March 27 / 2020

Data Encoding Specification of i-Urban Revitalization

- Urban Planning ADE –

ver.1.4

Contents

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*".

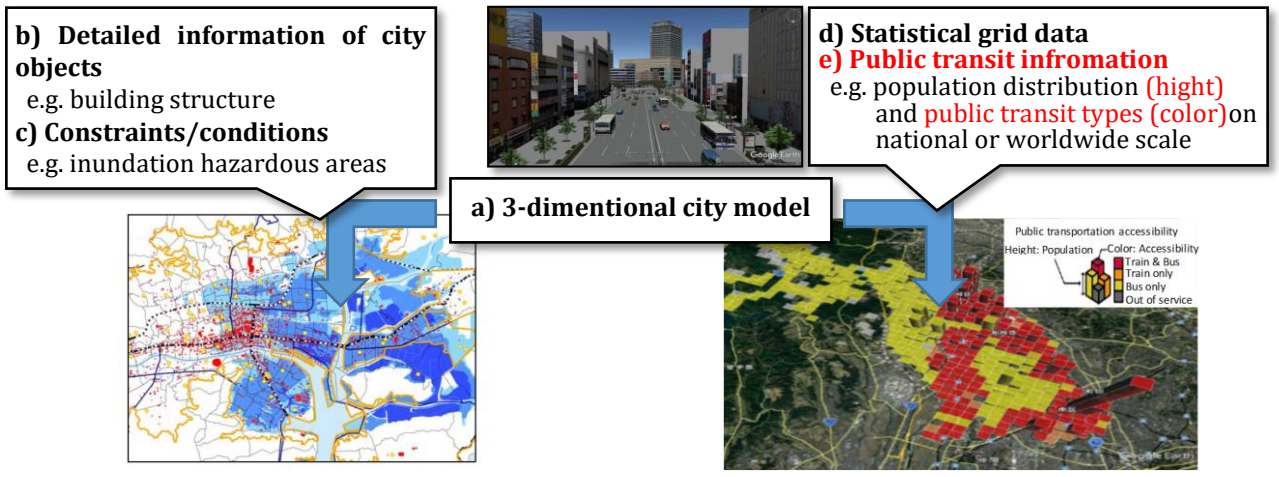
Recently, the investment climate has changed dramatically with the expansion of the Internet and the development of information communication technologies such as "Fin-Tech". Information-intensive activities are very important to call for investment.

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



Example of analysis: Damage estimation by flood

Example of analysis: Overhaul of public transit network

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 1.4" is a collection of four modules which are defined in each part of this encoding specification mentioned above.

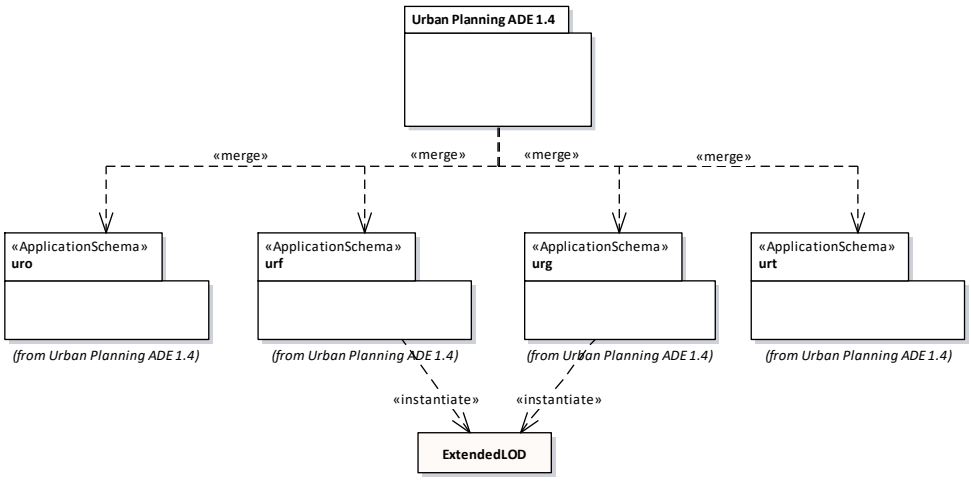


Figure 2 Conceptual strucuture of i-UR Data model

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

CityGMLCity 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.

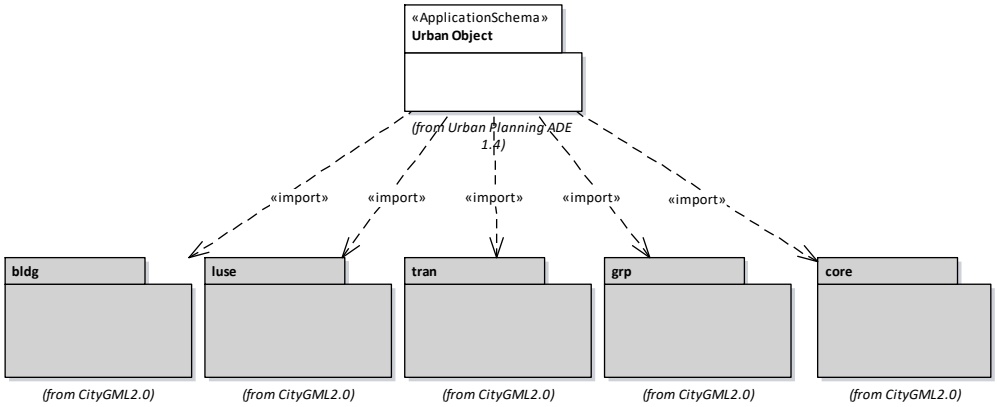


Figure 1-1 Package diagram of Urban Object Data

Module name	Urban Object
XML namespace identifier	http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/uro/1.4
XMLSchema location	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 *building*, *land use*, *transportation* and *cityObjectGroup.*

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.

