xs="http://www.w3.org/2001/XMLSchema" xmlns:gml="http://www.opengis.net/gml"
  targetNamespace="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/urg/1.4"
  elementFormDefault="qualified" attributeFormDefault="unqualified" version="1.4">
  <xs:annotation>
    <xs:documentation>XML Schema for Statistical Grid module</xs:documentation>
  </xs:annotation>
  <xs:import namespace="http://www.opengis.net/gml"
    schemaLocation="http://schemas.opengis.net/gml/3.1.1/base/gml.xsd"/>
  <xs:import namespace="http://www.opengis.net/citygml/2.0"
    schemaLocation="http://schemas.opengis.net/citygml/2.0/cityGMLBase.xsd"/>
  <xs:import namespace="http://www.opengis.net/citygml/cityobjectgroup/2.0"
    schemaLocation="http://schemas.opengis.net/citygml/cityobjectgroup/2.0/cityObjectGroup.xsd"/>
  <!-- ===== -->
  <!-- ===== CityGML StatisticalGrid module ===== -->
  <!-- ===== -->
  <xs:complexType name="StatisticalGridType" abstract="true">
    <xs:complexContent>
      <xs:extension base="core:AbstractCityObjectType">
        <xs:sequence>
          <xs:element name="class" type="gml:CodeType" minOccurs="0"/>
          <xs:element name="value" type="xs:anyType" minOccurs="0" maxOccurs="unbounded"/>
          <xs:element name="urbanPlanType" type="gml:CodeType" minOccurs="0"/>
          <xs:element name="areaClassificationType" type="gml:CodeType" minOccurs="0"/>
          <xs:element name="prefecture" type="gml:CodeType" minOccurs="0"/>
          <xs:element name="city" type="gml:CodeType" minOccurs="0"/>
          <xs:element name="surveyYear" type="xs:gYear" minOccurs="0"/>
          <xs:element name="lod-1MultiSurface" type="gml:MultiSurfacePropertyType" minOccurs="0"/>
          <xs:element name="lod-2MultiSurface" type="gml:MultiSurfacePropertyType" minOccurs="0"/>
        </xs:sequence>
      </xs:extension>
    </xs:complexContent>
  </xs:complexType>
  <xs:element name="_StatisticalGrid" type="urg:StatisticalGridType" abstract="true"
    substitutionGroup="core:_CityObject"/>
    <xs:complexType name="StatisticalGrid.PropertyType">
      <xs:sequence minOccurs="0">
        <xs:element ref="urg:_StatisticalGrid"/>
      </xs:sequence>
      <xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
    </xs:complexType>
    <!-- ===== -->
    <xs:complexType name="PopulationType">
      <xs:annotation>
        <xs:documentation>grid cell with population values</xs:documentation>
      </xs:annotation>
      <xs:complexContent>
        <xs:extension base="urg:StatisticalGridType">
```

```

<xs:sequence>
<xs:element name="total" type="xs:integer" minOccurs="0"/>
<xs:element name="daytimePopulation" type="xs:integer" minOccurs="0"/>
<xs:element name="daytimePopulationDensity" type="xs:double" minOccurs="0"/>
<xs:element name="naturalIncrease" type="xs:integer" minOccurs="0"/>
<xs:element name="births" type="xs:integer" minOccurs="0"/>
<xs:element name="deaths" type="xs:integer" minOccurs="0"/>
<xs:element name="socialIncrease" type="xs:integer" minOccurs="0"/>
<xs:element name="moveFrom" type="xs:integer" minOccurs="0"/>
<xs:element name="moveTo" type="xs:integer" minOccurs="0"/>
<xs:element name="increasement" type="xs:integer" minOccurs="0"/>
<xs:element name="malePopulation" type="xs:integer" minOccurs="0"/>
<xs:element name="femalePopulation" type="xs:integer" minOccurs="0"/>
<xs:element name="populationByAgeAndSex" type="urg:PopulationByAgeAndSexPropertyType" minOccurs="0"
maxOccurs="unbounded"/>
    </xs:sequence>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:element name="Population" type="urg:PopulationType" substitutionGroup="urg:_StatisticalGrid"/>
<xs:complexType name="Population.PropertyType">
<xs:sequence minOccurs="0">
    <xs:element ref="urg:Population"/>
</xs:sequence>
<xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>
<!-- ===== -->
<xs:element name="PopulationByAgeAndSex" type="urg:PopulationByAgeAndSexType"/>
<xs:complexType name="PopulationByAgeAndSexType">
<xs:sequence>
    <xs:element name="ageAndSex" type="gml:CodeType"/>
    <xs:element name="number" type="xs:integer" minOccurs="0"/>
</xs:sequence>
</xs:complexType>
<xs:complexType name="PopulationByAgeAndSex.PropertyType">
<xs:sequence>
    <xs:element ref="urg:PopulationByAgeAndSex"/>
</xs:sequence>
</xs:complexType>
<!-- ===== -->
<xs:complexType name="PublicTransitAccessibilityType">
<xs:annotation>
    <xs:documentation>grid cell to describe areas where the public transportation service is
available</xs:documentation>
</xs:annotation>
<xs:complexContent>
<xs:extension base="urg:StatisticalGridType">
    <xs:sequence>
        <xs:element name="availability" type="xs:boolean" minOccurs="0"/>
    </xs:sequence>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:element name="PublicTransitAccessibility" type="urg:PublicTransitAccessibilityType"
substitutionGroup="urg:_StatisticalGrid"/>
<xs:complexType name="PublicTransitAccessibility.PropertyType">
<xs:sequence minOccurs="0">
    <xs:element ref="urg:PublicTransitAccessibility"/>
</xs:sequence>

```

```

<xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>
<!-- ===== -->
<xs:complexType name="LandPriceType">
<xs:annotation>
  <xs:documentation>grid cell with land prices</xs:documentation>
</xs:annotation>
<xs:complexContent>
  <xs:extension base="urg:StatisticalGridType">
    <xs:sequence>
      <xs:element name="landPrice" type="urg:LandPricePerLandUsePropertyType" minOccurs="0"
maxOccurs="unbounded"/>
      <xs:element name="currencyUnit" type="gml:CodeType" minOccurs="0"/>
    </xs:sequence>
  </xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:element name="LandPrice" type="urg:LandPriceType" substitutionGroup="urg:_StatisticalGrid"/>
<xs:complexType name="LandPrice.PropertyType">
<xs:sequence minOccurs="0">
  <xs:element ref="urg:LandPrice"/>
</xs:sequence>
<xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>
<!-- ===== -->
<xs:element name="LandPricePerLandUse" type="urg:LandPricePerLandUseType"/>
<xs:complexType name="LandPricePerLandUseType">
<xs:sequence>
  <xs:element name="landUse" type="gml:CodeType"/>
  <xs:element name="landPrice" type="xs:integer" minOccurs="0"/>
</xs:sequence>
</xs:complexType>
<xs:complexType name="LandPricePerLandUsePropertyType">
<xs:sequence>
  <xs:element ref="urg:LandPricePerLandUse"/>
</xs:sequence>
</xs:complexType>
<!-- ===== -->
<xs:complexType name="LandUseDiversionType">
<xs:annotation>
  <xs:documentation>grid cell with the number and area of land use diversion</xs:documentation>
</xs:annotation>
<xs:complexContent>
  <xs:extension base="urg:StatisticalGridType">
    <xs:sequence>
      <xs:element name="numberOfAnnualDiversion" type="urg:NumberOfAnnualDiversions.PropertyType" minOccurs="0"
maxOccurs="unbounded"/>
      <xs:element name="areaOfAnnualDiversion" type="urg:AreaOfAnnualDivisions.PropertyType" minOccurs="0"
maxOccurs="unbounded"/>
    </xs:sequence>
  </xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:element name="LandUseDiversion" type="urg:LandUseDiversionType" substitutionGroup="urg:_StatisticalGrid"/>
<xs:complexType name="LandUseDiversion.PropertyType">
<xs:sequence minOccurs="0">
  <xs:element ref="urg:LandUseDiversion"/>
</xs:sequence>
<xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>

```

```

<!-- ===== -->
<xs:element name="NumberOfAnnualDiversions" type="urg:NumberOfAnnualDiversionsType"/>
<xs:complexType name="NumberOfAnnualDiversionsType">
<xs:sequence>
<xs:element name="year" type="xs:gYear"/>
<xs:element name="count" type="xs:nonNegativeInteger" minOccurs="0"/>
</xs:sequence>
</xs:complexType>
<xs:complexType name="NumberOfAnnualDiversionsPropertyType">
<xs:sequence>
<xs:element ref="urg:NumberOfAnnualDiversions"/>
</xs:sequence>
</xs:complexType>
<!-- ===== -->
<xs:element name="AreaOfAnnualDiversions" type="urg:AreaOfAnnualDiversionsType"/>
<xs:complexType name="AreaOfAnnualDiversionsType">
<xs:sequence>
<xs:element name="year" type="xs:gYear"/>
<xs:element name="area" type="gml:MeasureType" minOccurs="0"/>
</xs:sequence>
</xs:complexType>
<xs:complexType name="AreaOfAnnualDiversionsPropertyType">
<xs:sequence>
<xs:element ref="urg:AreaOfAnnualDiversions"/>
</xs:sequence>
</xs:complexType>
<!-- ===== -->
<xs:complexType name="HouseholdsType">
<xs:annotation>
<xs:documentation>grid cell with the number of households</xs:documentation>
</xs:annotation>
<xs:complexContent>
<xs:extension base="urg:StatisticalGridType">
<xs:sequence>
<xs:element name="numberOfOrdinaryHousehold" type="xs:integer"/>
<xs:element name="numberOfHouseholdsByOwnership" type="urg:NumberOfHouseholdsPropertyType"
minOccurs="0" maxOccurs="unbounded"/>
<xs:element name="numberOfHouseholdsByStructure" type="urg:NumberOfHouseholdsPropertyType" minOccurs="0"
maxOccurs="unbounded"/>
<xs:element name="numberOfMainHousehold" type="xs:integer"/>
</xs:sequence>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:element name="Households" type="urg:HouseholdsType" substitutionGroup="urg:_StatisticalGrid"/>
<xs:complexType name="HouseholdsPropertyType">
<xs:sequence minOccurs="0">
<xs:element ref="urg:Households"/>
</xs:sequence>
<xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>
<!-- ===== -->
<xs:element name="NumberOfHouseholds" type="urg:NumberOfHouseholdsType"/>
<xs:complexType name="NumberOfHouseholdsType">
<xs:sequence>
<xs:element name="class" type="gml:CodeType"/>
<xs:element name="number" type="xs:integer"/>
</xs:sequence>
</xs:complexType>

```

```

<xs:complexType name="NumberOfHouseholdsPropertyType">
<xs:sequence>
<xs:element ref="urg:NumberOfHouseholds"/>
</xs:sequence>
</xs:complexType>
<!-- ===== -->
<xs:complexType name="OfficesAndEmployeesType">
<xs:complexContent>
<xs:extension base="urg:StatisticalGridType">
<xs:sequence>
<xs:element name="numberOfOffices" type="xs:nonNegativeInteger" minOccurs="0"/>
<xs:element name="numberOfEmployees" type="xs:nonNegativeInteger" minOccurs="0"/>
</xs:sequence>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:element name="OfficesAndEmployees" type="urg:OfficesAndEmployeesType"
substitutionGroup="urg:_StatisticalGrid"/>
<xs:complexType name="OfficesAndEmployeesPropertyType">
<xs:sequence minOccurs="0">
<xs:element ref="urg:OfficesAndEmployees"/>
</xs:sequence>
<xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>
<!-- ===== -->
<xs:complexType name="GenericGridCellType">
<xs:annotation>
<xs:documentation>grid cell for various use</xs:documentation>
</xs:annotation>
<xs:complexContent>
<xs:extension base="urg:StatisticalGridType">
<xs:sequence>
<xs:element name="genericValue" type="urg:KeyValuePair.PropertyType" maxOccurs="unbounded"/>
</xs:sequence>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:element name="GenericGridCell" type="urg:GenericGridCellType" substitutionGroup="urg:_StatisticalGrid"/>
<xs:complexType name="GenericGridCell.PropertyType">
<xs:sequence minOccurs="0">
<xs:element ref=" urg:GenericGridCell"/>
</xs:sequence>
<xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>
<!-- ===== -->
<xs:element name="KeyValuePair" type="urg:KeyValuePairType"/>
<xs:complexType name="KeyValuePairType">
<xs:sequence>
<xs:element name="key" type="gml:CodeType"/>
<xs:choice>
<xs:element name="stringValue" type="xs:string"/>
<xs:element name="intValue" type="xs:integer"/>
<xs:element name="doubleValue" type="xs:double"/>
<xs:element name="codeValue" type="gml:CodeType"/>
<xs:element name="measuredValue" type="gml:MeasureType"/>
<xs:element name="dateValue" type="xs:date"/>
<xs:element name="uriValue" type="xs:anyURI"/>
</xs:choice>
</xs:sequence>
</xs:complexType>

```

```

<xs:complexType name="KeyValuePair.PropertyType">
  <xs:sequence>
    <xs:element ref="urg:KeyValuePair"/>
  </xs:sequence>
</xs:complexType>
<!-- ===== Extended attribute for CityObjectGroup ===== -->
<xs:element name="fiscalYearOfPublication" type="xs:gYear"
substitutionGroup="grp:_GenericApplicationPropertyOfCityObjectGroup"/>
<xs:element name="language" type="gml:CodeType"
substitutionGroup="grp:_GenericApplicationPropertyOfCityObjectGroup"/>
</xs:schema>

```

A.2 Sample data (informative)

Example of Population

```

<?xml version="1.0" encoding="UTF-8"?>
<!-- Sample data edited by i-Urban Revitalization Promotion Committee Specification WG -->
<core:CityModel xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns:grp="http://www.opengis.net/citygml/cityobjectgroup/2.0" xmlns:xlink="http://www.w3.org/1999/xlink" xmlns:gml="http://www.opengis.net/gml" xmlns:core="http://www.opengis.net/citygml/2.0" xmlns:urg="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/urg/1.4" xsi:schemaLocation="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/urg/1.4 http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/schemas/urg/1.4/statisticalGrid.xsd http://www.opengis.net/citygml/cityobjectgroup/2.0 http://schemas.opengis.net/citygml/cityobjectgroup/2.0/cityObjectGroup.xsd http://www.opengis.net/citygml/2.0 http://schemas.opengis.net/citygml/2.0/cityGMLBase.xsd http://www.opengis.net/gml http://schemas.opengis.net/gml/3.1.1/base/gml.xsd">
  <gml:boundedBy>
    <gml:Envelope srsName="http://www.opengis.net/def/crs/EPSG/0/6697" srsDimension="3">
      <gml:lowerCorner>33.8 130.54 0</gml:lowerCorner>
      <gml:upperCorner>33.9 130.56 0</gml:upperCorner>
    </gml:Envelope>
  </gml:boundedBy>
  <core:cityObjectMember>
    <grp:CityObjectGroup>
      <gml:name>grid sample data</gml:name>
      <grp:usage codeSpace="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/CityObjectGroup_usage.xml">2000</grp:usage>
        <grp:groupMember>
          <urg:Population gml:id="population418">
            <gml:description>サンプル地区 1</gml:description>
            <gml:name>503064032</gml:name>
            <urg:urbanPlanType codeSpace="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Common_urbanPlanType.xml">1010</urg:urbanPlanType>
            <urg:areaClassificationType codeSpace="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Common_areaClassification.xml">1030</urg:areaClassificationType>
            <urg:prefecture codeSpace="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Common_prefecture.xml">40</urg:prefecture>
            <urg:city codeSpace="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Common_localPublicAuthorities.xml">40220</urg:city>
            <urg:surveyYear>2017</urg:surveyYear>
            <urg:lod-1MultiSurface>
              <gml:MultiSurface gml:id="grid1">
                <gml:surfaceMember>
                  <gml:Polygon>
                    <gml:exterior>
                      <gml:LinearRing>
                        <gml:pos>33.83333333 130.55 0</gml:pos>
                        <gml:pos>33.8375 130.55 0</gml:pos>
                        <gml:pos>33.8375 130.54375 0</gml:pos>

```

```

<gml:pos>33.83333333 130.54375 0</gml:pos>
<gml:pos>33.83333333 130.55 0</gml:pos>
</gml:LinearRing>
</gml:exterior>
</gml:Polygon>
</gml:surfaceMember>
</gml:MultiSurface>
</urg:lod-1MultiSurface>
<urg:total>400</urg:total>
<urg:daytimePopulation>50</urg:daytimePopulation>
<urg:naturalIncrease>-1</urg:naturalIncrease>
<urg:births>3</urg:births>
<urg:deaths>4</urg:deaths>
<urg:socialIncrease>5</urg:socialIncrease>
<urg:moveFrom>10</urg:moveFrom>
<urg:moveTo>5</urg:moveTo>
<urg:increasement>4</urg:increasement>
<urg:malePopulation>200</urg:malePopulation>
<urg:femalePopulation>200</urg:femalePopulation>
<urg:populationByAgeAndSex>
<urg:PopulationByAgeAndSex>
<urg:ageAndSex codeSpace="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/PopulationByAgeAndSexType_age.xml">1010</urg:ageAndSex>
    <urg:number>5</urg:number>
</urg:PopulationByAgeAndSex>
</urg:populationByAgeAndSex>
<urg:populationByAgeAndSex>
<urg:PopulationByAgeAndSex>
<urg:ageAndSex codeSpace="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/PopulationByAgeAndSexType_age.xml">1020</urg:ageAndSex>
    <urg:number>5</urg:number>
</urg:PopulationByAgeAndSex>
</urg:populationByAgeAndSex>

<!-- omitted -->

</grp:groupMember>
<grp:groupMember>
    <urg:Population gml:id="population417">
        <gml:description>サンプル地区 1</gml:description>
        <gml:name>503064032</gml:name>
        <urg:urbanPlanType codeSpace="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Common_urbanPlanType.xml">1010</urg:urbanPlanType>
            <urg:areaClassificationType codeSpace="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Common_areaClassification.xml">1030</urg:areaClassificationType>
                <urg:prefecture codeSpace="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Common_prefecture.xml">40</urg:prefecture>
                    <urg:city codeSpace="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Common_localPublicAuthorities.xml">40220</urg:city>
                        <urg:surveyYear>2016</urg:surveyYear>
                        <urg:lod-1MultiSurface xlink:href="#grid1"/>
<!-- omitted -->