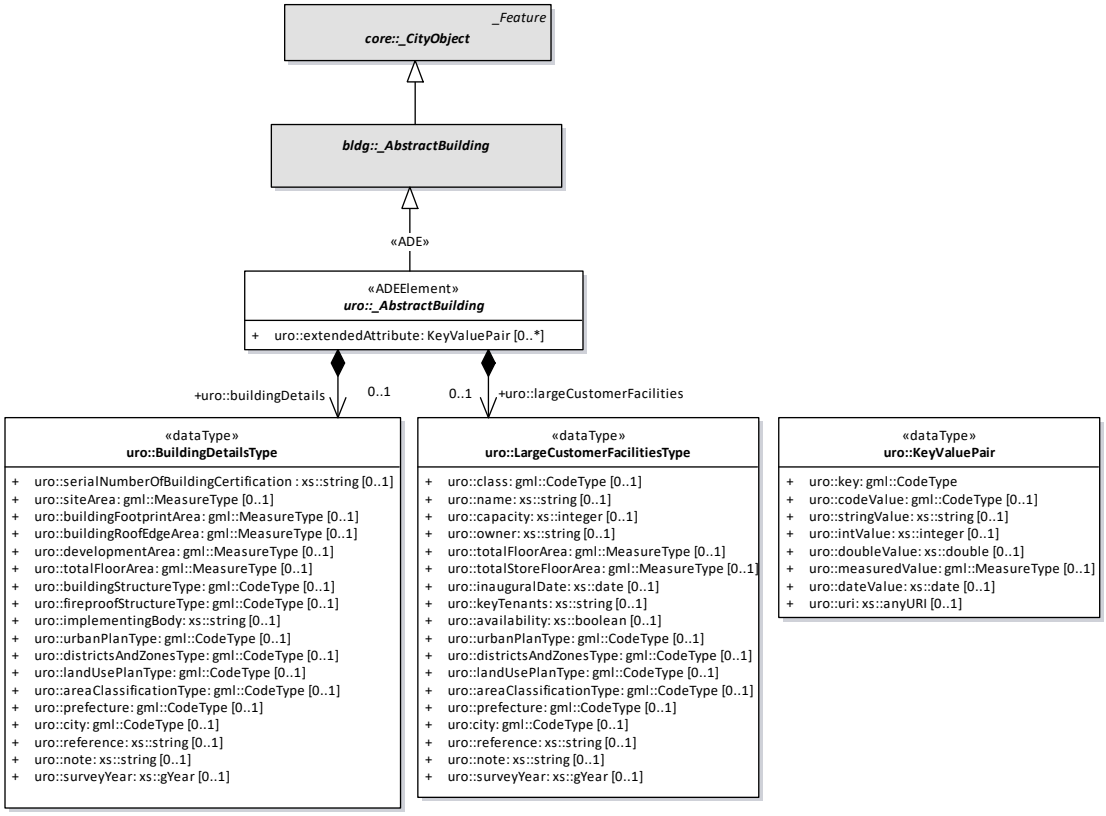


Figure 1-2 UML diagram of extended properties of AbstractBuilding. Element names with the prefix uro are defined within this module.

Extended properties of _AbstractBuilding

Property	Definition
uro::buildingDetails	Detailed descriptions of the building, e.g. building structure and total floor area
uro::largeCustomerFacilities	Current status of the building when if the building is a large customer facility
uro::extendedAttribute	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 detaild information of a building which is not defined in this module and CityGML Building module.

BuildingDetailsType

Type	Definition
uro::BuildingDetailsType	Detailed information of a building
Property	**Definition**
uro::serialNumberOfBuildingCertification	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 uro::codeValue, uro::stringValue, *uro::intValue*, *uro::doubleValue, uro::measuredValue, uro::dateValue* or *uro::uriValue* be specified.
Property	**Definition**
uro::key	Name of an attribute
uro::codeValue	Code value of the attribute
uro::stringValue	String value of the attribute
uro::intValue	Integer value of the attribute
uro::doubleValue	Double value of the attribute
uro::measuredValue	Measured value of the attribute
uro::dateValue	Date value of the attribute
uro::uriValue	URI value of the attribute

```
<xs:complexType name="KeyValuePairType">
 <xs:sequence>
     <xs:element name="key" type="gml:CodeType"/>
      <xs:choice>
        <xs:element name="codeValue" type="gml:CodeType"/>
        <xs:element name="stringValue" type="xs:string"/>
       <xs:element name="intValue" type="xs:integer"/>
       <xs:element name="doubleValue" type="xs:double"/>
        <xs:element name="measuredValue" type="gml:MeasureType"/>
        <xs:element name="dateValue" type="xs:double"/>
        <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="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.

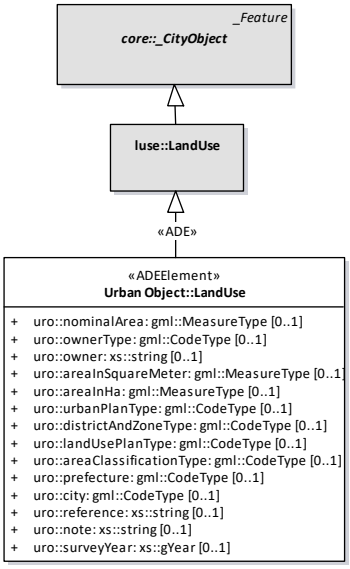


Figure 1-3 UML diagram of LandUse. An element name with the prefix uro is defined within this module.

Extended property of LandUse

Property	Definition
uro::nominalArea	Nominal area of the land
uro::ownerType	Type of the land owner
uro::owner	Name of the land owner
uro::areaInSquareMeter	Area of the land (m2)
uro::areaInHa	Area of the land (ha)
uro::urbanPlanType	Type of the land location designated by Urban Plan
uro::districtAndZoneType	Type of the land location designated by Districts and Zones
uro::landUsePlanType	Type of the land location designated by Land Use Plan
uro::areaClassificationType	Type of the land location designated by Area classification