        <urg:fiscalYearOfPublication>2016</urg:fiscalYearOfPublication>
    </grp:CityObjectGroup>
</core:cityObjectMember>
</core:CityModel>

```

Example of GenericGridCell

```
<?xml version="1.0" encoding="UTF-8"?>
<core:CityModel xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns:grp="http://www.opengis.net/citygml/cityobjectgroup/2.0"
  xmlns:xlink="http://www.w3.org/1999/xlink"
  xmlns:gml="http://www.opengis.net/gml"
  xmlns:core="http://www.opengis.net/citygml/2.0"
  xmlns:urg="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/urg/1.4"
  xsi:schemaLocation="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/urg/1.4 http://www.kantei.g
o.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/schemas/urg/1.4/statisticalGrid.xsd
http://www.opengis.net/citygml/cityobjectgroup/2.0 http://schemas.opengis.net/citygml/cityobjectgroup/2.0/cityO
bjectGroup.xsd
http://www.opengis.net/citygml/2.0 http://schemas.opengis.net/citygml/2.0/cityGMLBase.xsd
http://www.opengis.net/gml http://schemas.opengis.net/gml/3.1.1/base/gml.xsd">
  <gml:boundedBy>
    <gml:Envelope srsName="http://www.opengis.net/def/crs/EPSG/0/6697" srsDimension="3">
      <gml:lowerCorner>33.8 130.54 0</gml:lowerCorner>
      <gml:upperCorner>33.9 130.56 0</gml:upperCorner>
    </gml:Envelope>
  </gml:boundedBy>
  <core:cityObjectMember>
    <grp:CityObjectGroup>
      <gml:name>grid sample data</gml:name>
      <grp:usage codeSpace="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/CityObject
Group_usage.xml">2000</grp:usage>
        <grp:groupMember>
          <urg:GenericGridCell>
            <gml:description>サンプル地区 1</gml:description>
            <gml:name>503064032</gml:name>
            <urg:value>
              <urg:KeyValuePair>
                <urg:key codeSpace="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/GenericGr
id_key.xml">1010</urg:key>
                <urg:value codeSpace="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Ge
nericGrid_key1010value.xml">1010</urg:value>
              </urg:KeyValuePair>
            </urg:value>
            <urg:value>
              <urg:KeyValuePair>
                <urg:key codeSpace="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/GenericGr
id_key.xml">1020</urg:key>
                <urg:intValue>1</urg:intValue>
              </urg:KeyValuePair>
            </urg:value>
            <urg:lod-1MultiSurface>
              <gml:MultiSurface gml:id="grid1">
                <gml:surfaceMember>
                  <gml:Polygon>
                    <gml:exterior>
                      <gml:LinearRing>
                        <gml:pos>33.83333333 130.55 0</gml:pos>
                        <gml:pos>33.8375 130.55 0</gml:pos>
                        <gml:pos>33.8375 130.54375 0</gml:pos>
                        <gml:pos>33.83333333 130.54375 0</gml:pos>
                        <gml:pos>33.83333333 130.55 0</gml:pos>
                      </gml:LinearRing>
                    </gml:exterior>
                  </gml:Polygon>
                </gml:surfaceMember>
              </gml:MultiSurface>
            </urg:lod-1MultiSurface>
          </urg:GenericGridCell>
        </grp:groupMember>
      </grp:CityObjectGroup>
    </core:cityObjectMember>
  </core:CityModel>
```

```
</gml:surfaceMember>
</gml:MultiSurface>
</urg:lod-1MultiSurface>
</urg:GenericGridCell>
</grp:groupMember>
<urg:fiscalYearOfPublication>2016</urg:fiscalYearOfPublication>
</grp:CityObjectGroup>
</core:cityObjectMember>
</core:CityModel>
```

Annex B (informative)

Code lists for Statistical Grid Data

This annex exemplifies the specification of code lists for enumerative attributes of type *gml:CodeType* in Urban Planning ADE and provides proposals for selected attributes. Please note that this annex is non-normative and the presented code lists are neither mandatory nor complete.

Code lists for StatisticalGrid

| |
|--|
| Code list of the subclasses of <i>StatisticalGrid</i> attribute <i>urbanPlanType</i> |
|--|

| |
|---|
| See Code list for the <i>UrbanPlan</i> attribute <i>class</i> in part 2 |
|---|

| |
|---|
| Code list of the subclasses of <i>StatisticalGrid</i> attribute <i>areaClassificationType</i> |
|---|

| |
|--|
| See Code list for the <i>AreaClassification</i> attribute <i>class</i> in part 2 |
|--|

| |
|---|
| Code list of the subclasses of <i>StatisticalGrid</i> attribute <i>prefecture</i> |
|---|

| |
|---|
| See Code list for the <i>Administration</i> attribute <i>prefecture</i> in part 2 |
|---|

| |
|---|
| Code list of the subclasses of <i>StatisticalGrid</i> attribute <i>city</i> |
|---|

| |
|---|
| See Code list for the <i>Administration</i> attribute <i>city</i> in part 2 |
|---|

Code lists for Population

| |
|--|
| Code list for <i>Population</i> attribute <i>populationByAgeAndSex</i> |
|--|

| |
|---|
| http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Population_populationByAgeAndSex.xml |
|---|

| | | | |
|------|------------|------|--------------|
| 1010 | 0-4/male | 2010 | 0-4/female |
| 1020 | 5-9/male | 2020 | 5-9/female |
| 1030 | 10-14/male | 2030 | 10-14/female |
| 1040 | 15-19/male | 2040 | 15-19/female |
| 1050 | 20-24/male | 2050 | 20-24/female |
| 1060 | 25-29/male | 2060 | 25-29/female |
| 1070 | 30-34/male | 2070 | 30-34/female |
| 1080 | 35-39/male | 2080 | 35-39/female |
| 1090 | 40-44/male | 2090 | 40-44/female |
| 1100 | 45-49/male | 2100 | 45-49/female |
| 1110 | 50-54/male | 2110 | 50-54/female |
| 1120 | 55-59/male | 2120 | 55-59/female |
| 1130 | 60-64/male | 2130 | 60-64/female |
| 1140 | 65-69/male | 2140 | 65-69/female |
| 1150 | 70-74/male | 2150 | 70-74/female |
| 1160 | 75-79/male | 2160 | 75-79/female |
| 1170 | 80-84/male | 2170 | 80-84/female |
| 1180 | 85-89/male | 2180 | 85-89/female |
| 1190 | 90-94/male | 2190 | 90-94/female |
| 1200 | 95-99/male | 2200 | 95-99/female |
| 1210 | 100-/male | 2210 | 100-/female |

| | | | |
|---|------|------|--------|
| Code list for <i>Population</i> attribute <i>populationByAgeAndSex</i> (attribute <i>sex</i> of the datatype <i>PopulationByAgeAndSexType</i>) | | | |
| http://www.kantei.go.jp/jp/singi/tiki/toshisaisei/itoshisaisei/iur/codelists/1.4/PopulationByAgeAndSexType_sex.xml | | | |
| 1010 | male | 1020 | female |

Code lists for LandPrice

| | | | |
|---|--------------------------|------|--|
| Code list for <i>LandPrice</i> attribute <i>landPrice</i> (attribute <i>landuse</i> of the datatype <i>LandPricePerLandUseType</i>) | | | |
| http://www.kantei.go.jp/jp/singi/tiki/toshisaisei/itoshisaisei/iur/codelists/1.4/LandPricePerLandUseType_landuse.xml | | | |
| 1010 | Residential area | 3030 | Forestry |
| 1011 | Housing prospective area | 6010 | Residential in urbanization control area |
| 5010 | Industry area | 6020 | Forestry in urbanization control area |
| 5011 | Semi-industrial area | | |
| 5021 | Commercial area | | |

| | | | |
|---|--|--|--|
| Code list for <i>LandPrice</i> attribute <i>landPrice</i> (attribute <i>currencyUnit</i> of the datatype <i>LandPricePerLandUseType</i>) | | | |
| http://www.kantei.go.jp/jp/singi/tiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Common_currencyUnit.xml | | | |
| Currency codes defined by ISO 4217 that composed of a country's two-character Internet country code plus a third character denoting the currency unit. | | | |

Code lists for CityObjectGroup

| | | | |
|---|------------|------|----------------|
| Code list of the <i>CityObjectGroup</i> attribute <i>usage</i> | | | |
| http://www.kantei.go.jp/jp/singi/tiki/toshisaisei/itoshisaisei/iur/codelists/1.4/CityObjectGroup_usage.xml | | | |
| 1000 | lod1Storey | 2000 | urban planning |
| 1010 | lod2Storey | | |
| 1020 | lod3Storey | | |
| 1040 | lod4Storey | | |

Code values in grey cells are defined in the Code lists proposed by the SIG 3D in CityGML.

| | | | |
|---|--|--|--|
| Code list of the <i>CityObjectGroup</i> attribute <i>language</i> | | | |
| http://www.kantei.go.jp/jp/singi/tiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Common_language.xml | | | |
| ISO 639-1:2002, Codes for the representation of names of languages — Part 1: Alpha-2 code | | | |

Annex C (normative)

Concept of Extended LOD

C.1 Introduction

In city planning, it is necessary to harmonize with its higher plans, e.g. the national spatial strategy and the regional plan. These higher plans require rough city models which can be applied on a national or worldwide level for comparison and analysis of cities. For this purpose, this module defines two extended LODs for urban functions. The LOD-1 (minus one) for nationwide city models and the LOD-2 (minus two) for worldwide city models without inconsistency between LOD 0 to 4 as shown in Figure C-1. These extended LODs allow users to employ global 3D city models in policy making phases.

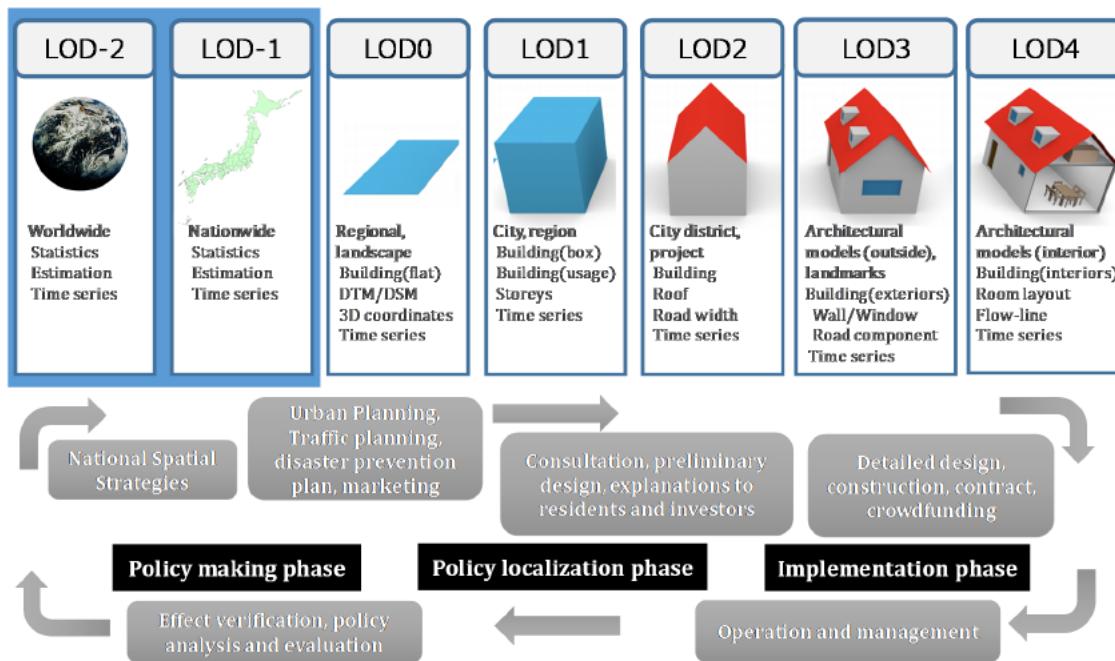


Figure C-1 Extended LOD for global city models

C.2 Extended LODs for Statistical Grid

The mechanism of Extended LOD in Statistical Grid module is implemented as associations of *urg::StatisticalGrid*, the root class of this module. Since grid cells provide an overview of the real world, this module defines *urg::lod-1MultiSurface* and *urg::lod-2MultiSurface* as shown in Figure C-1 to declare explicitly that a grid described in LOD-1 or LOD-2 represents the global city model.

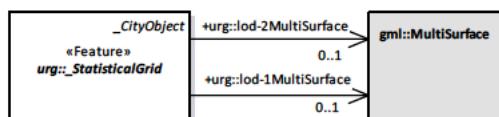


Figure C-2 Extended LOD applied to Statistical Grid module

Part 4. Public Transit Data Encoding Specification

1. Scope

Public transit connects urban areas to urban areas and enables people to move between cities. It also allows urban areas to share and aggregate their functions in regional area, therefore information on public transit is necessary for considering aggregation and relocation of urban functions.

The General Transit Feed Specification (GTFS) is a data specification that allows public transit agencies to publish their transit data in a common format that can be consumed by a wide variety of software applications and is now widely used to supply data on public transit for use in multimodal journey planning applications and research on transit accessibility.

This document defines conceptual model and XMLSchema based on the GTFS for integrating public transit information into 3D city models in order to contribute to promoting urban revitalization. The conceptual model and XMLSchema defined in this document also contains additional information extended by GTFS-JP, which expands GTFS according to the circumstances in Japan.

2. Normative references

Followings are normative references of this document.

- OpenGIS® OGC City Geography Markup Language (CityGML) Encoding Standard, Version 2.0, OGC document 12-019
- General Transit Feed Specification Reference (<http://gtfs.org/reference/static>)
- GTFS-JP (<https://www.gtfs.jp/developpers-guide/format-reference.html>)

3. Conventions

3.1 Terms and definitions

No terms and definitions are listed in this document.

3.2 Abbreviated terms

ADE Application Domain Extensions

CityGML City Geography Markup Language

GML Geography Markup Language

GTFS General Transit Feed Specification

LOD Levels Of Detail

OGC Open Geospatial Consortium

UML Unified Modeling Language

4. Public Transit Data Encoding

4.1 Overview

The Public Transit Data Encoding is an extension of CityGML. This document defines the elements and types according to the rules of the Application Domain Extensions (ADE) for describing public transit schedules and network based on GTFS file format. Those already defined in CityGML are imported without any inconsistency. Table 4-1 provides mapping between GTFS files and classes defined in this document.

Table 4-1 Implementation of types from GTFS files

| GTFS files | Description | Classes |
|--------------------------------|---|------------------------------------|
| agency.txt | Transit agencies with service represented in this dataset. | urt::Agency |
| stops.txt | Stops where vehicles pick up or drop off riders. Also defines stations and station entrances. | urt::Stop |
| routes.txt | Transit routes. A route is a group of trips that are displayed to riders as a single service. | urt::Route |
| trips.txt | Trips for each route. A trip is a sequence of two or more stops that occur during a specific time period. | urt::Trip |
| stop_times.txt | Times that a vehicle arrives at and departs from stops for each trip. | urt::StopTime |
| calendar.txt | Service dates specified using a weekly schedule with start and end dates. This file is required unless all dates of service are defined in calendar_dates.txt. | urt::Calendar |
| calendar_dates.txt | Exceptions for the services defined in the calendar.txt. If calendar.txt is omitted, then calendar_dates.txt is required and must contain all dates of service. | urt::CalendarDate |
| fare_attributes.txt | Fare information for a transit agency's routes. | urt::FareAttribute |
| fare_rules.txt | Rules to apply fares for itineraries. | urt::FareRule |
| shapes.txt | Rules for mapping vehicle travel paths, sometimes referred to as route alignments. | urt::Shape |
| frequencies.txt | Headway (time between trips) for headway-based service or a compressed representation of fixed-schedule service. | urt::Frequency |
| transfers.txt | Rules for making connections at transfer points between routes. | urt::Transfer |
| pathways.txt | Pathways linking together locations within stations. | urt::Pathway |
| levels.txt | Levels within stations. | urt::Level |
| translations.txt | Translations of customer-facing dataset values. | urt::Translation |
| feed_info.txt | Dataset metadata, including publisher, version, and expiration information. | urt::FeedInfo |
| attributions.txt | Dataset attributions. | urt::Attribution |
| agency_jp.txt | Additional descriptive information of an agency for the use in Japan | (Set as properties of urt::Agency) |
| route_jp.txt | Additional descriptive information of a route for the use in Japan | (Set as properties of urt::Route) |
| office_jp.txt | Opptional information of service office for the use in Japan | urt::Office |
| translations.txt (of Japan) | Extended information of translation for the use in Japan. | urt::TranslationJP |

Figure 4-1 shows the structure of Public Transit Data.

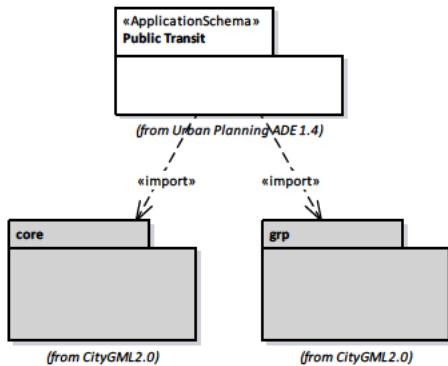


Figure 4-1 Package diagram of Public Transit Data

| | |
|-------------------------------------|---|
| Module name | Public Transit |
| XML namespace identifier | http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/urt/1.4 |
| XMLSchema location | http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/schemas/urg/1.4/publicTransit.xsd |
| Recommended namespace prefix | urt |
| Description | This module defines public transit schedules and associated geographic information; e.g. route, stop, trip. |

4.2 Object definition

Public Transit module defines two types of object; identifiable object and non-identifiable object. Those which have an identifier are inherited from *core::_CityObject* directly or indirectly. A root class of identifiable object is defined in 4.2.1, and a root class of non-identifiable objects is defined in 4.2.2 of this document.

4.2.1 PublicTransitType, _PublicTransit

A root class of identifiable object in this module is *urt::_PublicTransit* which inherits from *core::_CityObject* and it has one attribute *urt::orgId*. GTFS files include IDs of Objects, however these IDs may not conform to XML ID. The *urt::orgId* can be used to store original ID in GTFS files to keep reversibility.

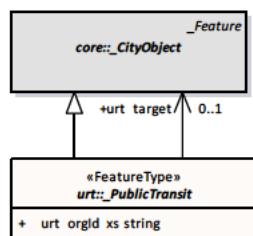


Figure 4-2 Public Transit

| Object | Definition |
|---------------------|--|
| urt::_PublicTransit | Identifiable root class of Public Transit module |
| Property | Definition |
| urt::orgId | A code which identifies the public transit object which is imported from GTFS files. |
| urt::target | Reference to the real city object; e.g. bus stop |