uro::prefecture	Prefecture name of the land location
uro::city	City name of the land location
uro::reference	Reference information of the landuse
uro::note	Additional information of the land
uro::surveyYear	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.

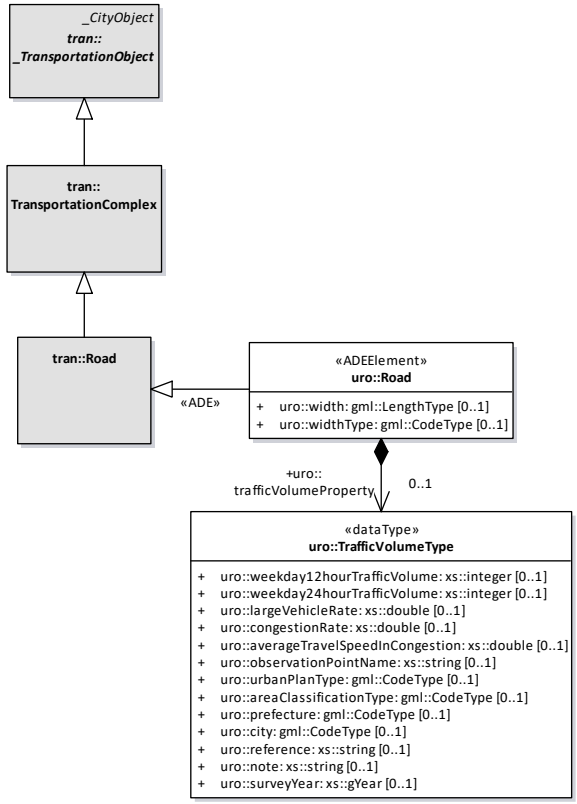


Figure 1-4 UML diagram of Transportation. Element names with the prefix uro are defined within this module.

Extended Properties of Road

Property	Definition
uro::width	Typical road width
uro::widthType	Code allotted to road width
uro::trafficVolumeProperty	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 druing 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.

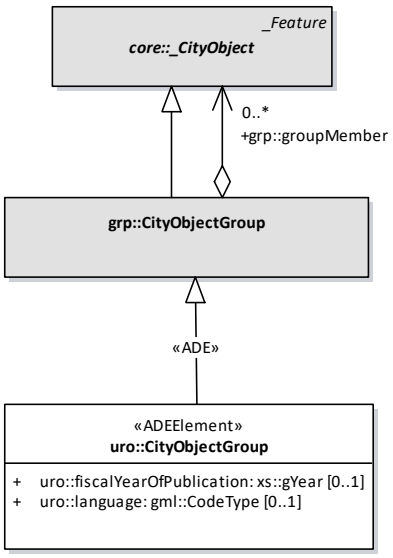


Figure 1-5 UML diagram of City Object Group

Extended properties of CityObjectGroup

Property	Definition
uro::fiscalYearOfPublication	Fiscal year when the group has been published
uro::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: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="1.4.0">
 <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:_GenericApplicationPropertyOfAbstractBuilding"/>
 <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:_GenericApplica
tionPropertyOfAbstractBuilding"/>
 <!-- ========================================================================== -->
 <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:double"/>
     <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:_GenericApplicationPropertyOfLand
Use"/>
 <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:_GenericApplicationProperty
OfLandUse"/>
 <xs:element name="areaInHa" type="gml:MeasureType" substitutionGroup="luse:_GenericApplicationPropertyOfLandUse
"/>
 <xs:element name="urbanPlanType" type="gml:CodeType" substitutionGroup="luse:_GenericApplicationPropertyOfLand
Use"/>
 <xs:element name="districtsAndZonesType" type="gml:CodeType" substitutionGroup="luse:_GenericApplicationProperty
OfLandUse"/>
 <xs:element name="landUsePlanType" type="gml:CodeType" substitutionGroup="luse:_GenericApplicationPropertyOfLan
dUse"/>
 <xs:element name="areaClassificationType" type="gml:CodeType" substitutionGroup="luse:_GenericApplicationProperty
OfLandUse"/>
 <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:_GenericApplication
PropertyOfRoad"/>
 <!-- ================================================================== -->
 <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:_GenericApplicationPropertyOfCit
yObjectGroup"/>
 <xs:element name="language" type="gml:CodeType" substitutionGroup="grp:_GenericApplicationPropertyOfCityObjectG
roup"/>
```

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

A.2 Sample data (informative)

```
<?xml version="1.0" encoding="UTF-8"?>
<!-- sample data edited by i-Urban Revitalization Promotion Committee Specification WG / source Fundamental Geospa
tial Data of GSI -->
<core:CityModel xmlns:uro="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/uro/1.4" xmlns:core="ht
tp://www.opengis.net/citygml/2.0" xmlns:luse="http://www.opengis.net/citygml/landuse/2.0" xmlns:bldg="http://ww
w.opengis.net/citygml/building/2.0" xmlns:tran="http://www.opengis.net/citygml/transportation/2.0" xmlns:grp="htt
p://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.ka
ntei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/uro/1.4 http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisa
isei/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/transpor
tation.xsd
http://www.opengis.net/citygml/cityobjectgroup/2.0 http://schemas.opengis.net/citygml/cityobjectgroup/2.0/cityO
bjectGroup.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">35.8434 130.488 0</gml:lowerCorner>
   <gml:upperCorner srsDimension="3">33.8459 130.494 50</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_cl
ass.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>33.805525 130.545234 17.9</gml:pos>
           <gml:pos>33.805410 130.5452 17.9</gml:pos>
           <gml:pos>33.805398 130.545255 17.9</gml:pos>
           <gml:pos>33.805416 130.545260 17.9</gml:pos>
           <gml:pos>33.805399 130.545347 17.9</gml:pos>
           <gml:pos>33.805496 130.545375 17.9</gml:pos>
           <gml:pos>33.805525 130.545234 17.9</gml:pos>
          </gml:LinearRing>
         </gml:exterior>
        </gml:Polygon>
       </gml:surfaceMember>
       <gml:surfaceMember>
        <gml:Polygon>
```

```
      <gml:exterior>
       <gml:LinearRing>
        <gml:pos>33.805525 130.545234 17.9</gml:pos>
        <gml:pos>33.805496 130.545375 17.9</gml:pos>
        <gml:pos>33.805496 130.545375 5.9</gml:pos>
        <gml:pos>33.805525 130.545234 5.9</gml:pos>
        <gml:pos>33.805525 130.545234 17.9</gml:pos>
       </gml:LinearRing>
      </gml:exterior>
     </gml:Polygon>
    </gml:surfaceMember>
    <gml:surfaceMember>
     <gml:Polygon>
      <gml:exterior>
       <gml:LinearRing>
        <gml:pos>33.80539922 130.545347 17.9</gml:pos>
        <gml:pos>33.80541694 130.5452606 17.9</gml:pos>
        <gml:pos>33.80541694 130.5452606 5.9</gml:pos>
        <gml:pos>33.80539922 130.545347 5.9</gml:pos>
        <gml:pos>33.80539922 130.545347 17.9</gml:pos>
       </gml:LinearRing>
      </gml:exterior>
     </gml:Polygon>
    </gml:surfaceMember>
                                          <-- omitted -->
    <gml:surfaceMember>
     <gml:Polygon>
      <gml:exterior>
       <gml:LinearRing>
        <gml:pos>33.80549653 130.5453755 17.9</gml:pos>
        <gml:pos>33.80539922 130.545347 17.9</gml:pos>
        <gml:pos>33.80539922 130.545347 5.9</gml:pos>
        <gml:pos>33.80549653 130.5453755 5.9</gml:pos>
        <gml:pos>33.80549653 130.5453755 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 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:serialNumberOfBuildingCertification>福ワ-182039-a1</uro:serialNumberOfBuildingCertification>
      <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/codelis
ts/1.4/Building_buildingStructureType.xml">9020</uro:buildingStructureType>
      <uro:fireproofStructureType codeSpace="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codeli
sts/1.4/Building_fireproofStructureType.xml">9020</uro:fireproofStructureType>
      <uro:implementingBody>片岡建設</uro:implementingBody>
      <uro:urbanPlanType codeSpace="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/
Common_uro:urbanPlanType.xml">1010</uro:urbanPlanType>