```

<xs:complexType name="PublicTransitType" abstract="true">
  <xs:complexContent>
    <xs:extension base="core:AbstractCityObjectType">
      <xs:sequence>
        <xs:element name="orgId" type="xs:string"/>
        <xs:element name="target" type="TargetPropertyType" minOccurs="0"/>
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>
<xs:element name="_PublicTransit" type="urt:PublicTransitType" abstract="true"
substitutionGroup="core:_CityObject"/>
<xs:complexType name="PublicTransitPropertyType">
  <xs:sequence minOccurs="0">
    <xs:element ref="urt:_PublicTransit"/>
  </xs:sequence>
  <xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>
<xs:complexType name="TargetPropertyType">
  <xs:sequence minOccurs="0">
    <xs:element ref="core:_CityObject"/>
  </xs:sequence>
  <xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>

```

The type “TargetPropertyType” is used for an association with a *core::_CityObject*. Subclass of *urt::_PublicTransit* may refer to concrete CityObject, e.g. bus stop using this property type.

Figure 4-3 shows the subclasses of *urt::_PublicTransit*. These subclasses are categorized into four group from the point of information granularity for public transit. The coarsest Level 0 class includes basic transit network and the most detailed level 3 classes include operation information of transit network.

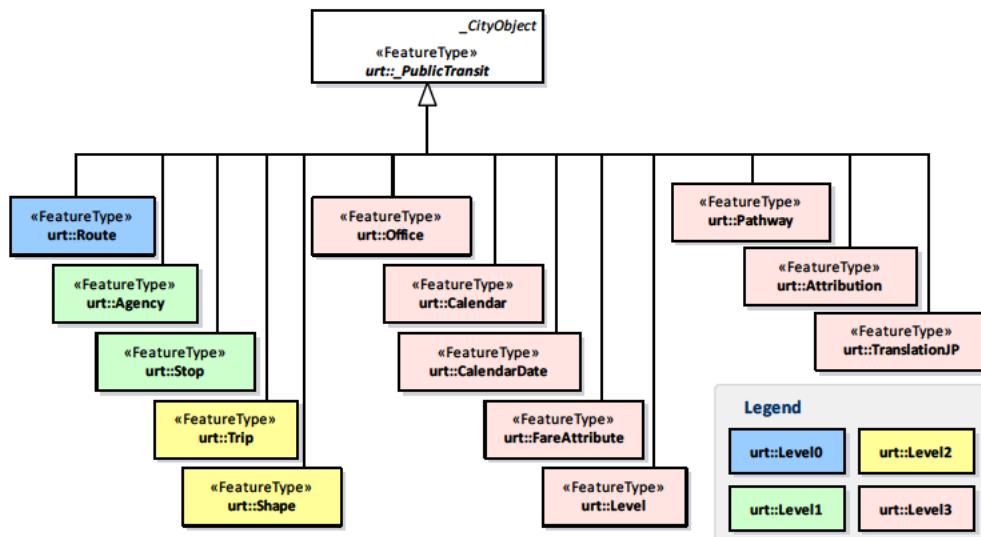


Figure 4-3 Subclasses of Public Transit module

4.2.2 PublicTransitDataTypeType, _PublicTransitDataType

An abstract class *urt::_PublicTransitDataType* is a root class of objects without identifier in this module. This class is defined for convenience to allow objects without identifier to appear under a city object group. Each DataType class which is not used as a part of FeatureType class inherits *urt::_PublicTransitDataType*. **Figure 4-4** shows the structure of *urt::_PublicTransitDataType* and its subclasses.

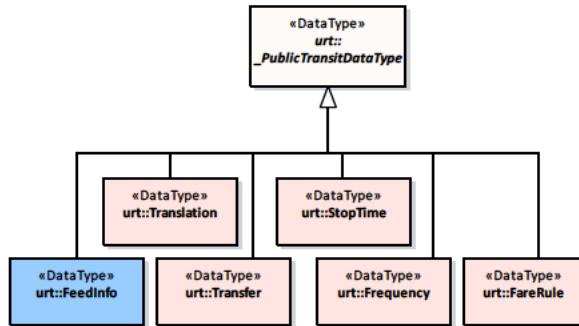


Figure 4-4 DataType classes in Public Transit module

| Type | Definition |
|-----------------------------------|--|
| <i>urt::PublicTransitDataType</i> | A root class for non-identifiable object defined in Public Transit module. |

```

<xsd:complexType name="PublicTransitDataTypeType" abstract="true"/>
<xsd:element name="_PublicTransitDataType" type="urt:PublicTransitDataTypeType" abstract="true"/>
<xsd:complexType name="PublicTransitDataTypePropertyType">
<xsd:sequence>
  <xsd:element ref="urt:_PublicTransitDataType"/>
</xsd:sequence>
</xsd:complexType>
  
```

Figure 4-5 shows the overview of these associations among identifiable classes and non-identifiable classes. Detailed UML class diagrams are described in following subclauses.

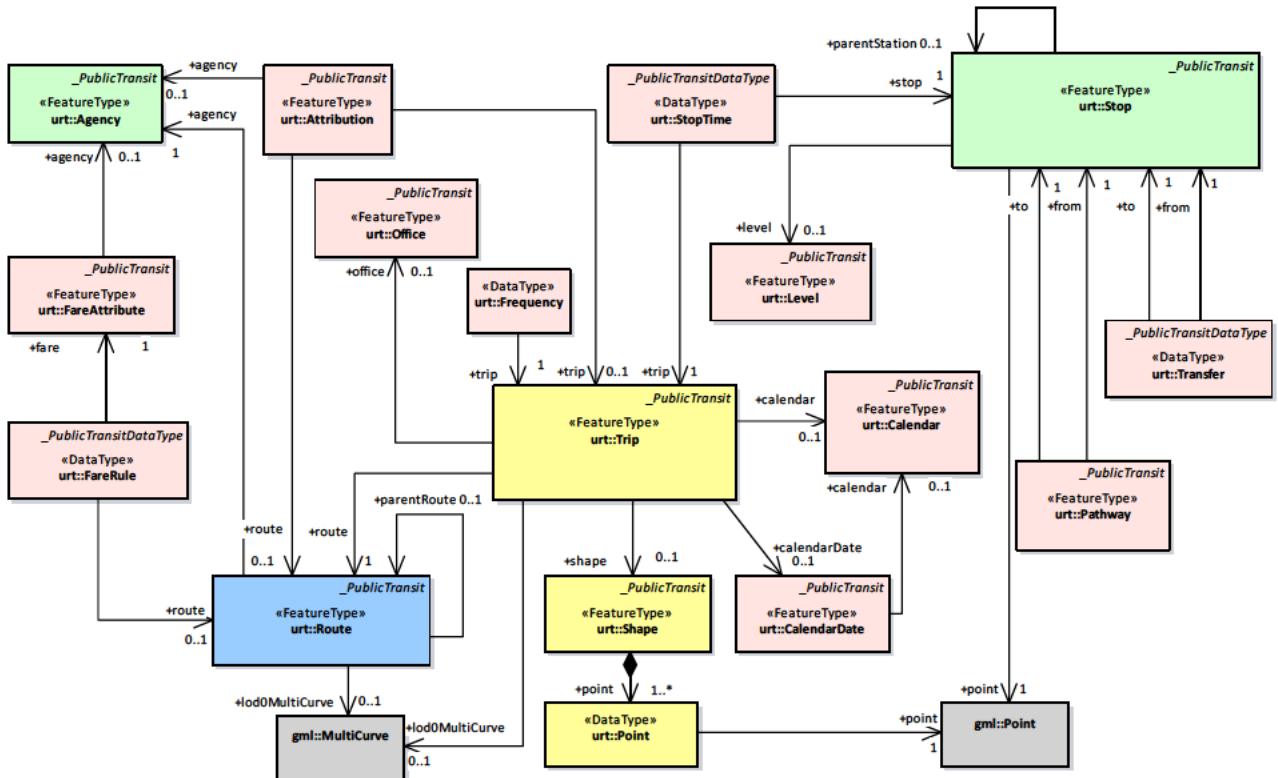


Figure 4-5 Associations between Subclasses of Public Transit module

4.2.3 RouteType, Route

A *urt::Route* is a transit route which is a group of trips that are displayed to riders as a single service. Figure 4-6 shows the structure of *urt::Route* and its related classes.

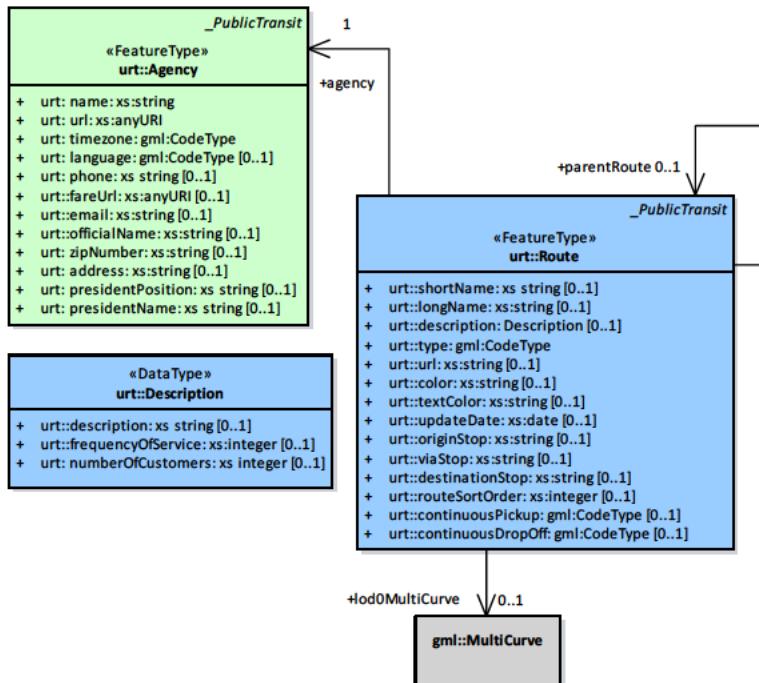


Figure 4-6 UML diagram of *urt::Route* and *urt::Agency*

| Type | Definition |
|------------------------|---|
| urt::Route | Transit routes. A route is a group of trips that are displayed to riders as a single service. |
| Property | Definition |
| urt::shortName | Short name of a route. Either <i>urt::shortName</i> or <i>urt::longName</i> must be specified, or potentially both if appropriate. |
| urt::longName | Full name of a route. Either <i>urt::shortName</i> or <i>urt::longName</i> must be specified, or potentially both if appropriate. |
| urt::description | Description of a route that provides useful, quality information. |
| urt::type | Indicates the type of transit used on a route. |
| urt::url | URL of a web page about the particular route. Should be different from the url value of agency |
| urt::color | Route color designation that matches public facing material. |
| urt::textColor | Legible color to use for text drawn against a background of <i>urt::color</i> |
| urt::updateDate | date of the service schedule changed |
| urt::originStop | Name of the start stop, extended in GTFS-JP. |
| urt::viaStop | Name of the via stop, extended in GTFS-JP. |
| urt::destinationStop | Name of the destination stop, extended in GTFS-JP. |
| urt::routeSortOrder | Orders the routes in a way which is ideal for presentation to customers |
| urt::continuousPickup | Indicates that the rider can board the transit vehicle at any point along the vehicle's travel path as described by <i>urt::shape</i> , on every trip of the route. |
| urt::continuousDropOff | Indicates that the rider can alight from the transit vehicle at any point along the vehicle's travel path as described by <i>urt::shape</i> , on every trip of the route. |
| urt::agency | Agency for the specified route. |
| urt::parentRoute | Parent route of this route |
| urt::lod0MultiCurve | Geometry of this route. This geometric attribute is not defined in GTFS <i>Route.txt</i> but is extended for the use in i-Urban Revitalization. |

```

<xs:complexType name="RouteType">
  <xs:complexContent>
    <xs:extension base="urt:PublicTransitType">
      <xs:sequence>
        <xs:element name="shortName" type="xs:string" minOccurs="0"/>
        <xs:element name="longName" type="xs:string" minOccurs="0"/>
        <xs:element name="description" type="urt:DescriptionPropertyType" minOccurs="0"/>
        <xs:element name="type" type="gml:CodeType"/>
        <xs:element name="url" type="xs:string" minOccurs="0"/>
        <xs:element name="color" type="xs:string" minOccurs="0"/>
        <xs:element name="textColor" type="xs:string" minOccurs="0"/>
        <xs:element name="updateDate" type="xs:date" minOccurs="0"/>
        <xs:element name="originStop" type="xs:string" minOccurs="0"/>
        <xs:element name="viaStop" type="xs:string" minOccurs="0"/>
        <xs:element name="destinationStop" type="xs:string" minOccurs="0"/>
        <xs:element name="routeSortOrder" type="xs:integer" minOccurs="0"/>
        <xs:element name="continuousPickup" type="gml:CodeType" minOccurs="0"/>
        <xs:element name="continuousDropOff" type="gml:CodeType" minOccurs="0"/>
        <xs:element name="agency" type="urt:AgencyPropertyType"/>
        <xs:element name="parentRoute" type="urt:RoutePropertyType" minOccurs="0"/>
        <xs:element name="lod0MultiCurve" type="gml:MultiCurvePropertyType" minOccurs="0"/>
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>
<xs:element name="Route" type="urt:RouteType" substitutionGroup="urt:_PublicTransit"/>
<xs:complexType name="RoutePropertyType">
```

```

<xs:sequence minOccurs="0">
  <xs:element ref="urt:Route" />
</xs:sequence>
<xs:attributeGroup ref="gml:AssociationAttributeGroup" />
</xs:complexType>

```

DescriptionType, Description

| Type | Definition |
|--------------------|---|
| Description | Descriptive information of a route |
| Property | Definition |
| description | Useful and quality information of a route |
| frequencyOfService | Frequency of service per day. This information is not defined in GTFS but is added for i-Urban Revitalization. |
| numberOfCustomers | Number of customers per day. This information is not defined in GTFS but is added for i-Urban Revitalization. |

```

<xs:complexType name="DescriptionType">
<xs:sequence>
  <xs:element name="description" type="xs:string" minOccurs="0"/>
  <xs:element name="frequencyOfService" type="xs:integer" minOccurs="0"/>
  <xs:element name="numberOfCustomers" type="xs:integer" minOccurs="0"/>
</xs:sequence>
</xs:complexType>
<xs:element name="Description" type="urt:DescriptionType" />
<xs:complexType name="Description.PropertyType">
<xs:sequence>
  <xs:element ref="urt:Description" />
</xs:sequence>
</xs:complexType>

```

4.2.4 AgencyType, Agency

A *urt:Agency* is a class to describe a transit agency with service represented in this dataset.

| Type | Definition |
|-------------------|---|
| urt::Agency | An organization which provides public transit service. |
| Property | Definition |
| urt::name | Name of the transit agency |
| urt::url | URL of the transit agency |
| urt::timezone | Timezone where the transit agency is located. If multiple agencies are specified in the dataset, each must have the same timezone. |
| urt::language | Primary language used by this transit agency. |
| urt::phone | A voice telephone number for the specified agency. This field is a string value that presents the telephone number as typical for the agency's service area. It can and should contain |
| urt::fareUrl | URL of a web page that allows a rider to purchase tickets or other fare instruments for that agency online. |
| urt::email | Email address actively monitored by the agency's customer service department. This email address should be a direct contact point where transit riders can reach a customer service representative at the agency. |
| urt::officialName | Official name of the agency, extended in GTFS-JP. |
| urt::zipNumber | Zip number for the agency head office, extended in GTFS-JP. |
| urt::address | Address of the agency, extended in GTFS-JP. |

| | |
|------------------------|--|
| urt::presidentPosition | Position of the agency president, extended in GTFS-JP. |
| urt::presidentName | Name of the agency president, extended in GTFS-JP. |

```

<xs:complexType name="AgencyType">
<xs:complexContent>
<xs:extension base="urt:PublicTransitType">
<xs:sequence>
<xs:element name="name" type="xs:string"/>
<xs:element name="url" type="xs:anyURI"/>
<xs:element name="timeZone" type="gml:CodeType"/>
<xs:element name="language" type="gml:CodeType" minOccurs="0"/>
<xs:element name="phone" type="xs:string" minOccurs="0"/>
<xs:element name="fareUrl" type="xs:anyURI" minOccurs="0"/>
<xs:element name="email" type="xs:string" minOccurs="0"/>
<xs:element name="officialName" type="xs:string" minOccurs="0"/>
<xs:element name="zipNumber" type="xs:string" minOccurs="0"/>
<xs:element name="address" type="xs:string" minOccurs="0"/>
<xs:element name="presidentPosition" type="xs:string" minOccurs="0"/>
<xs:element name="presidentName" type="xs:string" minOccurs="0"/>
</xs:sequence>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:element name="Agency" type="urt:AgencyType" substitutionGroup="urt: PublicTransit"/>
<xs:complexType name="AgencyPropertyType">
<xs:sequence minOccurs="0">
<xs:element ref="urt:Agency"/>
</xs:sequence>
<xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>

```

4.2.5 StopType, Stop

A *urt::Stop* is a place where vehicles pick up or drop off riders. Instances of this class also include stations and station entrances.

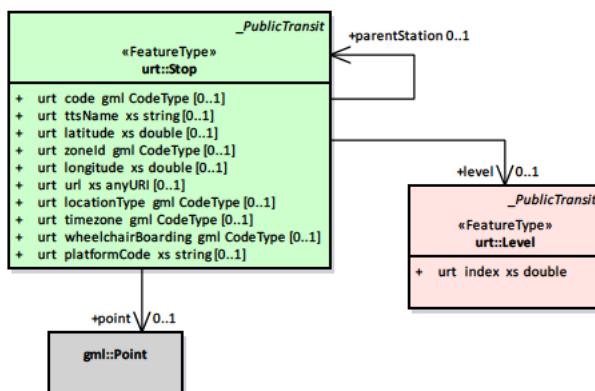


Figure 4-7 UML diagram of *urt::Stop* and *urt::Level*

| Type | Definition |
|-----------|--|
| urt::Stop | A stop, station, or station entrance where vehicles pick up or drop off riders. The attribute <i>name</i> and <i>desctiption</i> in <i>Stop.txt</i> are mapped to <i>gml::name</i> and <i>gml::description</i> . |

| Property | Definition |
|-------------------------|--|
| urt::code | Short text or a number that identifies the location for riders. These codes are often used in phone-based transit information systems or printed on signage to make it easier for riders to get information for a particular location. |
| urt::ttsName | Readable version of the name |
| urt::latitude | Latitude of the location. |
| urt::longitude | Longitude of the location. |
| urt::zoneId | Identifies the fare zone for a stop. |
| urt::url | URL of a web page about the location. |
| urt::locationType | Type of the location |
| urt::timezone | Timezone of the location. |
| urt::wheelchairBoarding | Indicates whether wheelchair boardings are possible from the location. |
| urt::platformCode | Platform identifier for a platform stop (a stop belonging to a station). |
| urt::point | Point location of this stop |
| urt::parentStation | Defines hierarchy between the different locations of stops |
| urt::level | Level of the location. |