      <uro:districtsAndZonesType codeSpace="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codeli
sts/1.4/Common_districtsAndZones.xml">1000</uro:districtsAndZonesType>
      <uro:landUsePlanType>5070</uro:landUsePlanType>
      <uro:areaClassificationType codeSpace="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codeli
sts/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/Co
mmon_uro:prefecture.xml">40</uro:prefecture>
      <uro:city codeSpace="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Common_l
ocalPublicAuthorities.xml">220</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">1
020</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>
 </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 *_AbstractBuilding* attribute *class*			
http:// 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 *BuildingDetails* attribute *buildingStructureType*			
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 *BuildingDetails* attribute *fireproofStructureType*			
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 *LargeCustomerFacilities* 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 *LandUse* attributes *function*			
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	Agriculure
1050	Monument	3030	Forest
1060	Dump	3040	Grove
1070	Mining	3050	heath
1100	Park	3060	Moor
1120	Cemetary	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 corperatoin		

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 *TransportationSrvice* and *Road* attribute *urbanPlanType*
See Code list for the *UrbanPlan* attribute *class*

Code list of the *TransportationSrvice* and *Road* attribute *districtsAndZonesType*
See Code list for the *DistrictsAndZones* attribute *class*

Code list of the *TransportationSrvice* and *Road* attribute *landUsePlanType*
See Code list for the *LandUsePlan* attribute *class* in part 2

Code list of the *TransportationSrvice* and *Road* attribute *areaClassificationType*
See Code list for the *AreaClassification* attribute *class* in part 2

Code list of the *TransportationSrvice* and *Road* attribute *prefecture*
See Code list for the *Administration* attribute *prefecture* in part 2

Code list of the *TransportationSrvice* and *Road* attribute *city*
See Code list for the *Administration* attribute *city* 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

CityGMLCity 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.

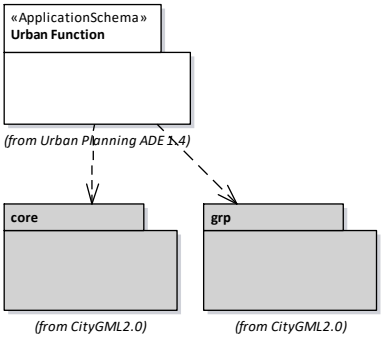


Figure 2-1 Package diagram of Urban Function Data

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::_CityObjets*. 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.

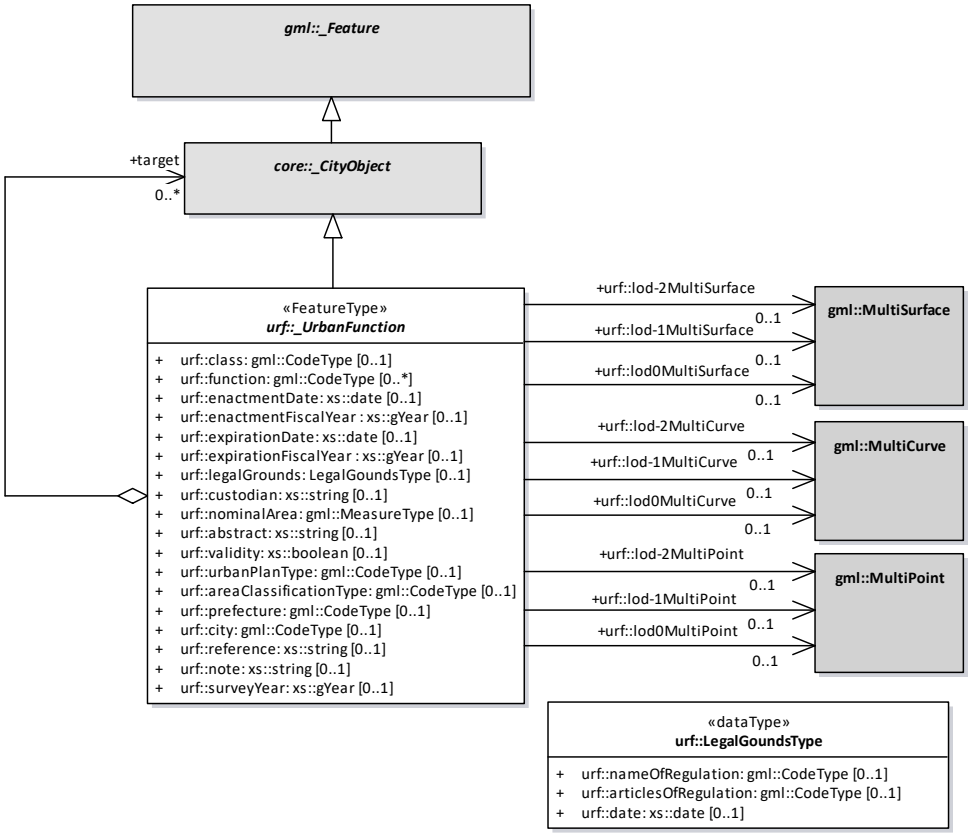


Figure 2-2 UML diagram of *urf::_UrbanFunction*

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

urf::lod-2MultiSurface	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).

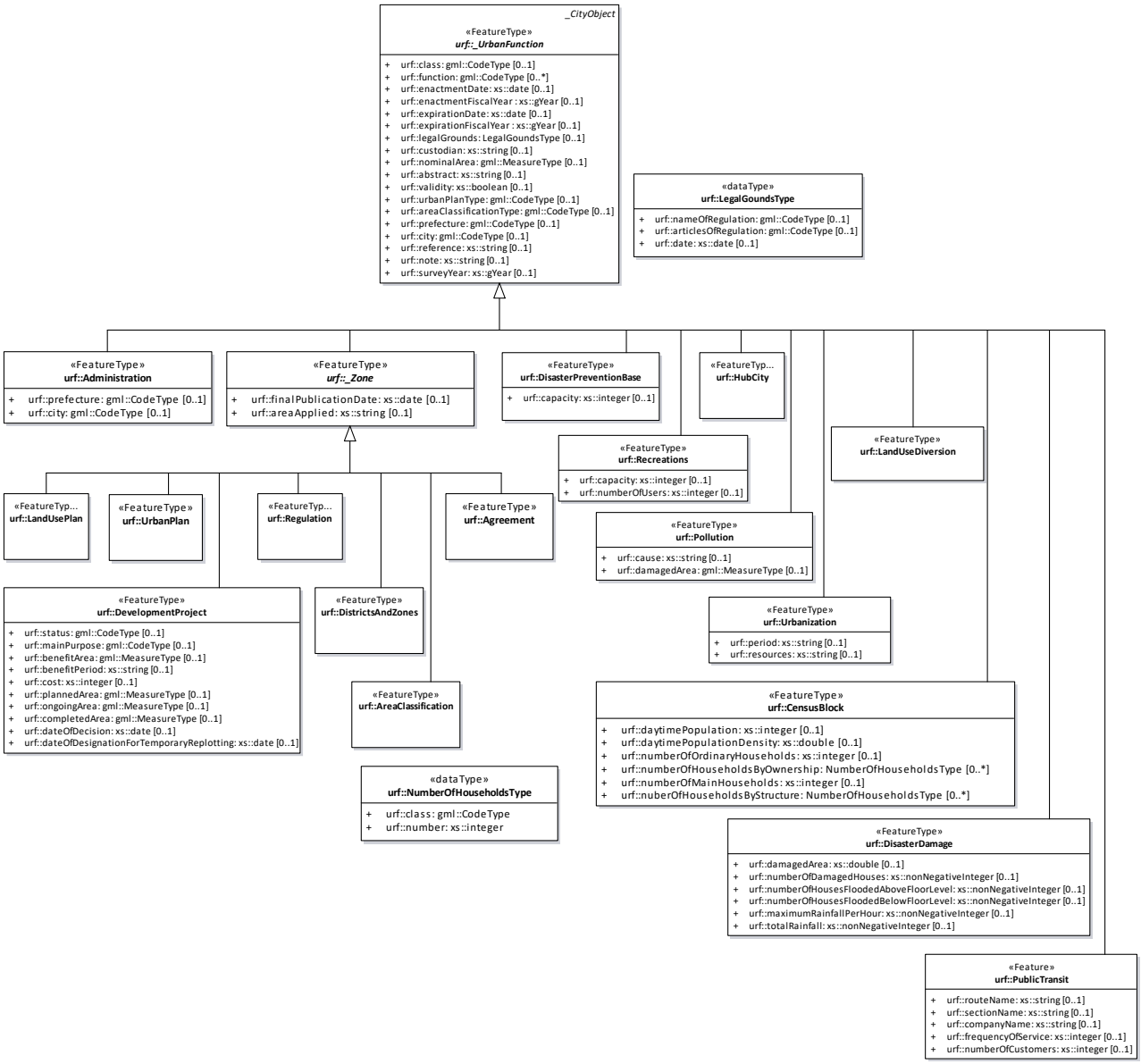


Figure 2-3 Subclasses of *urf::_UrbanFunction*

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::numberOfOrdinaryHousehold	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="RecreationsPropertyType">
 <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="HubCityPropertyType">
 <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 PublicTransitType, PublicTransit

Type	Definition
urf::PublicTransit	Information for public transit
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="PublicTransitType">
 <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="PublicTransit" type="PublicTransitType"/>
```

```
<!-- ====================================================================== -->
 <xs:complexType name="PublicTransitPropertyType">
  <xs:sequence minOccurs="0">
   <xs:element ref="urf:PublicTransit"/>
  </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 spacification 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.

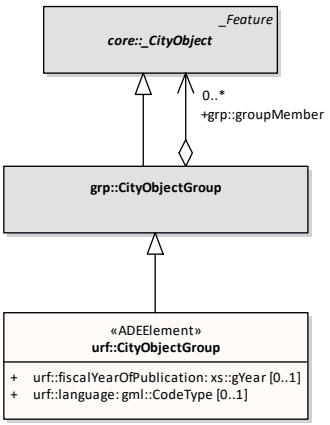


Figure 2-4 ***Extension of grp:CityObjectGroup***

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"?>
<!-- edited with XMLSpy v2020 sp1 (x64) (http://www.altova.com) by Chikako Yasutaka (Asia Air Survey) -->
<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="1.4.0">
 <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="LegalGroundsPropertyType">
  <xs:sequence minOccurs="0">
   <xs:element ref="urf:LegalGrounds"/>
  </xs:sequence>
 </xs:complexType>
 <!-- ====================================================================== -->
 <xs:complexType name="TargetPropertyType">
  <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="RegulationPropertyType">
 <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="AreaClassificationPropertyType">
 <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="DistrictsAndZonesPropertyType">
 <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: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="PublicTransitType">
 <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="PublicTransit" type="urf:PublicTransitType"/>
<!-- ====================================================================== -->
<xs:complexType name="PublicTransitPropertyType">
 <xs:sequence minOccurs="0">
  <xs:element ref="urf:PublicTransit"/>
 </xs:sequence>
 <xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</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.g
o.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/Comm
on_prefecture.xml">40</urf:prefecture>
   <urf:city codeSpace="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Common_loca
lPublicAuthorities.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 *UrbanFunction* attribute *urbanPlanType*
See Code list for the *UrbanPlan* attribute *class*

Code list of the subclasses of *UrbanFunction* attribute *areaClassificationType*
See Code list for the *AreaClassification* attribute *class*

Code list of the subclasses of *UrbanFunction* attribute *prefecture*
See Code list for the *Administration* attribute *prefecture* in Part 2

Code list of the subclasses of *UrbanFunction* attribute *city*
See Code list of the *Administration* attribute *city* in Part 2

Code lists for Administration

Code list of the *Administration* attribute *prefecture*
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 *Administration* attribute *city*
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 *LandUsePlan* attribute *class*			
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	hight 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 *UrbanPlan* attribute *class*			
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 *Agreement* attribute *class*			
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 *DevelopmentProject* attribute *class*			
http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/DevelopmentProject_class.xml			
1010	housing	1030	urban fucilities
1020	agricultural facilities		

Code list for the *DevelopmentProject* attribute *function*			
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 *DevelopmentProject* attribute *usage*
http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/DevelopmentProject_usage.xml

1010	residential	9000	unexamined
1020	commertial	9010	exception
1030	industrial	9020	unknown
1040	agriculture, foresty and fisheries		
1050	public		
1060	other		

Code list for the *DevelopmentProject* attribute *status*			
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 *class*			
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 *DistrictsAndZones* attribute *class*			
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 *CensusBlock* attribute *numberOfHouseholdsByOwnership* (attribute *class* of the datatype *NumberOfHouseholdsType*)			