```

<xs:complexType name="StopType">
  <xs:complexContent>
    <xs:extension base="urt:PublicTransitType">
      <xs:sequence>
        <xs:element name="code" type="gml:CodeType" minOccurs="0"/>
        <xs:element name="ttsName" type="xs:string" minOccurs="0"/>
        <xs:element name="zoneId" type="gml:CodeType" minOccurs="0"/>
        <xs:element name="url" type="xs:anyURI" minOccurs="0"/>
        <xs:element name="locationType" type="gml:CodeType" minOccurs="0"/>
        <xs:element name="timezone" type="gml:CodeType" minOccurs="0"/>
        <xs:element name="wheelchairBoarding" type="gml:CodeType" minOccurs="0"/>
        <xs:element name="platformCode" type="xs:string" minOccurs="0"/>
        <xs:element name="point" type="gml:PointPropertyType" minOccurs="0"/>
        <xs:element name="parentStation" type="urt:Stop.PropertyType" minOccurs="0"/>
        <xs:element name="level" type="urt:Level.PropertyType" minOccurs="0"/>
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>
<xs:element name="Stop" type="urt:StopType" substitutionGroup="urt:_PublicTransit"/>
<xs:complexType name="Stop.PropertyType">
  <xs:sequence minOccurs="0">
    <xs:element ref="urt:Stop"/>
  </xs:sequence>
  <xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>

```

4.2.6 LevelType, Level

A *urt::Level* is a level within a station. It is mostly useful when used in conjunction with *urt::Pathway*, and is required for elevator to ask the user to take the elevator to the “Mezzanine” or the “Platform” level.

| Type | Definition |
|------------|---|
| urt::Level | Description of each level of a station The attribute <i>name</i> in <i>Level.txt</i> is mapped to <i>gml::name</i> . |
| Property | Definition |

| | |
|------------|---|
| urt::index | Numeric index of the level that indicates relative position of this level in relation to other levels (levels with higher indices are assumed to be located above levels with lower indices). |
|------------|---|

```

<xsd:complexType name="LevelType">
  <xsd:complexContent>
    <xsd:extension base="urt:PublicTransitType">
      <xsd:sequence>
        <xsd:element name="index" type="xsd:double" />
      </xsd:sequence>
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:element name="Level" type="urt:LevelType" substitutionGroup="urt:_PublicTransit"/>
<xsd:complexType name="Level.PropertyType">
  <xsd:sequence minOccurs="0">
    <xsd:element ref="urt:Level"/>
  </xsd:sequence>
  <xsd:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xsd:complexType>

```

4.2.7 TripType, Trip

A trip is a sequence of two or more stops that occur during a specific time period. Figure 4-8 shows the structure of *urt:Trip* and other related classes which necessary for *urt:Trip*.

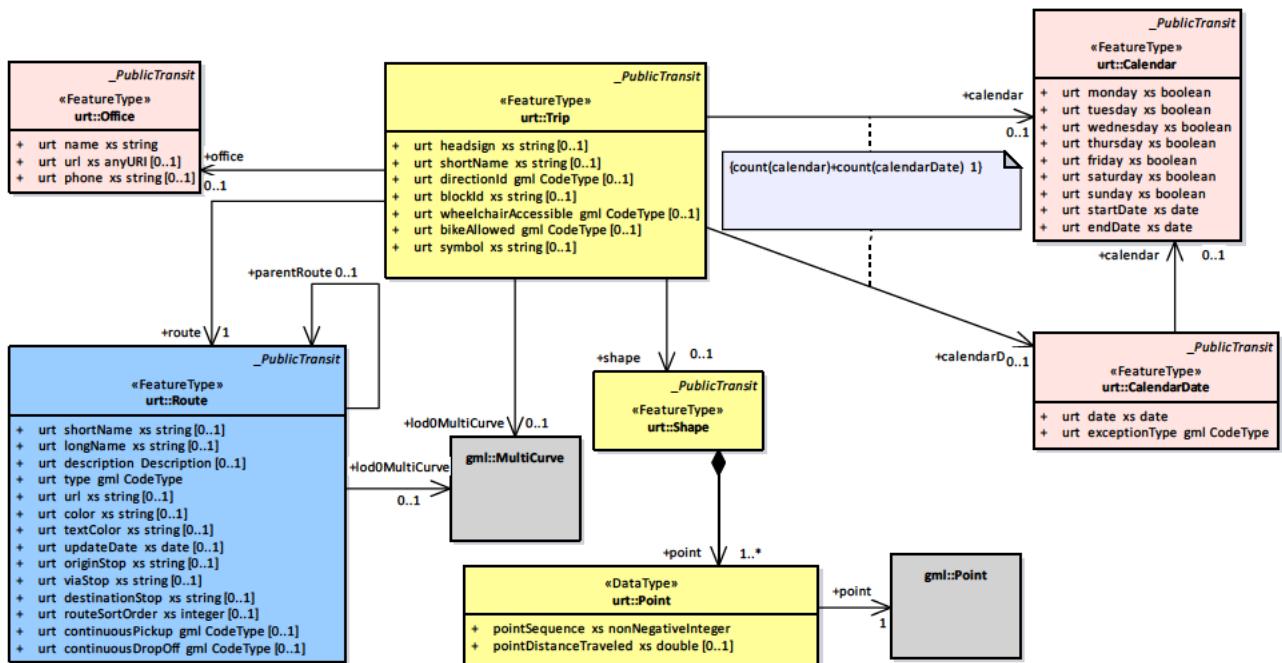


Figure 4-8 UML diagram of *urt:Trip* and related classes

| Type | Definition |
|-----------|--|
| urt::Trip | A trips for each route. The attribute <i>desctiption</i> in <i>Trip.txt</i> is mapped to <i>gml:description</i> . |
| Property | Definition |

| | |
|---------------------------|---|
| urt::headsign | Short text or a number that identifies the location for riders. These codes are often used in phone-based transit information systems or printed on signage to make it easier for riders to get information for a particular location. |
| urt::shortName | Name of the location. Use a name that people will understand in the local and tourist vernacular. |
| urt::directionId | Readable version of the name |
| urt::blockId | Description of the location that provides useful, quality information. |
| urt::wheelchairAccessible | Identifies the fare zone for a stop. |
| urt::bikeAllowed | URL of a web page about the location. |
| urt::symbol | Symbol set on timetable, extended in GTFS-JP. |
| urt::route | Identifies a route |
| urt::calendar | Identifies a calendar when service is available for one or more routes. It matches with <i>service_id</i> in <i>Trip.txt</i> when the trip refers <i>service_id</i> in <i>Calendar.txt</i> $\{\text{count(calendar)} + \text{count(calendarDate)} = 1\}$ |
| urt::calendarDate | Identifies a calendar date when service is available for one or more routes. It matches with <i>service_id</i> in <i>Trip.txt</i> when the trip refers <i>service_id</i> in <i>CalendarDate.txt</i> $\{\text{count(calendar)} + \text{count(calendarDate)} = 1\}$ |
| urt::office | Office for this trip, extended in GTFS-JP. |
| urt::shape | Sequence of points to describe this trip. |
| urt::lod0MultiCurve | Linear curve of this trip, extended in this module. This curve is consist of a sequence of points in a <i>urt::Shape</i> which is referred from this trip. |

```

<xs:complexType name="TripType">
  <xs:complexContent>
    <xs:extension base="urt:PublicTransitType">
      <xs:sequence>
        <xs:element name="headsign" type="xs:string" minOccurs="0"/>
        <xs:element name="shortName" type="xs:string" minOccurs="0"/>
        <xs:element name="directionId" type="gml:CodeType" minOccurs="0"/>
        <xs:element name="blockId" type="xs:string" minOccurs="0"/>
        <xs:element name="wheelchairAccessible" type="gml:CodeType" minOccurs="0"/>
        <xs:element name="bikeAllowed" type="gml:CodeType" minOccurs="0"/>
        <xs:element name="symbol" type="xs:string" minOccurs="0"/>
        <xs:element name="route" type="urt:RoutePropertyType"/>
        <xs:element name="calendar" type="urt:CalendarPropertyType" minOccurs="0"/>
        <xs:element name="calendarDate" type="urt:CalendarDatePropertyType" minOccurs="0"/>
        <xs:element name="office" type="urt:OfficePropertyType" minOccurs="0"/>
        <xs:element name="shape" type="urt:ShapePropertyType" minOccurs="0"/>
        <xs:element name="lod0MultiCurve" type="gml:MultiCurvePropertyType" minOccurs="0"/>
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>
<xs:element name="Trip" type="urt:TripType" substitutionGroup="urt:_PublicTransit"/>
<xs:complexType name="TripPropertyType">
  <xs:sequence minOccurs="0">
    <xs:element ref="urt:Trip"/>
  </xs:sequence>
  <xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>

```

4.2.8 ShapeType, Shape

| Type | Definition |
|------------|--|
| urt::Shape | A rule for mapping vehicle travel path, sometimes referred to as a route alignment |
| Property | Definition |
| urt::point | A sequence of points |

```

<xs:element name="Shape" type="urt:ShapeType" substitutionGroup="urt:_PublicTransit"/>
<xs:complexType name="ShapeType">
<xs:complexContent>
  <xs:extension base="urt:PublicTransitType">
    <xs:sequence>
      <xs:element name="point" type="urt:PointPropertyType" maxOccurs="unbounded"/>
    </xs:sequence>
  </xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:complexType name="Shape.PropertyType">
  <xs:sequence minOccurs="0">
    <xs:element ref="urt:Shape"/>
  </xs:sequence>
  <xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>

```

PointType, Point

| Type | Definition |
|----------------------------|--|
| urt::Point | A point which is a part of a shape. |
| Property | Definition |
| urt::latitude | Latitude of a shape point |
| urt::longitude | Longitude of a shape point |
| urt::point | Location of this point |
| urt::pointSequence | Sequence in which the shape points connect to form the shape. |
| urt::pointDistanceTraveled | Actual distance traveled along the shape from the first shape point to the point specified in this record. |

```

<xs:complexType name="PointType">
<xs:sequence>
  <xs:element name="latitude" type="xs:double"/>
  <xs:element name="longitude" type="xs:double"/>
  <xs:element name="point" type="gml:PointPropertyType"/>
  <xs:element name="pointSequence" type="xs:nonNegativeInteger"/>
  <xs:element name="pointDistanceTraveled" type="xs:double" minOccurs="0"/>
</xs:sequence>
</xs:complexType>
<xs:element name="Point" type="urt:PointType"/>
<xs:complexType name="Point.PropertyType">
<xs:sequence>
  <xs:element ref="urt:Point"/>
</xs:sequence>
</xs:complexType>

```

4.2.9 CalendarType, Calendar

| Type | Definition |
|------|------------|
|------|------------|

| | |
|-----------------|--|
| urt::Calendar | A service dates specified using a weekly schedule with start and end dates. |
| Property | Definition |
| urt::monday | Indicates whether the service operates on all Mondays in the date range specified by the <i>urt::startDate</i> and <i>urt::endDate</i> . Note that exceptions for particular dates may be listed in <i>urt::CalendarDate</i> |
| urt::tuesday | Functions in the same way as monday except applies to Tuesdays |
| urt::wednesday | Functions in the same way as monday except applies to Wednesdays |
| urt::thursday | Functions in the same way as monday except applies to Thursdays |
| urt::friday | Functions in the same way as monday except applies to Fridays |
| urt::saturday | Functions in the same way as monday except applies to Saturdays |
| urt::sunday | Functions in the same way as monday except applies to Sundays |
| urt::startDate | Start service day for the service interval. |
| urt::endDate | End service day for the service interval. This service day is included in the interval. |

```

<xs:complexType name="CalendarType">
  <xs:complexContent>
    <xs:extension base="urt:PublicTransitType">
      <xs:sequence>
        <xs:element name="monday" type="xs:boolean"/>
        <xs:element name="tuesday" type="xs:boolean"/>
        <xs:element name="wednesday" type="xs:boolean"/>
        <xs:element name="thursday" type="xs:boolean"/>
        <xs:element name="friday" type="xs:boolean"/>
        <xs:element name="saturday" type="xs:boolean"/>
        <xs:element name="sunday" type="xs:boolean"/>
        <xs:element name="startDate" type="xs:date"/>
        <xs:element name="endDate" type="xs:date"/>
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>
<xs:element name="Calendar" type="urt:CalendarType" substitutionGroup="urt:_PublicTransit"/>
<xs:complexType name="Calendar.PropertyType">
  <xs:sequence minOccurs="0">
    <xs:element ref="urt:Calendar"/>
  </xs:sequence>
  <xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>

```

4.2.10 CalendarDateType, CalendarDate

| Type | Definition |
|--------------------|---|
| urt::CalendarDate | CalendarDate defines exceptions to the default service patterns defined in calendar |
| Property | Definition |
| urt::date | Date when service exception occurs. |
| urt::exceptionType | Indicates whether service is available on the date specified in the date field. |
| urt::calendar | Identifies a calendar when a service exception occurs for one or more routes. |

```

<xs:complexType name="CalendarDateType">
  <xs:complexContent>
    <xs:extension base="urt:PublicTransitType">
      <xs:sequence>
        <xs:element name="date" type="xs:date"/>
        <xs:element name="exceptionType" type="gml:CodeType"/>
        <xs:element name="calendar" type="urt:Calendar.PropertyType" minOccurs="0"/>
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>

```

```

</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:element name="CalendarDate" type="urt:CalendarDateType" substitutionGroup="urt:_PublicTransit"/>
<xs:complexType name="CalendarDatePropertyType">
<xs:sequence minOccurs="0">
  <xs:element ref="urt:CalendarDate"/>
</xs:sequence>
<xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>

```

4.2.11 OfficeType, Office

| Type | Definition |
|-------------|---------------------------|
| urt::Office | Service office. |
| Property | Definition |
| urt::name | Name of an office |
| urt::url | URL of an office |
| urt::phone | Phone number of an office |

```

<xs:complexType name="OfficeType">
<xs:complexContent>
  <xs:extension base="urt:PublicTransitType">
    <xs:sequence>
      <xs:element name="name" type="xs:string"/>
      <xs:element name="url" type="xs:anyURI" minOccurs="0"/>
      <xs:element name="phone" type="xs:string" minOccurs="0"/>
    </xs:sequence>
  </xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:element name="Office" type="urt:OfficeType" substitutionGroup="urt:_PublicTransit"/>
<xs:complexType name="OfficePropertyType">
<xs:sequence minOccurs="0">
  <xs:element ref="urt:Office"/>
</xs:sequence>
<xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>

```

4.2.12 FareAttributeType, FareAttribute

Figure 4-9 shows the structure of fare information for a transit agency's routes.

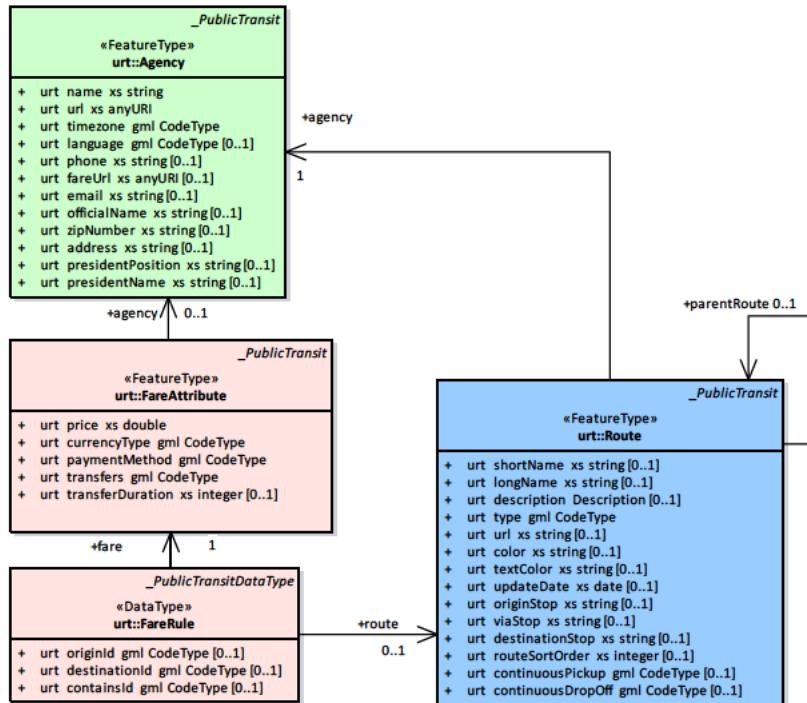


Figure 4-9 UML diagram of `urt::FareAttribute` and `urt::FareRule`

| Type | Definition |
|------------------------------------|---|
| <code>urt::FareAttribute</code> | Detailed information of the fare |
| Property | Definition |
| <code>urt::price</code> | Fare price |
| <code>urt::currencyType</code> | Currency used to pay the fare |
| <code>urt::paymentMethod</code> | Indicates when the fare must be paid. |
| <code>urt::transfers</code> | Indicates the number of transfers permitted on this fare. |
| <code>urt::transferDuration</code> | Length of time in seconds before a transfer expires. When transfers=0 this field can be used to indicate how long a ticket is valid for or it can be left empty |
| <code>urt::agency</code> | Identifies the relevant agency for a fare. |

```

<xs:complexType name="FareAttributeType">
<xs:complexContent>
<xs:extension base="urt:PublicTransitType">
<xs:sequence>
<xs:element name="price" type="xs:double"/>
<xs:element name="currencyType" type="gml:CodeType"/>
<xs:element name="paymentMethod" type="gml:CodeType"/>
<xs:element name="transfers" type="gml:CodeType"/>
<xs:element name="transferDuration" type="xs:integer" minOccurs="0"/>
<xs:element name="agency" type="urt:AgencyPropertyType" minOccurs="0"/>
</xs:sequence>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:element name="FareAttribute" type="urt:FareAttributeType" substitutionGroup="urt:_PublicTransit"/>
<xs:complexType name="FareAttributePropertyType">
<xs:sequence minOccurs="0">
<xs:element ref="urt:FareAttribute"/>
</xs:sequence>

```

```

<xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>

```

4.2.13 FareRuleType, FareRule

| Type | Definition |
|--------------------|--|
| urt::FareRule | Rules to apply fares for itineraries |
| Property | Definition |
| urt::originId | Identifies an origin zone. |
| urt::destinationId | Identifies a destination zone. |
| urt::containsId | Identifies the zones that a rider will enter while using a given fare class. |
| urt::fare | Identifies a fare class. |
| urt::route | Identifies a route associated with the fare class. |

```

<xs:complexType name="FareRuleType">
  <xs:complexContent>
    <xs:extension base="urt:PublicTransitDataTypeType">
      <xs:sequence>
        <xs:element name="originId" type="gml:CodeType" minOccurs="0"/>
        <xs:element name="destinationId" type="gml:CodeType" minOccurs="0"/>
        <xs:element name="containsId" type="gml:CodeType" minOccurs="0"/>
        <xs:element name="fare" type="urt:FareAttributePropertyType"/>
        <xs:element name="route" type="urt:RoutePropertyType" minOccurs="0"/>
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>
<xs:element name="FareRule" type="urt:FareRuleType" substitutionGroup="urt:_PublicTransitDataType"/>
<xs:complexType name="FareRulePropertyType">
  <xs:sequence>
    <xs:element ref="urt:FareRule"/>
  </xs:sequence>
</xs:complexType>

```

4.2.14 StopTimeType, StopTime

A *urt::StopTime* is a class to describe times that a vehicle arrives at and departs from stops for each trip.

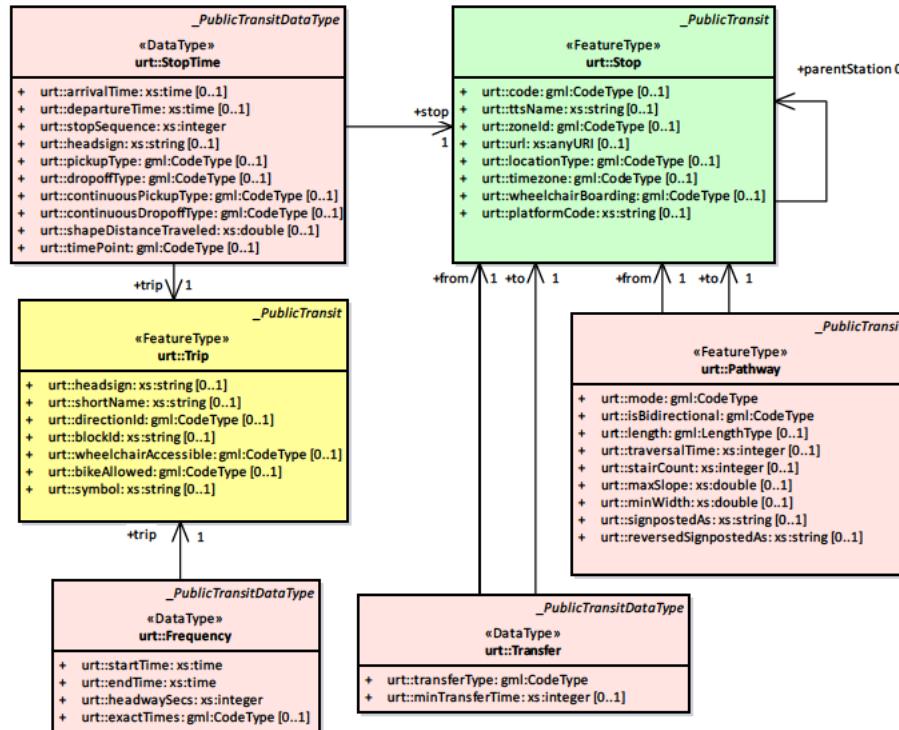


Figure 4-10 UML diagram of *urt::StopTime*, *urt::Frequency*, *urt::Transfer* and *urt::Pathway*

| Type | Definition |
|----------------------------|--|
| Property | Definition |
| urt::StopTime | Arrival and departure time at the stop |
| urt::arrivalTime | Arrival time at a specific stop for a specific trip on a route. |
| urt::departureTime | Departure time from a specific stop for a specific trip on a route. |
| urt::stopSequence | Order of stops for a particular trip. The values must increase along the trip but do not need to be consecutive. |
| urt::headsign | Text that appears on signage identifying the trip's destination to riders. |
| urt::pickupType | Indicates pickup method. |
| urt::dropoffType | Indicates drop off method. |
| urt::continuousPickupType | Indicates that the rider can board the transit vehicle at any point along the vehicle's travel path as described by shapes.txt, from this <i>urt::StopTime</i> to the next <i>urt::StopTime</i> in the trip's <i>stopSequence</i> . |
| urt::continuousDropoffType | Indicates that the rider can alight from the transit vehicle at any point along the vehicle's travel path as described by <i>urt::Shape</i> , from this <i>urt::StopTime</i> to the next <i>urt::StopTime</i> in the trip's <i>urt::stopSequence</i> . |
| urt::shapeDistTraveled | Actual distance traveled along the associated shape, from the first stop to the stop specified in this record. |
| urt::timePoint | Indicates if arrival and departure times for a stop are strictly adhered to by the vehicle or if they are instead approximate and/or interpolated times. |
| urt::trip | Identifies a trip. |
| urt::stop | Identifies the serviced stop. |

```
<xs:complexType name="StopTimeType">
  <xs:complexContent>
    <xs:extension base="urt:PublicTransitDataTypeType">
      <xs:sequence>
        <xs:element name="arrivalTime" type="xs:time" minOccurs="0"/>
```

```

<xs:element name="departureTime" type="xs:time" minOccurs="0"/>
<xs:element name="stopSequence" type="xs:integer"/>
<xs:element name="headsign" type="xs:string" minOccurs="0"/>
<xs:element name="pickupType" type="gml:CodeType" minOccurs="0"/>
<xs:element name="dropoffType" type="gml:CodeType" minOccurs="0"/>
<xs:element name="continuousPickupType" type="gml:CodeType" minOccurs="0"/>
<xs:element name="continuousDropoffType" type="gml:CodeType" minOccurs="0"/>
<xs:element name="shapeDistanceTraveled" type="xs:double" minOccurs="0"/>
<xs:element name="timePoint" type="gml:CodeType" minOccurs="0"/>
<xs:element name="trip" type="urt:TripPropertyType"/>
<xs:element name="stop" type="urt:StopPropertyType"/>
</xs:sequence>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:element name="StopTime" type="urt:StopTimeType" substitutionGroup="urt:_PublicTransitDataType"/>
<xs:complexType name="StopTime.PropertyType">
<xs:sequence>
<xs:element ref="urt:StopTime"/>
</xs:sequence>
</xs:complexType>

```

4.2.15 FrequencyType, Frequency

A *urt::Frequency* is used when there is no fixed timetable and the train operates at regular intervals.

| Type | Definition |
|------------------|---|
| urt::Frequency | Headway (time between trips) for headway-based service or a compressed representation of fixed-schedule service. |
| Property | Definition |
| urt::startTime | Time at which the first vehicle departs from the first stop of the trip with the specified headway. |
| urt::endTime | Time at which service changes to a different headway (or ceases) at the first stop in the trip |
| urt::headwaySecs | Time, in seconds, between departures from the same stop (headway) for the trip, during the time interval specified by <i>urt::startTime</i> and <i>urt::endTime</i> . |
| urt::exactTimes | Indicates the type of service for a trip. See the file description for more information |
| urt::trip | Identifies a trip to which the specified headway of service applies |

```

<xs:complexType name="FrequencyType">
<xs:complexContent>
<xs:extension base="urt:PublicTransitDataTypeType">
<xs:sequence>
<xs:element name="startTime" type="xs:time"/>
<xs:element name="endTime" type="xs:time"/>
<xs:element name="headwaySecs" type="xs:integer"/>
<xs:element name="exactTimes" type="gml:CodeType" minOccurs="0"/>
<xs:element name="trip" type="urt:TripPropertyType"/>
</xs:sequence>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:element name="Frequency" type="urt:FrequencyType" substitutionGroup="urt:_PublicTransitDataType"/>
<xs:complexType name="Frequency.PropertyType">
<xs:sequence>
<xs:element ref="urt:Frequency"/>
</xs:sequence>
</xs:complexType>

```

4.2.16 TransferType, Transfer

A *urt::Transfer* defines Rules for making connections at transfer points between routes.

| Type | Definition |
|----------------------|--|
| urt::Transfer | Rules for making connections at transfer points between routes. |
| Property | Definition |
| urt::transferType | Indicates the type of connection for the specified (<i>urt::from</i> and <i>urt::to</i>) pair. |
| urt::minTransferTime | Amount of time, in seconds, that must be available to permit a transfer between routes at the specified stops. |
| urt::from | Identifies a stop or station where a connection between routes begins. |
| urt::to | Identifies a stop or station where a connection between routes ends. |

```

<xs:complexType name="TransferType">
  <xs:complexContent>
    <xs:extension base="urt:PublicTransitDataTypeType">
      <xs:sequence>
        <xs:element name="transferType" type="gml:CodeType"/>
        <xs:element name="minTransferTime" type="xs:integer" minOccurs="0"/>
        <xs:element name="from" type="urt:StopPropertyType"/>
        <xs:element name="to" type="urt:StopPropertyType"/>
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>
<xs:element name="Transfer" type="urt:TransferType" substitutionGroup="urt:_PublicTransitDataType"/>
<xs:complexType name="TransferPropertyType">
  <xs:sequence>
    <xs:element ref="urt:Transfer"/>
  </xs:sequence>
</xs:complexType>

```

4.2.17 PathwayType, Pathway

A *urt::Pathway* describes a graph representation to describe subway or train, with nodes (the locations) and edges (the pathways).

| Type | Definition |
|---------------------------|--|
| urt::Pathway | A graph representation to describe subway or train, with nodes (the locations) and edges (the pathways) |
| Property | Definition |
| urt::mode | Type of pathway between the specified (<i>urt::from</i> and <i>urt::to</i>) pair. |
| urt::isBidirectional | Indicates in which direction the pathway can be used |
| urt::length | Horizontal length in meters of the pathway from the origin location to the destination location. |
| urt::traversalTime | Average time in seconds needed to walk through the pathway from the origin location to the destination location. |
| urt::stairCount | Number of stairs of the pathway. |
| urt::maxSlope | Maximum slope ratio of the pathway. |
| urt::mixWidth | Minimum width of the pathway in meters. |
| urt::signpostedAs | String of text from physical signage visible to transit riders. |
| urt::reversedSignpostedAs | Same than the signpostedAs field, but when the pathways is used backward |
| urt::from | Stop at which the pathway begins. |
| urt::to | Stop at which the pathway ends. |

```

<xs:complexType name="PathwayType">
  <xs:complexContent>
    <xs:extension base="urt:PublicTransitType">
      <xs:sequence>
        <xs:element name="mode" type="gml:CodeType" minOccurs="0"/>
        <xs:element name="isBidirectional" type="gml:CodeType"/>
        <xs:element name="length" type="gml:LengthType" minOccurs="0"/>
        <xs:element name="traversalTime" type="xs:integer" minOccurs="0"/>
        <xs:element name="stairCount" type="xs:integer" minOccurs="0"/>
        <xs:element name="maxSlope" type="xs:double" minOccurs="0"/>
        <xs:element name="minWidth" type="xs:double" minOccurs="0"/>
        <xs:element name="signpostedAs" type="xs:string" minOccurs="0"/>
        <xs:element name="reversedSignpostedAs" type="xs:string" minOccurs="0"/>
        <xs:element name="from" type="urt:Stop.PropertyType"/>
        <xs:element name="to" type="urt:Stop.PropertyType"/>
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>
<xs:element name="Pathway" type="urt:PathwayType" substitutionGroup="urt:_PublicTransit"/>
<xs:complexType name="PathwayPropertyType">
  <xs:sequence minOccurs="0">
    <xs:element ref="urt:Pathway"/>
  </xs:sequence>
  <xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>

```

4.2.18 TranslationType, Translation

In regions that have multiple official languages, transit agencies/operators typically have language-specific names and web pages. In order to best serve riders in those regions, it is useful for the dataset to include these language-dependent values. Furthermore, some countries use several styles of letters for their language and languages written ideographically is difficult to read for riders who are not familiar to that language. Figure 4-11 shows the structure of translation information which is used for such purpose.

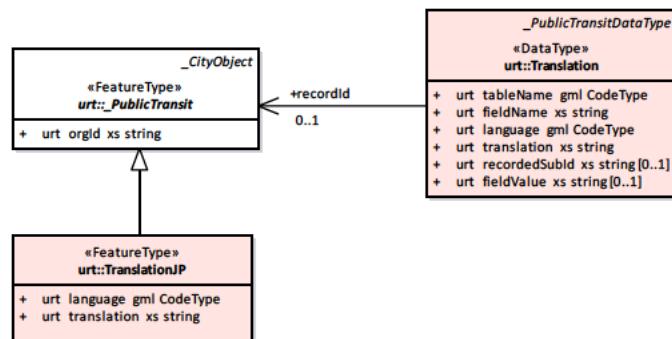


Figure 4-11 UML diagram of *urt::Translation* and *urt::TranslationJP*

| Type | Definition |
|------------------|---|
| urt::Translation | Language-specific names |
| Property | Definition |
| urt::tableName | Defines the table that contains the field to be translated. |
| urt::fieldName | Name of the field to be translated. |

| | |
|------------------|--|
| urt::language | Language of translation. |
| urt::translation | Translated value. |
| urt::recordId | Defines the record that corresponds to the field to be translated. |
| urt::recordSubId | Helps the record that contains the field to be translated when the table doesn't have a unique ID. |
| urt::fieldValue | Instead of defining which record should be translated by using <i>urt::recordId</i> and <i>urt::recordSubId</i> , this field can be used to define the value which should be translated. |

```

<xs:complexType name="TranslationType">
  <xs:complexContent>
    <xs:extension base="urt:PublicTransitDataTypeType">
      <xs:sequence>
        <xs:element name="tableName" type="gml:CodeType"/>
        <xs:element name="fieldName" type="xs:string"/>
        <xs:element name="language" type="gml:CodeType"/>
        <xs:element name="translation" type="xs:string"/>
        <xs:element name="recordId" type="urt:PublicTransitPropertyType" minOccurs="0"/>
        <xs:element name="recordSubId" type="xs:string" minOccurs="0"/>
        <xs:element name="fieldValue" type="xs:string" minOccurs="0"/>
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>
<xs:element name="Translation" type="urt:TranslationType" substitutionGroup="urt:_PublicTransitDataType"/>
<xs:complexType name="TranslationPropertyType">
  <xs:sequence>
    <xs:element ref="urt:Translation"/>
  </xs:sequence>
</xs:complexType>

```

4.2.19 TranslationJPType, TranslationJP

The class *urt::TranslationJP* is a class which is from not-standardized GTFS considering the situation in Japan, where uses combination of three styles of letter: kanji, hiragana, katakana.

| Type | Definition |
|--------------------|--|
| urt::TranslationJP | The Japanese pronunciation and Roman character notation of a name. The name to be translated is described in <i>urt::orgId</i> . |
| Property | Definition |
| urt::language | Language of translation |
| urt::translation | Translated value |

```

<xs:complexType name="TranslationJPType">
  <xs:complexContent>
    <xs:extension base="urt:PublicTransitType">
      <xs:sequence>
        <xs:element name="language" type="gml:CodeType"/>
        <xs:element name="translation" type="xs:string"/>
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>
<xs:element name="TranslationJP" type="urt:TranslationJPType" substitutionGroup="urt:_PublicTransit"/>
<xs:complexType name="TranslationJPPropertyType">
  <xs:sequence minOccurs="0">

```

```

<xs:element ref="urt:TranslationJP"/>
</xs:sequence>
<xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>

```

4.2.20 AttributionType, Attribution

A *urt::Attribution* defines the attributions applied to the dataset.

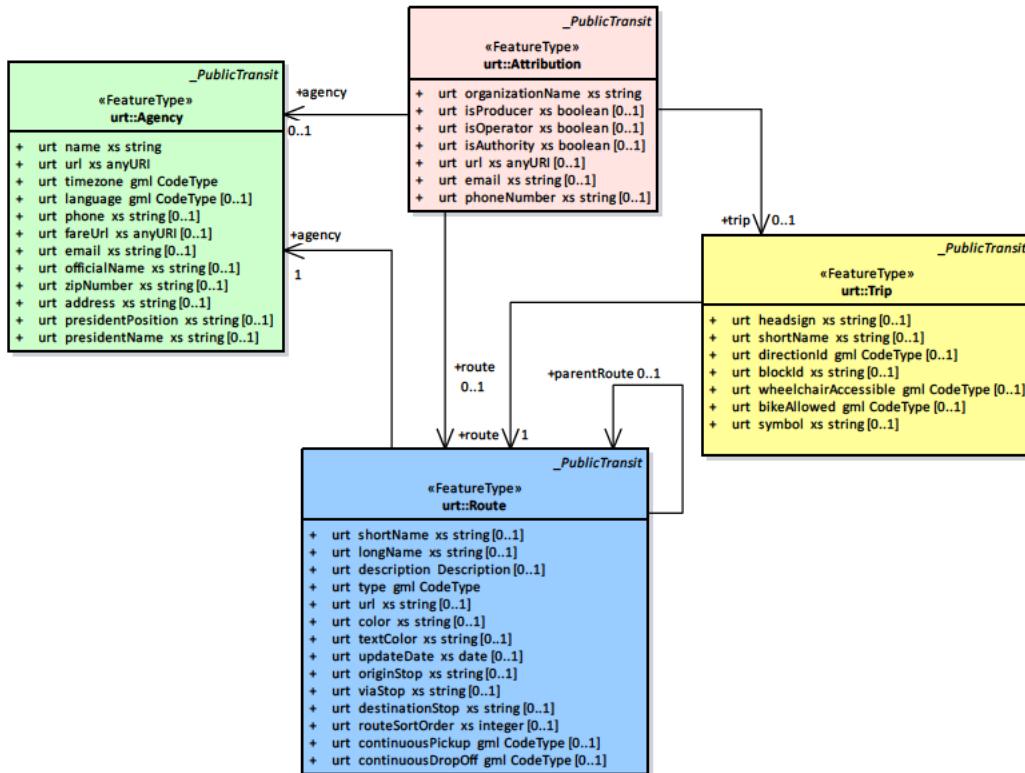


Figure 4-12 UML diagram of *urt::Attribution* and related classes

| Type | Definition |
|-----------------------|--|
| urt::Attribution | The attributions applied to the dataset. |
| Property | Definition |
| urt::organizationName | Name of the organization that the dataset is attributed to |
| urt::isProducer | The role of the organization is producer. Valid options are: <i>false</i> : Organization doesn't have this role, <i>true</i> : Organization does have this role. |
| urt::isOperator | The role of the organization is operator. Valid options are: <i>false</i> : Organization doesn't have this role, <i>true</i> : Organization does have this role. |
| urt::isAuthority | The role of the organization is authority. Valid options are: <i>false</i> : Organization doesn't have this role, <i>true</i> : Organization does have this role. |
| urt::url | URL of the organization |
| urt::email | Email of the organization |
| urt::phone | Phone number of the organization. |
| urt::agency | Agency to which the attribution applies |
| urt::route | Route to which the attribution applies |
| urt::trip | Trip to which the attribution applies |