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 *CensusBlock* attribute *numberOfHouseholdsByStructure* (attribute *class* of the datatype *NumberOfHouseholdsType*)			
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 *DisasterDamage* attribute *class*			
http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/DisasterDamage_class.xml			
1010	flood	1020	landslide

Code list for the *DisasterDamage* attribute *function*			
http://www.kantei.go.jp/jp/singi/tiiki/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 *Pollution* attribute *class*			
http://www.kantei.go.jp/jp/singi/tiiki/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 *DisasterPreventionBase* attribute *class*			
http://www.kantei.go.jp/jp/singi/tiiki/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 *Recreations* attribute *class*			
http://www.kantei.go.jp/jp/singi/tiiki/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 *Recreations* attribute *function*			
http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Recreation_function.xml			
1010	baseball studium	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 *HubCity* attribute *class*			
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 *LandUseDiversion* attribute *class*			
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 *Urbanization* attribute *class*			
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 *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

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.

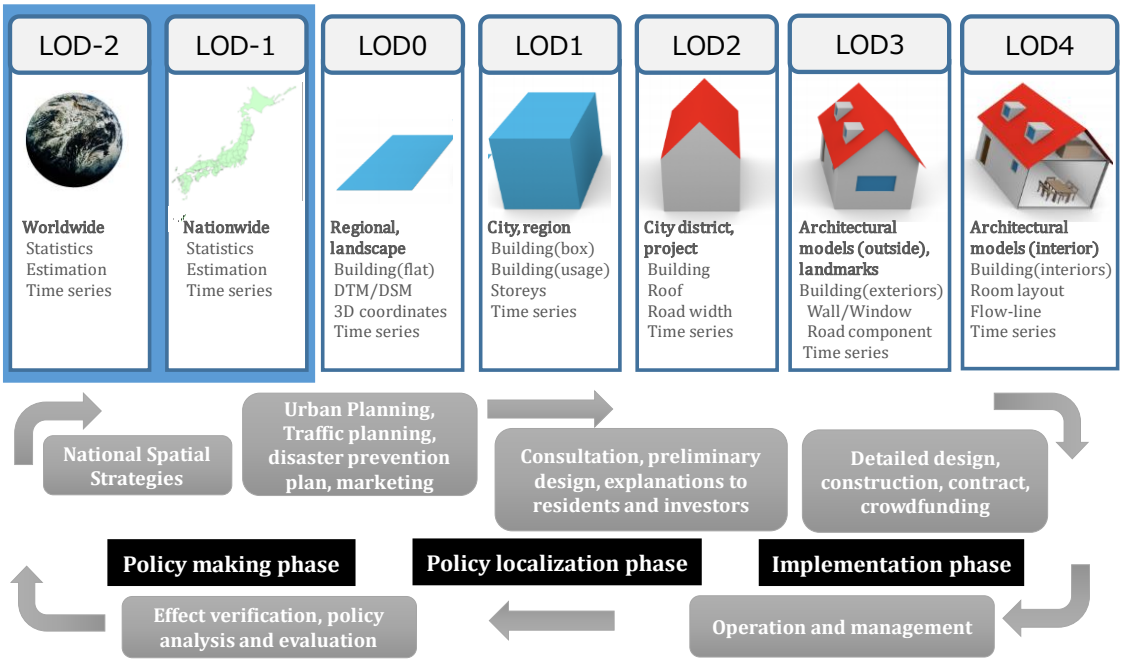


Figure C-1 Extended LOD for global city models

C.2 Extended LODs for Urban Functions

The mechanism of Extended LOD in Urban Function module is implemented as associaions 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.

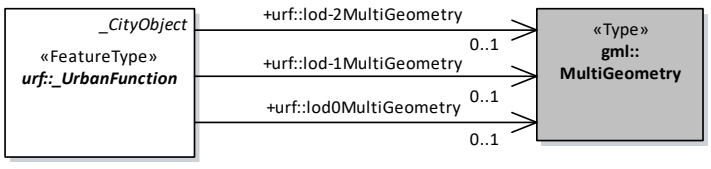


Figure C-2 Extended LOD applied to Urban Function module

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

CityGMLCity 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 boundries 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 suc 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.

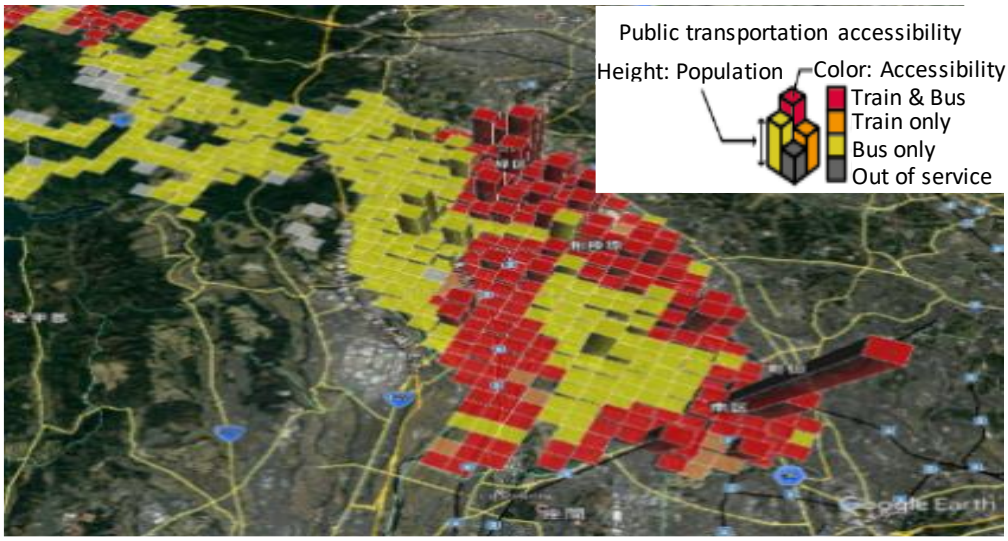


Figure 3-1 Example of grids describing a global city model

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.

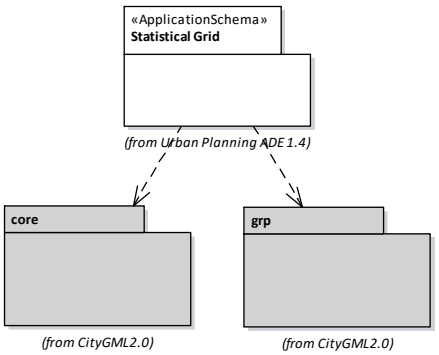


Figure 3-2 Package diagram of Statistical Grid Data

Module name	Statistical Grid
XML namespace identifier	http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/urg/1.4
XMLSchema location	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*.

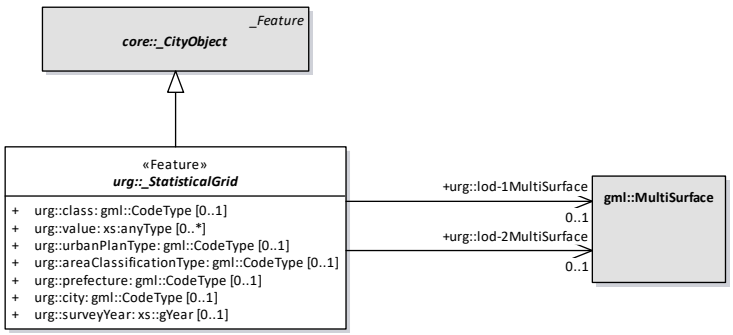


Figure 3-3 UML diagram of Statistical Grid Data

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

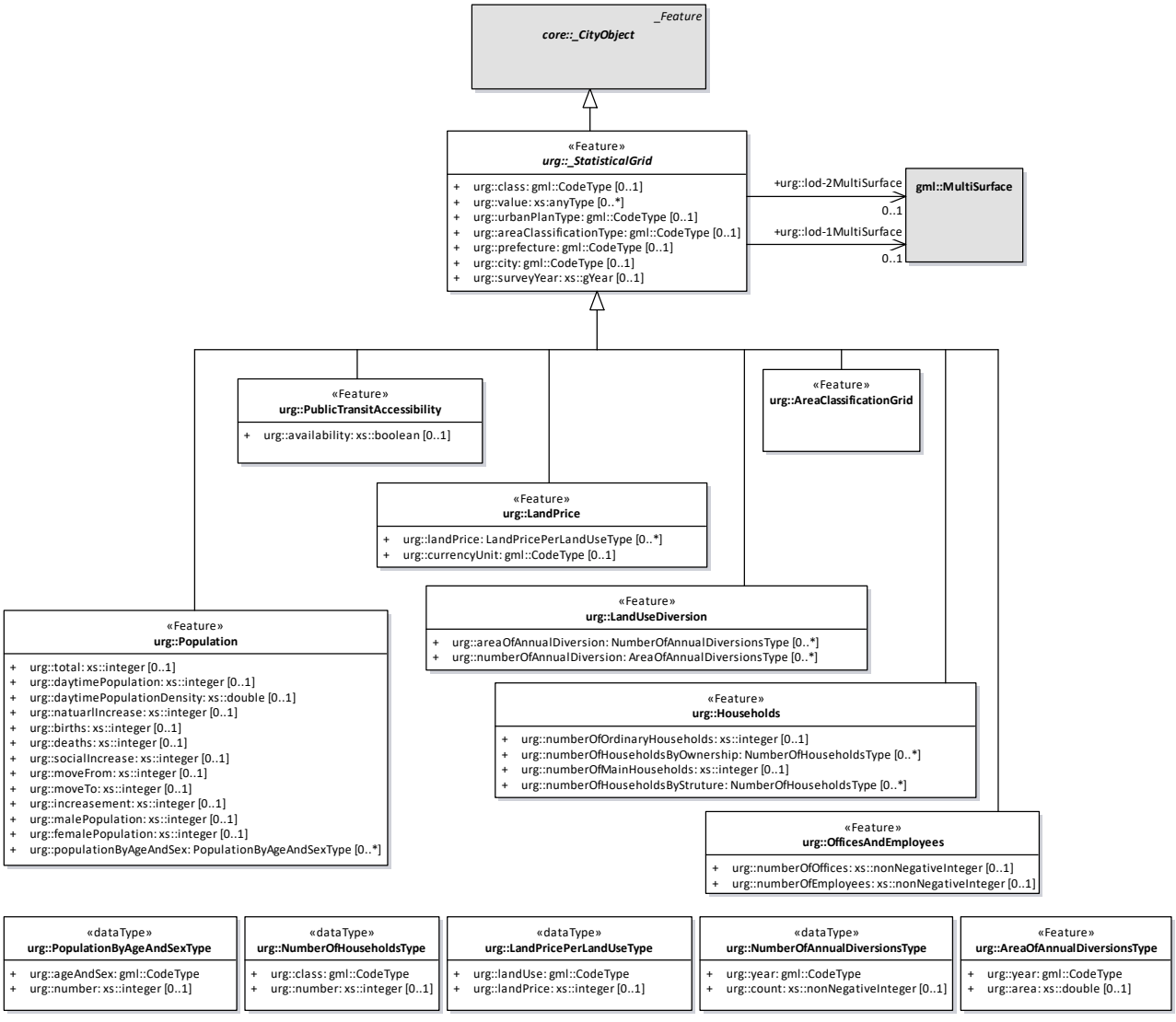


Figure 3-4 Subclasses of *urg::_StatisticalGrid*

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="AreaOfAnnualDiversionsPropertyType" minOccurs="0"/>
     </xs:sequence>
  </xs:extension>
 </xs:complexContent>
```

```
</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="NumberOfAnnualDiversions" type="NumberOfAnnualDiversionsType"/>
<xs:complexType name="NumberOfAnnualDiversionsType">
 <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="NumberOfAnnualDiversionsPropertyType">
 <xs:sequence>
  <xs:element ref="NumberOfAnnualDiversions"/>
 </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="AreaOfAnnualDiversions" type="AreaOfAnnualDiversionsType"/>
<xs:complexType name="NumberOfAnnualDiversionsType">
 <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="AreaOfAnnualDiversionsPropertyType">
 <xs:sequence>
  <xs:element ref="AreaOfAnnualDiversions"/>
 </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.

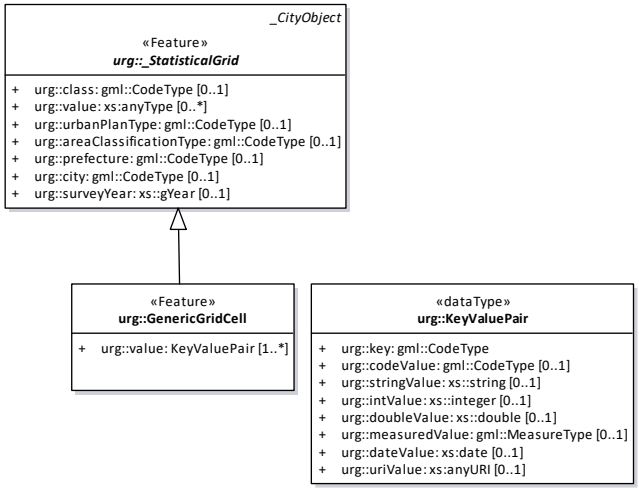


Figure 3-5 *urg::GenericGridCell*

GenericGridCell

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