```

<xs:complexType name="AttributionType">

```

```

<xs:complexContent>
  <xs:extension base="urt:PublicTransitType">
    <xs:sequence>
      <xs:element name="organizationName" type="xs:string"/>
      <xs:element name="isProducer" type="xs:boolean" minOccurs="0"/>
      <xs:element name="isOperator" type="xs:boolean" minOccurs="0"/>
      <xs:element name="isAuthority" type="xs:boolean" minOccurs="0"/>
      <xs:element name="url" type="xs:anyURI" minOccurs="0"/>
      <xs:element name="email" type="xs:string" minOccurs="0"/>
      <xs:element name="phone" type="xs:string" minOccurs="0"/>
      <xs:element name="agency" type="urt:AgencyPropertyType" minOccurs="0"/>
      <xs:element name="route" type="urt:RoutePropertyType" minOccurs="0"/>
      <xs:element name="trip" type="urt:TripPropertyType" minOccurs="0"/>
    </xs:sequence>
  </xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:element name="Attribution" type="urt:AttributionType" substitutionGroup="urt:_PublicTransit"/>
<xs:complexType name="Attribution.PropertyType">
  <xs:sequence minOccurs="0">
    <xs:element ref="urt:Attribution"/>
  </xs:sequence>
  <xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>

```

4.2.21 FeedInfoType, FeedInfo

A urt::FeedInfo is a class for dataset metadata, including publisher, version, and expiration information as shown in **Figure 4-13**.

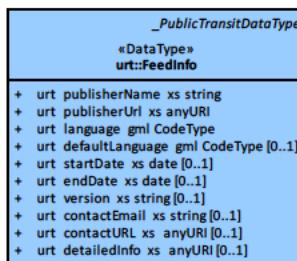


Figure 4-13 UML diagram of *urt::FeedInfo*

| Type | Definition |
|----------------------|--|
| urt::FeedInfo | Information about the dataset itself, rather than the services the dataset describes. |
| Property | Definition |
| urt::publisherName | Full name of the organization that publishes the dataset. |
| urt::publisherUrl | URL of the dataset publishing organization's website. |
| urt::language | Default language for the text in this dataset. |
| urt::defaultLanguage | Defines the language used when the data consumer doesn't know the language of the rider. |
| urt::startDate | The dataset provides complete and reliable schedule information for service in the period from the beginning to the end. |
| urt::endDate | The dataset provides complete and reliable schedule information for service in the period from the beginning to the end. |

| | |
|-------------------|---|
| urt::version | String that indicates the current version of their GTFS dataset. |
| urt::contactEmail | Email address for communication regarding the GTFS dataset and data publishing practices. |
| urt::contactURL | URL for contact information, a web-form, support desk, or other tools for communication regarding the GTFS dataset and data publishing practices. |
| urt::detailedInfo | URL for GTFS dataset files. |

```

<xs:complexType name="FeedInfoType">
  <xs:complexContent>
    <xs:extension base="urt:PublicTransitDataTypeType">
      <xs:sequence>
        <xs:element name="publisherName" type="xs:string"/>
        <xs:element name="publisherUrl" type="xs:anyURI"/>
        <xs:element name="language" type="gml:CodeType" minOccurs="0"/>
        <xs:element name="defaultLanguage" type="gml:CodeType" minOccurs="0"/>
        <xs:element name="startDate" type="xs:date" minOccurs="0"/>
        <xs:element name="endDate" type="xs:date" minOccurs="0"/>
        <xs:element name="version" type="xs:string" minOccurs="0"/>
        <xs:element name="contactEmail" type="xs:string" minOccurs="0"/>
        <xs:element name="contactURL" type="xs:anyURI" minOccurs="0"/>
        <xs:element name="detailedInfo" type="xs:anyURI" minOccurs="0"/>
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>
<xs:element name="FeedInfo" type="urt:FeedInfoType" substitutionGroup="urt: PublicTransitDataType"/>
<xs:complexType name="FeedInfoPropertyType">
  <xs:sequence>
    <xs:element ref="urt:FeedInfo"/>
  </xs:sequence>
</xs:complexType>

```

4.2.22 Extended properties of CityObjectGroup

A *grp::CityObjectGroup* inherits attributes from the parent class *core::_CityObject*.

The *groupMember* property of *grp::CityObjectGroup* may contain a *core::_CityObject* element inline or an XLink reference to a remote *core::_CityObject* element, therefore extended city objects defined in this module may also be contained in or referred from a *grp::CityObjectGroup*. XLink reference prevents data duplication and enables multiple use of the city objects. The *urt::CityObjectGroup* extended in this module shall contain only subclasses of *urt::_PublicTransit* and *urt::_PublicTransitDataType*. The attribute *grp::usage* which is inherited from *grp::CityObjectGroup* can represent that this object group is for the use of public transit.

One association role, *urt::dataType* is added as a member of the substitution group *grp::_GenericApplicationPropertyOfCityObjectGroup* to allow datasets to contain datatype instances directly as a part of dataset.

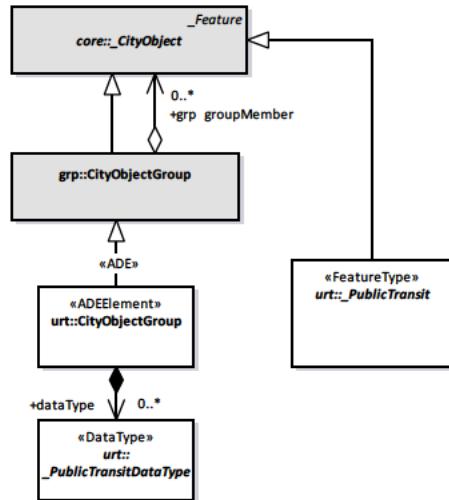


Figure 4-14 UML diagram of `urt::CityObjectGroup`

Extended properties of CityObjectGroup

| Property | Definition |
|----------------------------|--|
| <code>urt::dataType</code> | Association to contain <code>DataType</code> instances directly under the <code>CityObjectGroup</code> |

```

<xsd:element name="dataType" type="urt:PublicTransitDataTypePropertyType"
substitutionGroup="grp:_GenericApplicationPropertyOfCityObjectGroup"/>
  
```

Annex A (normative)

XMLSchema Definition

A.1 XMLSchema

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:urt="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/urt/1.4"
  xmlns:core="http://www.opengis.net/citygml/2.0" xmlns:grp="http://www.opengis.net/citygml/cityobjectgroup/2.0"
  xmlns:xs="http://www.w3.org/2001/XMLSchema" xmlns:gml="http://www.opengis.net/gml"
  targetNamespace="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/urt/1.4"
  elementFormDefault="qualified" attributeFormDefault="unqualified" version="1.4">
  <xs:annotation>
    <xs:documentation>XML Schema for Public Transit module</xs:documentation>
  </xs:annotation>
  <xs:import namespace="http://www.opengis.net/gml"
    schemaLocation="http://schemas.opengis.net/gml/3.1.1/base/gml.xsd"/>
  <xs:import namespace="http://www.opengis.net/citygml/2.0"
    schemaLocation="http://schemas.opengis.net/citygml/2.0/cityGMLBase.xsd"/>
  <xs:import namespace="http://www.opengis.net/citygml/cityobjectgroup/2.0"
    schemaLocation="http://schemas.opengis.net/citygml/cityobjectgroup/2.0/cityObjectGroup.xsd"/>
  <!-- ===== CityGML PublicTransit module ===== -->
  <!-- ===== CityGML PublicTransit module ===== -->
  <!-- ===== CityGML PublicTransit module ===== -->
  <xs:complexType name="PublicTransitType" abstract="true">
    <xs:complexContent>
      <xs:extension base="core:AbstractCityObjectType">
        <xs:sequence>
          <xs:element name="orgId" type="xs:string">
            <xs:annotation>
              <xs:documentation>id field of GTFS files</xs:documentation>
            </xs:annotation>
          </xs:element>
          <xs:element name="target" type="urt:TargetPropertyType" minOccurs="0"/>
        </xs:sequence>
      </xs:extension>
    </xs:complexContent>
  </xs:complexType>
  <xs:element name="_PublicTransit" type="urt:PublicTransitType" abstract="true"
    substitutionGroup="core:_CityObject"/>
  <xs:complexType name="PublicTransitPropertyType">
    <xs:sequence minOccurs="0">
      <xs:element ref="urt:_PublicTransit"/>
    </xs:sequence>
    <xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
  </xs:complexType>
  <!-- ===== TargetPropertyType ===== -->
  <xs:complexType name="TargetPropertyType">
    <xs:sequence minOccurs="0">
      <xs:element ref="core:_CityObject"/>
    </xs:sequence>
    <xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
  </xs:complexType>
  <!-- ===== RouteType ===== -->
  <xs:complexType name="RouteType">
    <xs:complexContent>
```

```

<xs:extension base="urt:PublicTransitType">
  <xs:sequence>
    <xs:element name="shortName" type="xs:string" minOccurs="0"/>
    <xs:element name="longName" type="xs:string" minOccurs="0"/>
    <xs:element name="description" type="urt:DescriptionPropertyType" minOccurs="0"/>
    <xs:element name="type" type="gml:CodeType"/>
    <xs:element name="url" type="xs:string" minOccurs="0"/>
    <xs:element name="color" type="xs:string" minOccurs="0"/>
    <xs:element name="textColor" type="xs:string" minOccurs="0"/>
    <xs:element name="updateDate" type="xs:date" minOccurs="0">
      <xs:annotation>
        <xs:documentation>extended field in GTFS-JP</xs:documentation>
      </xs:annotation>
    </xs:element>
    <xs:element name="originStop" type="xs:string" minOccurs="0">
      <xs:annotation>
        <xs:documentation>extended field in GTFS-JP</xs:documentation>
      </xs:annotation>
    </xs:element>
    <xs:element name="viaStop" type="xs:string" minOccurs="0">
      <xs:annotation>
        <xs:documentation>extended field in GTFS-JP</xs:documentation>
      </xs:annotation>
    </xs:element>
    <xs:element name="destinationStop" type="xs:string" minOccurs="0">
      <xs:annotation>
        <xs:documentation>extended field in GTFS-JP</xs:documentation>
      </xs:annotation>
    </xs:element>
    <xs:element name="routeSortOrder" type="xs:integer" minOccurs="0"/>
    <xs:element name="continuousPickup" type="gml:CodeType" minOccurs="0"/>
    <xs:element name="continuousDropOff" type="gml:CodeType" minOccurs="0"/>
    <xs:element name="agency" type="urt:AgencyPropertyType"/>
    <xs:element name="parentRoute" type="urt:RoutePropertyType" minOccurs="0">
      <xs:annotation>
        <xs:documentation>extended field in GTFS-JP</xs:documentation>
      </xs:annotation>
    </xs:element>
    <xs:element name="lod0MultiCurve" type="gml:MultiCurvePropertyType" minOccurs="0">
      <xs:annotation>
        <xs:documentation>geometric property added in this module</xs:documentation>
      </xs:annotation>
    </xs:element>
  </xs:sequence>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:element name="Route" type="urt:RouteType" substitutionGroup="urt:_PublicTransit"/>
<xs:complexType name="RoutePropertyType">
  <xs:sequence minOccurs="0">
    <xs:element ref="urt:Route"/>
  </xs:sequence>
  <xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>
<!-- ===== -->
<xs:complexType name="DescriptionType">
  <xs:sequence>
    <xs:element name="description" type="xs:string" minOccurs="0">
      <xs:annotation>

```

```

<xs:documentation>route_desc</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="frequencyOfService" type="xs:integer" minOccurs="0">
  <xs:annotation>
    <xs:documentation>extended information defined in this modeule</xs:documentation>
  </xs:annotation>
</xs:element>
<xs:element name="numberOfCustomers" type="xs:integer" minOccurs="0">
  <xs:annotation>
    <xs:documentation>extended information defined in this modeule</xs:documentation>
  </xs:annotation>
</xs:element>
</xs:sequence>
</xs:complexType>
<xs:element name="Description" type="urt:DescriptionType"/>
<xs:complexType name="DescriptionPropertyType">
  <xs:sequence>
    <xs:element ref="urt:Description"/>
  </xs:sequence>
</xs:complexType>
<!-- ===== -->
<xs:complexType name="AgencyType">
  <xs:complexContent>
    <xs:extension base="urt:PublicTransitType">
      <xs:sequence>
        <xs:element name="name" type="xs:string"/>
        <xs:element name="url" type="xs:anyURI"/>
        <xs:element name="timeZone" type="gml:CodeType"/>
        <xs:element name="language" type="gml:CodeType" minOccurs="0"/>
        <xs:element name="phone" type="xs:string" minOccurs="0"/>
        <xs:element name="fareUrl" type="xs:anyURI" minOccurs="0"/>
        <xs:element name="email" type="xs:string" minOccurs="0"/>
        <xs:element name="officialName" type="xs:string" minOccurs="0">
          <xs:annotation>
            <xs:documentation>extended field in GTFS-JP</xs:documentation>
          </xs:annotation>
        </xs:element>
        <xs:element name="zipNumber" type="xs:string" minOccurs="0">
          <xs:annotation>
            <xs:documentation>extended field in GTFS-JP</xs:documentation>
          </xs:annotation>
        </xs:element>
        <xs:element name="address" type="xs:string" minOccurs="0">
          <xs:annotation>
            <xs:documentation>extended field in GTFS-JP</xs:documentation>
          </xs:annotation>
        </xs:element>
        <xs:element name="presidentPosition" type="xs:string" minOccurs="0">
          <xs:annotation>
            <xs:documentation>extended field in GTFS-JP</xs:documentation>
          </xs:annotation>
        </xs:element>
        <xs:element name="presidentName" type="xs:string" minOccurs="0">
          <xs:annotation>
            <xs:documentation>extended field in GTFS-JP</xs:documentation>
          </xs:annotation>
        </xs:element>
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>

```

```

</xs:complexContent>
</xs:complexType>
<xs:element name="Agency" type="urt:AgencyType" substitutionGroup="urt:_PublicTransit"/>
<xs:complexType name="Agency.PropertyType">
<xs:sequence minOccurs="0">
<xs:element ref="urt:Agency"/>
</xs:sequence>
<xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>
<!-- ===== -->
<xs:complexType name="StopType">
<xs:complexContent>
<xs:extension base="urt:PublicTransitType">
<xs:sequence>
<xs:element name="code" type="gml:CodeType" minOccurs="0"/>
<xs:element name="ttsName" type="xs:string" minOccurs="0"/>
<xs:element name="latitude" type="xs:double" minOccurs="0"/>
<xs:element name="longitude" type="xs:double" minOccurs="0"/>
<xs:element name="zoneId" type="gml:CodeType" minOccurs="0"/>
<xs:element name="url" type="xs:anyURI" minOccurs="0"/>
<xs:element name="locationType" type="gml:CodeType" minOccurs="0"/>
<xs:element name="timeZone" type="gml:CodeType" minOccurs="0"/>
<xs:element name="wheelchairBoarding" type="gml:CodeType" minOccurs="0"/>
<xs:element name="platformCode" type="xs:string" minOccurs="0"/>
<xs:element name="point" type="gml:PointPropertyType"/>
<xs:element name="parentStation" type="urt:Stop.PropertyType" minOccurs="0"/>
<xs:element name="level" type="urt:Level.PropertyType" minOccurs="0"/>
</xs:sequence>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:element name="Stop" type="urt:StopType" substitutionGroup="urt:_PublicTransit"/>
<xs:complexType name="Stop.PropertyType">
<xs:sequence minOccurs="0">
<xs:element ref="urt:Stop"/>
</xs:sequence>
<xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>
<!-- ===== -->
<xs:complexType name="LevelType">
<xs:complexContent>
<xs:extension base="urt:PublicTransitType">
<xs:sequence>
<xs:element name="index" type="xs:double"/>
</xs:sequence>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:element name="Level" type="urt:LevelType" substitutionGroup="urt:_PublicTransit"/>
<xs:complexType name="Level.PropertyType">
<xs:sequence minOccurs="0">
<xs:element ref="urt:Level"/>
</xs:sequence>
<xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>
<!-- ===== -->
<xs:complexType name="TripType">
<xs:complexContent>
<xs:extension base="urt:PublicTransitType">

```

```

<xs:sequence>
  <xs:element name="headsign" type="xs:string" minOccurs="0"/>
  <xs:element name="shortName" type="xs:string" minOccurs="0"/>
  <xs:element name="directionId" type="gml:CodeType" minOccurs="0"/>
  <xs:element name="blockId" type="xs:string" minOccurs="0"/>
  <xs:element name="wheelchairAccessible" type="gml:CodeType" minOccurs="0"/>
  <xs:element name="bikeAllowed" type="gml:CodeType" minOccurs="0"/>
  <xs:element name="symbol" type="xs:string" minOccurs="0">
    <xs:annotation>
      <xs:documentation>extended field in GTFS-JP</xs:documentation>
    </xs:annotation>
  </xs:element>
  <xs:element name="route" type="urt:RoutePropertyType"/>
  <xs:element name="calendar" type="urt:CalendarPropertyType" minOccurs="0"/>
  <xs:element name="calendarDate" type="urt:CalendarDatePropertyType" minOccurs="0"/>
  <xs:element name="office" type="urt:OfficePropertyType" minOccurs="0">
    <xs:annotation>
      <xs:documentation>extended field in GTFS-JP</xs:documentation>
    </xs:annotation>
  </xs:element>
  <xs:element name="shape" type="urt:ShapePropertyType" minOccurs="0"/>
  <xs:element name="lod0MultiCurve" type="gml:MultiCurvePropertyType" minOccurs="0">
    <xs:annotation>
      <xs:documentation>extended property defined in this module. The curve is composed of a sequence of points in a shape.</xs:documentation>
    </xs:annotation>
  </xs:element>
</xs:sequence>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:element name="Trip" type="urt:TripType" substitutionGroup="urt:_PublicTransit"/>
<xs:complexType name="Trip.PropertyType">
  <xs:sequence minOccurs="0">
    <xs:element ref="urt:Trip"/>
  </xs:sequence>
  <xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>
<!-- ===== -->
<xs:element name="Shape" type="urt:ShapeType" substitutionGroup="urt:_PublicTransit"/>
<xs:complexType name="ShapeType">
  <xs:complexContent>
    <xs:extension base="urt:PublicTransitType">
      <xs:sequence>
        <xs:element name="point" type="urt:PointPropertyType" minOccurs="0" maxOccurs="unbounded"/>
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>
<xs:complexType name="Shape.PropertyType">
  <xs:sequence minOccurs="0">
    <xs:element ref="urt:Shape"/>
  </xs:sequence>
  <xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>
<!-- ===== -->
<xs:complexType name="PointType">
  <xs:sequence>
    <xs:element name="latitude" type="xs:double"/>
    <xs:element name="longitude" type="xs:double"/>
  </xs:sequence>
</xs:complexType>

```

```

<xs:element name="point" type="gml:PointPropertyType"/>
<xs:element name="pointSequence" type="xs:nonNegativeInteger"/>
<xs:element name="pointDistanceTraveled" type="xs:double" minOccurs="0"/>
</xs:sequence>
</xs:complexType>
<xs:element name="Point" type="urt:PointType"/>
<xs:complexType name="PointPropertyType">
<xs:sequence>
<xs:element ref="urt:Point"/>
</xs:sequence>
</xs:complexType>
<!-- ===== -->
<xs:complexType name="OfficeType">
<xs:annotation>
<xs:documentation>extended file in GTFS-JP</xs:documentation>
</xs:annotation>
<xs:complexContent>
<xs:extension base="urt:PublicTransitType">
<xs:sequence>
<xs:element name="name" type="xs:string"/>
<xs:element name="url" type="xs:anyURI" minOccurs="0"/>
<xs:element name="phone" type="xs:string" minOccurs="0"/>
</xs:sequence>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:element name="Office" type="urt:OfficeType" substitutionGroup="urt:_PublicTransit"/>
<xs:complexType name="Office.PropertyType">
<xs:sequence minOccurs="0">
<xs:element ref="urt:Office"/>
</xs:sequence>
<xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>
<!-- ===== -->
<xs:complexType name="CalendarType">
<xs:complexContent>
<xs:extension base="urt:PublicTransitType">
<xs:sequence>
<xs:element name="monday" type="xs:boolean"/>
<xs:element name="tuesday" type="xs:boolean"/>
<xs:element name="wednesday" type="xs:boolean"/>
<xs:element name="thursday" type="xs:boolean"/>
<xs:element name="friday" type="xs:boolean"/>
<xs:element name="saturday" type="xs:boolean"/>
<xs:element name="sunday" type="xs:boolean"/>
<xs:element name="startDate" type="xs:date"/>
<xs:element name="endDate" type="xs:date"/>
</xs:sequence>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:element name="Calendar" type="urt:CalendarType" substitutionGroup="urt:_PublicTransit"/>
<xs:complexType name="Calendar.PropertyType">
<xs:sequence minOccurs="0">
<xs:element ref="urt:Calendar"/>
</xs:sequence>
<xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>
<!-- ===== -->

```

```

<xs:complexType name="CalendarDateType">
  <xs:complexContent>
    <xs:extension base="urt:PublicTransitType">
      <xs:sequence>
        <xs:element name="date" type="xs:date"/>
        <xs:element name="exceptionType" type="gml:CodeType"/>
        <xs:element name="calendar" type="urt:CalendarPropertyType" minOccurs="0"/>
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>
<xs:element name="CalendarDate" type="urt:CalendarDateType" substitutionGroup="urt:_PublicTransit"/>
<xs:complexType name="CalendarDatePropertyType">
  <xs:sequence minOccurs="0">
    <xs:element ref="urt:CalendarDate"/>
  </xs:sequence>
  <xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>
<!-- ===== -->
<xs:complexType name="FareAttributeType">
  <xs:complexContent>
    <xs:extension base="urt:PublicTransitType">
      <xs:sequence>
        <xs:element name="price" type="xs:double"/>
        <xs:element name="currencyType" type="gml:CodeType"/>
        <xs:element name="paymentMethod" type="gml:CodeType"/>
        <xs:element name="transfers" type="gml:CodeType"/>
        <xs:element name="transferDuration" type="xs:integer" minOccurs="0"/>
        <xs:element name="agency" type="urt:AgencyPropertyType" minOccurs="0"/>
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>
<xs:element name="FareAttribute" type="urt:FareAttributeType" substitutionGroup="urt:_PublicTransit"/>
<xs:complexType name="FareAttributePropertyType">
  <xs:sequence minOccurs="0">
    <xs:element ref="urt:FareAttribute"/>
  </xs:sequence>
  <xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>
<!-- ===== -->
<xs:complexType name="PathwayType">
  <xs:complexContent>
    <xs:extension base="urt:PublicTransitType">
      <xs:sequence>
        <xs:element name="mode" type="gml:CodeType" minOccurs="0"/>
        <xs:element name="isBidirectional" type="gml:CodeType"/>
        <xs:element name="length" type="gml:LengthType" minOccurs="0"/>
        <xs:element name="traversalTime" type="xs:integer" minOccurs="0"/>
        <xs:element name="stairCount" type="xs:integer" minOccurs="0"/>
        <xs:element name="maxSlope" type="xs:double" minOccurs="0"/>
        <xs:element name="minWidth" type="xs:double" minOccurs="0"/>
        <xs:element name="signpostedAs" type="xs:string" minOccurs="0"/>
        <xs:element name="reversedSignpostedAs" type="xs:string" minOccurs="0"/>
        <xs:element name="from" type="urt:Stop.PropertyType"/>
        <xs:element name="to" type="urt:Stop.PropertyType"/>
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>

```

```

<xs:element name="Pathway" type="urt:PathwayType" substitutionGroup="urt:_PublicTransit"/>
<xs:complexType name="Pathway.PropertyType">
<xs:sequence minOccurs="0">
<xs:element ref="urt:Pathway"/>
</xs:sequence>
<xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>
<!-- ===== -->
<xs:complexType name="TranslationJPType">
<xs:annotation>
<xs:documentation>extended file in GTFS-JP</xs:documentation>
</xs:annotation>
<xs:complexContent>
<xs:extension base="urt:PublicTransitType">
<xs:sequence>
<xs:element name="language" type="gml:CodeType"/>
<xs:element name="translation" type="xs:string"/>
</xs:sequence>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:element name="TranslationJP" type="urt:TranslationJPType" substitutionGroup="urt:_PublicTransit"/>
<xs:complexType name="TranslationJP.PropertyType">
<xs:sequence minOccurs="0">
<xs:element ref="urt:TranslationJP"/>
</xs:sequence>
<xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>
<!-- ===== -->
<xs:complexType name="AttributionType">
<xs:complexContent>
<xs:extension base="urt:PublicTransitType">
<xs:sequence>
<xs:element name="organizationName" type="xs:string"/>
<xs:element name="isProducer" type="xs:boolean" minOccurs="0"/>
<xs:element name="isOperator" type="xs:boolean" minOccurs="0"/>
<xs:element name="isAuthority" type="xs:boolean" minOccurs="0"/>
<xs:element name="url" type="xs:anyURI" minOccurs="0"/>
<xs:element name="email" type="xs:string" minOccurs="0"/>
<xs:element name="phoneNumber" type="xs:string" minOccurs="0"/>
<xs:element name="agency" type="urt:AgencyPropertyType" minOccurs="0"/>
<xs:element name="route" type="urt:RoutePropertyType" minOccurs="0"/>
<xs:element name="trip" type="urt:TripPropertyType" minOccurs="0"/>
</xs:sequence>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:element name="Attribution" type="urt:AttributionType" substitutionGroup="urt:_PublicTransit"/>
<xs:complexType name="Attribution.PropertyType">
<xs:sequence minOccurs="0">
<xs:element ref="urt:Attribution"/>
</xs:sequence>
<xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>
<!-- ===== -->
<!-- ===== Data Type Declaration ===== -->
<!-- ===== -->
<xs:complexType name="PublicTransitDataTypeType" abstract="true"/>
<xs:element name="_PublicTransitDataType" type="urt:PublicTransitDataTypeType" abstract="true"/>

```

```

<xs:complexType name="PublicTransitDataTypePropertyType">
  <xs:sequence>
    <xs:element ref="urt:_PublicTransitDataType"/>
  </xs:sequence>
</xs:complexType>
<!-- ===== -->
<xs:complexType name="FeedInfoType">
  <xs:complexContent>
    <xs:extension base="urt:PublicTransitDataTypeType">
      <xs:sequence>
        <xs:element name="publisherName" type="xs:string"/>
        <xs:element name="publisherUrl" type="xs:anyURI"/>
        <xs:element name="language" type="gml:CodeType" minOccurs="0"/>
        <xs:element name="defaultLanguage" type="gml:CodeType" minOccurs="0"/>
        <xs:element name="startDate" type="xs:date" minOccurs="0"/>
        <xs:element name="endDate" type="xs:date" minOccurs="0"/>
        <xs:element name="version" type="xs:string" minOccurs="0"/>
        <xs:element name="contactEmail" type="xs:string" minOccurs="0"/>
        <xs:element name="contactURL" type="xs:anyURI" minOccurs="0"/>
        <xs:element name="detailedInfo" type="xs:anyURI" minOccurs="0">
          <xs:annotation>
            <xs:documentation>extended information defined in this module</xs:documentation>
          </xs:annotation>
        </xs:element>
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>
<xs:element name="FeedInfo" type="urt:FeedInfoType" substitutionGroup="urt:_PublicTransitDataType"/>
<xs:complexType name="FeedInfo.PropertyType">
  <xs:sequence>
    <xs:element ref="urt:FeedInfo"/>
  </xs:sequence>
</xs:complexType>
<!-- ===== -->
<xs:complexType name="TranslationType">
  <xs:complexContent>
    <xs:extension base="urt:PublicTransitDataTypeType">
      <xs:sequence>
        <xs:element name="tableName" type="gml:CodeType"/>
        <xs:element name="fieldName" type="xs:string"/>
        <xs:element name="language" type="gml:CodeType"/>
        <xs:element name="translation" type="xs:string"/>
        <xs:element name="fieldValue" type="xs:string" minOccurs="0"/>
        <xs:element name="recordId" type="urt:PublicTransitPropertyType" minOccurs="0"/>
        <xs:element name="recordSubId" type="xs:string" minOccurs="0"/>
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>
<xs:element name="Translation" type="urt:TranslationType" substitutionGroup="urt:_PublicTransitDataType"/>
<xs:complexType name="Translation.PropertyType">
  <xs:sequence>
    <xs:element ref="urt:Translation"/>
  </xs:sequence>
</xs:complexType>
<!-- ===== -->
<xs:complexType name="TransferType">
  <xs:complexContent>
    <xs:extension base="urt:PublicTransitDataTypeType">

```

```

<xs:sequence>
<xs:element name="transferType" type="gml:CodeType"/>
<xs:element name="minTransferTime" type="xs:integer" minOccurs="0"/>
<xs:element name="from" type="urt:StopPropertyType"/>
<xs:element name="to" type="urt:StopPropertyType"/>
</xs:sequence>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:element name="Transfer" type="urt:TransferType" substitutionGroup="urt:_PublicTransitDataType"/>
<xs:complexType name="TransferPropertyType">
<xs:sequence>
<xs:element ref="urt:Transfer"/>
</xs:sequence>
</xs:complexType>
<!-- ===== -->
<xs:complexType name="FrequencyType">
<xs:complexContent>
<xs:extension base="urt:PublicTransitDataTypeType">
<xs:sequence>
<xs:element name="startTime" type="xs:time"/>
<xs:element name="endTime" type="xs:time"/>
<xs:element name="headwaySecs" type="xs:integer"/>
<xs:element name="exactTimes" type="gml:CodeType" minOccurs="0"/>
<xs:element name="trip" type="urt:TripPropertyType"/>
</xs:sequence>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:element name="Frequency" type="urt:FrequencyType" substitutionGroup="urt:_PublicTransitDataType"/>
<xs:complexType name="FrequencyPropertyType">
<xs:sequence>
<xs:element ref="urt:Frequency"/>
</xs:sequence>
</xs:complexType>
<!-- ===== -->
<xs:complexType name="StopTimeType">
<xs:complexContent>
<xs:extension base="urt:PublicTransitDataTypeType">
<xs:sequence>
<xs:element name="arrivalTime" type="xs:time"/>
<xs:element name="departureTime" type="xs:time"/>
<xs:element name="stopSequence" type="xs:integer"/>
<xs:element name="headsign" type="xs:string" minOccurs="0"/>
<xs:element name="pickupType" type="gml:CodeType" minOccurs="0"/>
<xs:element name="dropoffType" type="gml:CodeType" minOccurs="0"/>
<xs:element name="continuousPickupType" type="gml:CodeType" minOccurs="0"/>
<xs:element name="continuousDropoffType" type="gml:CodeType" minOccurs="0"/>
<xs:element name="shapeDistanceTraveled" type="xs:double" minOccurs="0"/>
<xs:element name="timePoint" type="gml:CodeType" minOccurs="0"/>
<xs:element name="trip" type="urt:TripPropertyType"/>
<xs:element name="stop" type="urt:StopPropertyType"/>
</xs:sequence>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:element name="StopTime" type="urt:StopTimeType" substitutionGroup="urt:_PublicTransitDataType"/>
<xs:complexType name="StopTimePropertyType">
<xs:sequence>

```

```

<xs:element ref="urt:StopTime"/>
</xs:sequence>
</xs:complexType>
<!-- ===== -->
<xs:complexType name="FareRuleType">
<xs:complexContent>
<xs:extension base="urt:PublicTransitDataTypeType">
<xs:sequence>
<xs:element name="originId" type="gml:CodeType" minOccurs="0"/>
<xs:element name="destinationId" type="gml:CodeType" minOccurs="0"/>
<xs:element name="containsId" type="gml:CodeType" minOccurs="0"/>
<xs:element name="fare" type="urt:FareAttributePropertyType"/>
<xs:element name="route" type="urt:RoutePropertyType" minOccurs="0"/>
</xs:sequence>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:element name="FareRule" type="urt:FareRuleType" substitutionGroup="urt:_PublicTransitDataType"/>
<xs:complexType name="FareRule.PropertyType">
<xs:sequence>
<xs:element ref="urt:FareRule"/>
</xs:sequence>
</xs:complexType>
<!-- ===== Extended attribute for CityObjectGroup ===== -->
<xs:element name="dataType" type="urt:PublicTransitDataType.PropertyType"
substitutionGroup="grp:_GenericApplicationPropertyOfCityObjectGroup"/>
</xs:schema>

```

A.2 Sample data (informative)

```

<core:CityModel xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns:grp="http://www.opengis.net/citygml/cityobjectgroup/2.0" xmlns:xlink="http://www.w3.org/1999/xlink" xmlns:gml="http://www.opengis.net/gml" xmlns:core="http://www.opengis.net/citygml/2.0" xmlns:urt="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/urt/1.4" xsi:schemaLocation="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/urt/1.4 http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/schemas/urt/1.4/publicTransit.xsd http://www.opengis.net/citygml/cityobjectgroup/2.0 http://schemas.opengis.net/citygml/cityobjectgroup/2.0/cityObjectGroup.xsd http://www.opengis.net/citygml/2.0 http://schemas.opengis.net/citygml/2.0/cityGMLBase.xsd http://www.opengis.net/gml http://schemas.opengis.net/gml/3.1.1/base/gml.xsd">
<gml:boundedBy>
<gml:Envelope srsName="http://www.opengis.net/def/crs/EPSG/0/6697" srsDimension="3">
<gml:lowerCorner>36 137 0</gml:lowerCorner>
<gml:upperCorner>37 137.3 0</gml:upperCorner>
</gml:Envelope>
</gml:boundedBy>
<core:cityObjectMember>
<grp:CityObjectGroup>
<grp:groupMember>
<urt:Route gml:id="route1">
<urt:orgId>1</urt:orgId>
<urt:longName>中央ルート</urt:longName>
<urt:type>3</urt:type>
<urt:color>92D050</urt:color>
<urt:updateDate>2017-12-01</urt:updateDate>
<urt:agency xlink:href="agency7230001002032"/>
<urt:parentRoute xlink:href="route1"/>
</urt:Route>
</grp:groupMember>
<grp:groupMember>
<urt:Route gml:id="route2">

```

```

<urt:orgId>2</urt:orgId>
<urt:longName>清水町ルート</urt:longName>
<urt:type>3</urt:type>
<urt:color>FFC000</urt:color>
<urt:updateDate>2017-12-01</urt:updateDate>
<urt:agency xlink:href="agency7230001002032"/>
<urt:parentRoute xlink:href="route2"/>
</urt:Route>
</grp:groupMember>
<grp:groupMember>
<urt:Agency gml:id="agency7230001002032">
<urt:orgId>7230001002032</urt:orgId>
<urt:name>まいどはやバス</urt:name>
<urt:url>http://mdtoyama.com/?tid=100324,Asia/Tokyo,ja</urt:url>
<urt:timeZone>Asia/Tokyo</urt:timeZone>
<urt:language>ja</urt:language>
<urt:officialName>株式会社富山市民プラザ まちづくり事業部</urt:officialName>
<urt:zipNumber>9300083</urt:zipNumber>
<urt:address>富山県富山市総曲輪3丁目3番16号 ウィズビル3階</urt:address>
</urt:Agency>
</grp:groupMember>
<grp:groupMember>
<urt:Calendar gml:id="calendar1">
<urt:orgId>毎日</urt:orgId>
<urt:monday>true</urt:monday>
<urt:tuesday>true</urt:tuesday>
<urt:wednesday>true</urt:wednesday>
<urt:thursday>true</urt:thursday>
<urt:friday>true</urt:friday>
<urt:saturday>true</urt:saturday>
<urt:sunday>true</urt:sunday>
<urt:startDate>2020-01-31</urt:startDate>
<urt:endDate>2021-03-31</urt:endDate>
</urt:Calendar>
</grp:groupMember>
<grp:groupMember>
<urt:CalendarDate>
<urt:orgId>毎日</urt:orgId>
<urt:date>2020-02-11</urt:date>
<urt:exceptionType>1</urt:exceptionType>
<urt:calendar xlink:href="calendar1"/>
</urt:CalendarDate>
</grp:groupMember>
<grp:groupMember>
<urt:Stop gml:id="stop1_1">
<gml:name>西田地方小学校東</gml:name>
<urt:orgId>1_1</urt:orgId>
<urt:latitude>36.68549</urt:latitude>
<urt:longitude>137.206998</urt:longitude>
<urt:zonelD>1_1</urt:zonelD>
<urt:locationType>0</urt:locationType>
<urt:point>
<gml:Point>
<gml:pos>36.68549 137.206998 0</gml:pos>
</gml:Point>
</urt:point>
</urt:Stop>
</grp:groupMember>
<grp:groupMember>

```

```

<urt:Shape gml:id="shape1">
<urt:orgId>1</urt:orgId>
<urt:point>
<urt:Point>
<urt:latitude>36.6993267946332</urt:latitude>
<urt:longitude>137.213000565343</urt:longitude>
<urt:point>
<gml:Point>
<gml:pos>36.6993267946332 137.213000565343 0</gml:pos>
</gml:Point>
</urt:point>
<urt:pointSequence>1</urt:pointSequence>
</urt:Point>
</urt:point>
<urt:point>
<urt:Point>
<urt:latitude>36.699333944</urt:latitude>
<urt:longitude>137.2131175</urt:longitude>
<urt:point>
<gml:Point>
<gml:pos>36.699333944 137.2131175 0</gml:pos>
</gml:Point>
</urt:point>
<urt:pointSequence>2</urt:pointSequence>
</urt:Point>
</urt:point>
<urt:point>
<urt:Point>
<urt:latitude>36.699393258</urt:latitude>
<urt:longitude>137.213110883</urt:longitude>
<urt:point>
<gml:Point>
<gml:pos>36.699393258 137.213110883 0</gml:pos>
</gml:Point>
</urt:point>
<urt:pointSequence>3</urt:pointSequence>
</urt:Point>
</urt:point>
</urt:Shape>
</grp:groupMember>
<grp:groupMember>
<urt:Trip gml:id="trip1">
<urt:orgId>1+毎日+1</urt:orgId>
<urt:headsign>新桜町公園前</urt:headsign>
<urt:route xlink:href="route1"/>
<urt:calendar xlink:href="calendar1"/>
<urt:shape xlink:href="shape1"/>
<urt:lod0MultiCurve>
<gml:MultiCurve>
<gml:curveMembers>
<gml:LineString>
<gml:pos>36.6993267946332 137.213000565343 0</gml:pos>
<gml:pos>36.699333944 137.2131175 0</gml:pos>
<gml:pos>36.699393258 137.213110883 0</gml:pos>
</gml:LineString>
</gml:curveMembers>
</gml:MultiCurve>
</urt:lod0MultiCurve>
</urt:Trip>
</grp:groupMember>

```

```

<grp:groupMember>
  <urt:FareAttribute gml:id="fare1">
    <urt:orgId>均一運賃_00</urt:orgId>
    <urt:price>100</urt:price>
    <urt:currencyType>JPY</urt:currencyType>
    <urt:paymentMethod>0</urt:paymentMethod>
    <urt:transfers>0</urt:transfers>
  </urt:FareAttribute>
</grp:groupMember>
<urt:	dataType>
  <urt:StopTime>
    <urt:arrivalTime>09:20:00</urt:arrivalTime>
    <urt:departureTime>09:20:00</urt:departureTime>
    <urt:stopSequence>18</urt:stopSequence>
    <urt:headsign>グランドプラザ前にいかわ信用金庫</urt:headsign>
    <urt:pickupType>0</urt:pickupType>
    <urt:dropoffType>0</urt:dropoffType>
    <urt:trip xlink:href="trip1"/>
    <urt:stop xlink:href="stop1_1"/>
  </urt:StopTime>
</urt:	dataType>
<urt:	dataType>
  <urt:FeedInfo>
    <urt:publisherName>富山県富山市</urt:publisherName>
    <urt:publisherUrl>https://www.city.toyama.toyama.jp/</urt:publisherUrl>
    <urt:language codeSpace="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Comm
on_language.xml">ja</urt:language>
    <urt:startDate>2020-01-31</urt:startDate>
    <urt:endDate>2021-03-31</urt:endDate>
    <urt:version>2020v1</urt:version>
  </urt:FeedInfo>
</urt:	dataType>
<urt:	dataType>
  <urt:FareRule>
    <urt:fare xlink:href="fare1"/>
    <urt:route xlink:href="route1"/>
  </urt:FareRule>
</urt:	dataType>
</grp:CityObjectGroup>
</core:cityObjectMember>
</core:CityModel>

```

Annex B (informative)

Code lists for Public Transit Data

This annex exemplifies the specification of code lists for enumerative attributes of type *gml:CodeType* in Urban Planning ADE and provides proposals for selected attributes. Please note that this annex is non-normative and the presented code lists are neither mandatory nor complete.

The code lists presented in this annex are managed and maintained by the GTFS.org and are accessible at <https://gtfs.org/reference/static/>. For more details of code values in these code lists, visit this website.

Code lists for Stop

| Code list for <i>Stop</i> attribute <i>locationType</i> | | | |
|---|--------------------|---|--------------|
| http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Stop_locationType.xml | | | |
| 0 | Stop (or Platform) | 1 | Station |
| 2 | Entrance/Exit | 3 | Generic Node |
| 4 | Boarding Area | | |

| Code list for <i>Stop</i> attribute <i>wheelchairBoarding</i> | | | |
|---|---|---|--|
| http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Stop_wheelchairBoarding.xml | | | |
| 0 | For parentless stops: No accessibility information for the stop For child stops: Stop will inherit its behavior from the parent station, if specified in the parent For station entrance/exits: Station entrance will inherit its behavior from the parent station, if specified for the parent. | 1 | For parentless stops: Some vehicles at this stop can be boarded by a rider in a wheelchair. For child stops: There exists some accessible path from outside the station to the specific stop/platform. For station entrance/exits: Station entrance is wheelchair accessible. |
| 2 | For parentless stops: Wheelchair boarding is not possible at this stop For child stops: There exists no accessible path from outside the station to the specific stop/platform. For station entrance/exits: No accessible path from station entrance to stops/platforms. | | |

Code lists for Route

| Code list for <i>Route</i> attribute <i>type</i> | | | |
|---|---|----|---------------|
| http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Route_type.xml | | | |
| 0 | Tram, Streetcar, Light rail | 1 | Subway, Metro |
| 2 | Rail | 3 | Bus |
| 4 | Ferry | 5 | Cable tram |
| 6 | Aerial lift, suspended cable car (e.g., gondola lift, aerial tramway) | 7 | Funicular |
| 11 | Trolleybus | 12 | Monorail |

Code lists for Trip

| Code list for <i>Trip</i> attribute <i>directionId</i> | | | |
|---|-------------------------|---|----------------------------------|
| http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Trip_directionId.xml | | | |
| 0 | Travel in one direction | 1 | Travel in the opposite direction |

| Code list for <i>Trip</i> attribute <i>wheelchairAccessible</i> | | | |
|---|---|---|---|
| http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Trip_wheelchairAccessible.xml | | | |
| 0 | No accessibility information for the trip | 1 | Vehicle being used on this particular trip can accommodate at least one rider in a wheelchair |
| 2 | No riders in wheelchairs can be accommodated on this trip | | |

| Code list for <i>Trip</i> attribute <i>bikeAllowed</i> | | | |
|---|---------------------------------------|---|--|
| http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Trip_bikeAllowed.xml | | | |
| 0 | No bike information for the trip. | 1 | Vehicle being used on this particular trip can accommodate at least one bicycle. |
| 2 | No bicycles are allowed on this trip. | | |

Code lists for StopTime

| Code list for <i>StopTime</i> attribute <i>pickupType</i> | | | |
|---|-------------------------------------|---|---|
| http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/StopTime_pickupType.xml | | | |
| 0 | Regularly scheduled pickup | 1 | No pickup available |
| 2 | Must phone agency to arrange pickup | 3 | Must coordinate with driver to arrange pickup |

| Code list for <i>StopTime</i> attribute <i>dropoffType</i> | | | |
|---|---------------------------------------|---|---|
| http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/StopTime_dropoffType.xml | | | |
| 0 | Regularly scheduled drop off | 1 | No drop off available |
| 2 | Must phone agency to arrange drop off | 3 | Must coordinate with driver to arrange drop off |

| Code list for <i>StopTime</i> attribute <i>continuousPickupType</i> | | | |
|---|---|---|--|
| http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/StopTime_continuousPickupType.xml | | | |
| 0 | Continuous stopping pickup | 1 | No continuous stopping pickup |
| 2 | Must phone agency to arrange continuous stopping pickup | 3 | Must coordinate with driver to arrange continuous stopping pickup. |

| Code list for <i>StopTime</i> attribute <i>continuousDropoffType</i> | | | |
|---|--|---|--|
| http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/StopTime_continuousDropoffType.xml | | | |
| 0 | Continuous stopping drop off | 1 | No continuous stopping drop off |
| 2 | Must phone agency to arrange continuous stopping drop off. | 3 | Must coordinate with driver to arrange continuous stopping drop off. |

| Code list for <i>StopTime</i> attribute <i>timePoint</i> | | | |
|---|----------------------------------|---|-----------------------------|
| http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/StopTime_timePoint.xml | | | |
| 0 | Times are considered approximate | 1 | Times are considered exact. |

Code lists for Calendar

| Code list for <i>Calendar</i> attribute <i>monday, tuesday, wednesday, thursday, friday, saturday, and sunday</i> | | | |
|---|--|--|--|
| http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Calendar_dateType.xml | | | |

| | | | |
|---|--|---|--|
| 0 | Service is not available for Mondays in the date range | 1 | Service is available for all Mondays in the date range |
|---|--|---|--|

Code lists for CalendarDate

| | | | |
|---|---|---|---|
| Code list for <i>CalendarDate</i> attribute <i>exceptionType</i> http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/CalendarDate_exceptionType.xml | | | |
| 1 | Service has been added for the specified date | 2 | Service has been removed for the specified date |

Code lists for FareAttribute

| | | | |
|--|-----------------------|---|------------------------------------|
| Code list for <i>FareAttribute</i> attribute <i>paymentMethod</i> http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/FareAttribute_paymentMethod.xml | | | |
| 0 | Fare is paid on board | 1 | Fare must be paid before boarding. |

| | | | |
|---|-------------------------------------|----|-----------------------------------|
| Code list for <i>FareAttribute</i> attribute <i>transfer</i> http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/FareAttribute_transfer.xml | | | |
| 0 | No transfers permitted on this fare | 1 | Riders may transfer once |
| 2 | Riders may transfer twice | 99 | Unlimited transfers are permitted |

Code lists for Frequency

| | | | |
|---|-----------------------|---|---|
| Code list for <i>Frequency</i> attribute <i>exactTimes</i> http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Frequency_exactTimes.xml | | | |
| 0 | Frequency-based trips | 1 | Schedule-based trips with the exact same headway throughout the day |

Code lists for Transfer

| | | | |
|--|---|---|---|
| Code list for <i>Transfer</i> attribute <i>transferType</i> http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Transfer_transferType.xml | | | |
| 0 | Recommended transfer point between routes | 1 | Timed transfer point between two routes |
| 2 | Transfer requires a minimum amount of time between arrival and departure to ensure a connection | 3 | Transfers are not possible between routes at the location |

Code lists for Pathway

| | | | |
|---|----------------------------|---|------------------------------|
| Code list for <i>Pathway</i> attribute <i>mode</i> http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Pathway_mode.xml | | | |
| 1 | walkway | 2 | stairs |
| 3 | moving sidewalk/travelator | 4 | escalator |
| 5 | elevator | 6 | fare gate (ore payment gate) |
| 7 | exit gate | | |

| | | | |
|--|------------------------|---|-----------------------|
| Code list for <i>Pathway</i> attribute <i>isBidirectional</i> http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Pathway_isBidirectional.xml | | | |
| 0 | Unidirectional pathway | 1 | Bidirectional pathway |

Code lists for CityObjectGroup

| | | | |
|---|--|--|--|
| Code list of the <i>CityObjectGroup</i> attribute <i>usage</i> http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/CityObjectGroup_usage.xml | | | |
|---|--|--|--|

| | | | |
|------|------------|------|----------------|
| 1000 | lod1Storey | 2000 | urban planning |
| 1010 | lod2Storey | 2010 | public transit |
| 1020 | lod3Storey | | |
| 1040 | lod4Storey | | |

Code values in grey cells are defined in the Code lists proposed by the SIG 3D in CityGML.

Common code lists

| |
|---|
| Code list for <i>currencyUnit</i> |
| http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Common_currencyUnit.xml |
| Currency codes defined by ISO 4217 that composed of a country's two-character Internet country code plus a third character denoting the currency unit. |

| |
|---|
| Code list for <i>language</i> |
| http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Common_language.xml |
| ISO 639-1:2002, Codes for the representation of names of languages — Part 1: Alpha-2 code |

Bibliography

- [1] Filip Biljecki, Kavisha Kumar and Claus Nagel. CityGML Application Domain Extension (ADE): overview of developments, 27 August 2018,
<https://opengeospatialdata.springeropen.com/articles/10.1186/s40965-018-0055-6> (Accessed 7 March 2019)
- [2] CityGML UtilityNetworkADE,
http://www.citygmlwiki.org/index.php?title=CityGML_UtilityNetworkADE (Accessed 7 March 2019)
- [3] City Bureau, Ministry of Land, Infrastructure, Transport and Tourism of Japan: Implementation Guidelines of Basic Survey of City Planning (in Japanese), March 2019,
<http://www.mlit.go.jp/common/001282174.pdf> (Accessed 18 April 2019)
- [4] Fukuoka Prefecture, Data Specification for Basic Survey of City Planning Database (survey by city), 2018 (in Japanese)
- [5] Fukuoka Prefecture, Data Specification for Basic Survey of City Planning Database (survey by prefecture), 2018 (in Japanese)

Revision History

| Date | Release | Author | Paragraph modified | Description |
|------------|---------|--------|---------------------------|---|
| 2019/3/20 | 0.9 | | All | Document created |
| 2019/5/7 | 1.0 | | All | <p>Add elements and properties to ensure consistency with Basic Surveys Concerning City Planning (Part 1, Part 2, and Part 3)</p> <p>Add temporal attribute to accumulate and utilize time series datasets (Part1, part2, Part 3 and Part4)</p> <p>Import and extend grp::CityObjectGroup for object collection to mention the purpose or usage of the collection (Part1)</p> <p>Rename or add properties for clarification (Part 1)</p> <p>Add associations to describe global city model as LOD extension (Part 4)</p> <p>Modify UML diagrams and XML Schemata based on the modifications above (Part1, part2, Part 3 and Part4)</p> <p>Modify text description for clarification and Correct editorial errors (Through the document)</p> |
| 2019/11/01 | 1.1 | | Part 1 | Add an attribute “uro::widthType” to “tran::Road” and the code list for the attribute. |
| | | | Part 2 | Change the associated classes of “urf::area”, “urf::boundary” and “urf::location” to the multiple geometric objects. |
| | | | Part 1, Part 2 and Part 4 | Correct inconsistency between UML diagrams and XMLSchema. |
| | | | Part 2 and Part 3 | <p>Add remarks to that of featureType classes.</p> <p>Change global element of feature attributes to local elements not to use the mechanism of “hook”.</p> <p>Delete “_GenericApplicationPropertyOf...” elements of dataType classes.</p> |
| | | | All | Correct editorial errors (Through the document) |
| 2020/02/24 | 1.2 | | Part 3 and Part 4 | Delete Part 4 to integrate the concept of extended LOD into statistical grid. |
| | | | All | Clarify the XMLSchema location |

| | | | |
|------------|-----|-------------------|--|
| | | All | Update UML diagrams based on the OGC best practice (Modeling an application domain extension of CityGML in UML, 12-066. Open Geospatial Consortium. 2014.) |
| | | All | Correct inconsistency with "Element - Property" structure in XMLSchema |
| | | All | The type "xs:double" used to describe area is changed to "gml:MeasureType" for its strictness with "uom". |
| | | Part 2 | The type "xs:double" used to describe length is changed to "gml:LengthType" for its strictness with "uom". |
| | | All Annex A | XML Schemas are updated based on the modification above. |
| | | All Annex B | The URL of each codelist is added. |
| | | All Annex A | Sample datasets are updated based on the modification above. Describe CRS identifier in the sample datasets. |
| 2020/03/19 | 1.3 | Figures | Fix printing mistakes in figures. |
| | | Part1 and 2 | Add "PublicTransit" to represent public transit networks and delete extended properties for TransportationComplex in Urban Object module. |
| | | Part 2 and 3 | Correct typos. |
| 2020/3/27 | 1.4 | Part 2 and 3 | Reorganize the concept of extended LOD and new Annex C is added to explain the concept of ExtendedLOD. Delete "_GenericApplicationPropertyOf..." elements for maintaining strictness. |
| | | Part 1 and Part 3 | Generic property for building and statistical grid is added. |
| | | Part 3 | Modify data structure of Statistical Grid Module to avoid data complexity. |
| | | Part 4 and Part 2 | Define new module for "Public Transit" as Part 4. |
| 2020/08/31 | | Part 1 and Part 3 | Correct type of "dateValue" in KeyValuePair |
| | | Part 2 | Change name of the class "PublicTransit" to "PublicTransportationFacility" for clarification. |
| | | Part 3 | Add missing attribute "genericValue" into XMLSchema of GenericGridCell. |