```
<xs:complexType name="GenericGridCellType">
 <xs:complexContent>
  <xs:extension base="StatisticalGridType">
    <xs:sequence>
      <xs:element name="value" type="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="codeValue" type="gml:CodeType"/>
       <xs:element name="stringValue" type="xs:string"/>
      <xs:element name="intValue" type="xs:integer"/>
      <xs:element name="doubleValue" type="xs:double"/>
       <xs:element name="measuredValue" type="gml:MeasureType"/>
       <xs:element name="dateValue" type="xs:double"/>
       <xs:element name="uriValue" type="xs:anyURI"/>
     </xs:choice>
 </xs:sequence>
</xs:complexType>
<!-- ========================================================================== -->
<xs:element name="KeyValuePair" type="KeyValuePairType"/>
<!-- ========================================================================== -->
<xs:complexType name="KeyValuePairPropertyType">
 <xs:sequence>
  <xs:element ref="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 spacification 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.

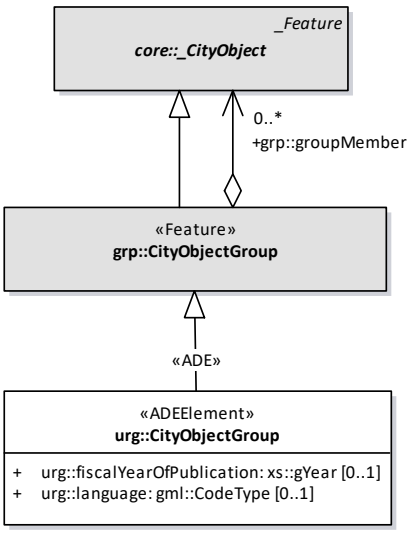


Figure 3-6 *Extension of grp:CityObjectGroup*

Extended properties of CityObjectGroup

Property	Definition
urg::fiscalYearOfPublication	Fiscal year when the group has been published
urg::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: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="1.4.0">
 <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="StatisticalGridPropertyType">
  <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="PopulationPropertyType">
  <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="PopulationByAgeAndSexPropertyType">
  <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="PublicTransitAccessibilityPropertyType">
  <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="LandPricePropertyType">
  <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:NumberOfAnnualDiversionsPropertyType" minOccurs="0"
maxOccurs="unbounded"/>
     <xs:element name="areaOfAnnualDiversion" type="urg:AreaOfAnnualDiversionsPropertyType" 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="LandUseDiversionPropertyType">
  <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:extension>
 </xs:complexContent>
</xs:complexType>
<xs:element name="GenericGridCell" type="urg:GenericGridCellType" substitutionGroup="urg:_StatisticalGrid"/>
<xs:complexType name="GenericGridCellPropertyType">
 <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:double"/>
   <xs:element name="uriValue" type="xs:anyURI"/>
  </xs:choice>
 </xs:sequence>
</xs:complexType>
<xs:complexType name="KeyValuePairPropertyType">
 <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"?>
<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/0/3857" srsDimension="3">
   <gml:lowerCorner>14532000 4006000 0</gml:lowerCorner>
   <gml:upperCorner>14533500 4007500 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/CityObjectG
roup_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/C
ommon_urbanPlanType.xml">1010</urg:urbanPlanType>
     <urg:areaClassificationType codeSpace="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelist
s/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/Com
mon_prefecture.xml">40</urg:prefecture>
     <urg:city codeSpace="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Common_loc
alPublicAuthorities.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>14532759.523100004 4006444.6594000012 0</gml:pos>
            <gml:pos>14532759.523100004 4007003.0613999963 0</gml:pos>
```

```
          <gml:pos>14532063.776199996 4007003.0613999963 0</gml:pos>
          <gml:pos>14532063.776199996 4006444.6594000012 0</gml:pos>
          <gml:pos>14532759.523100004 4006444.6594000012 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/Pop
ulationByAgeAndSexType_ageAndSec.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/Pop
ulationByAgeAndSexType_ageAndSex.xml">1020</urg:ageAndSex>
      <urg:number>5</urg:number>
     </urg:PopulationByAgeAndSex>
    </urg:populationByAgeAndSex>
                                                <!-- omitted -->
   </urg:Population>
  </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/C
ommon_urbanPlanType.xml">1010</urg:urbanPlanType>
    <urg:areaClassificationType codeSpace="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelist
s/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/Com
mon_prefecture.xml">40</urg:prefecture>
    <urg:city codeSpace="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Common_loc
alPublicAuthorities.xml">40220</urg:city>
    <urg:surveyYear>2016</urg:surveyYear>
    <urg:lod-1MultiSurface xlink:href="#grid1">
    </urg:lod-1MultiSurface>
                                                <!-- omitted -->
   </urg:Population>
  </grp:groupMember>
  <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:codeValue codeSpace="http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/Ge
nericGrid_key1010value.xml">1010</urg:codeValue>
      </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>
   <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 *StatisticalGrid* attribute *urbanPlanType*
See Code list for the *UrbanPlan* attribute *class* in part 2

Code list of the subclasses of *StatisticalGrid* attribute *areaClassificationType*
See Code list for the *AreaClassification* attribute *class* in part 2

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

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

Code lists for Population

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

Code lists for LandPrice

Code list for *LandPrice* attribute *landPrice* (attribute *landuse* of the datatype *LandPricePerLandUseType*)			
http://www.kantei.go.jp/jp/singi/tiiki/toshisaisei/itoshisaisei/iur/codelists/1.4/LandPricePerLandUseType_landuse.xml			
1010	Residential ara	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	Commertial area		

Code list for *LandPrice* attribute *landPrice* (attribute *currencyUnit* of the datatype *LandPricePerLandUseType*)
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 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

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.

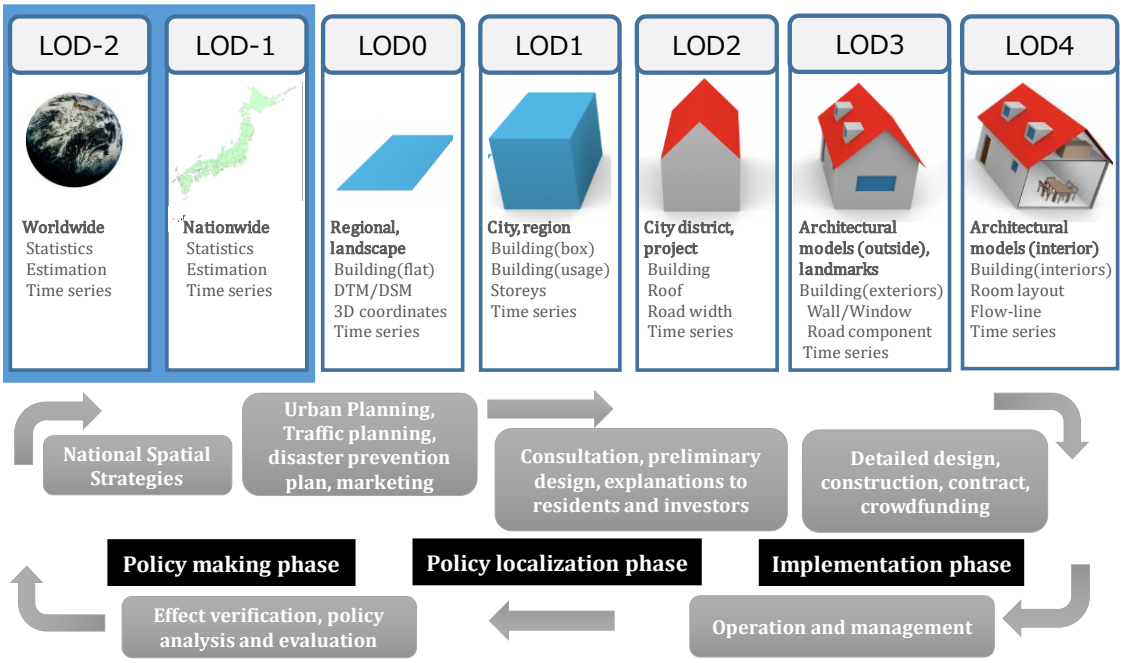


Figure C-1 Extended LOD for global city models

C.2 Extended LODs for Statistical Grid

The mechanism of Extended LOD in Statisical Grid module is implemented as associaions 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.

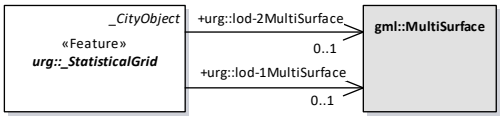


Figure C-2 Extended LOD applied to Statistical Grid module

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

CityGMLCity 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.

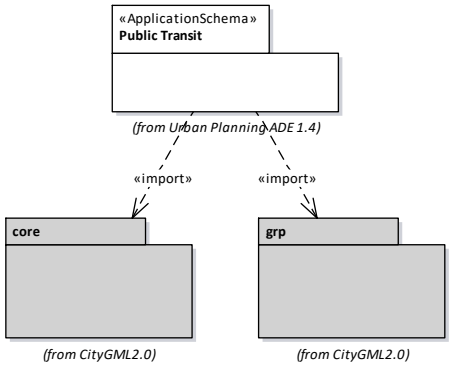


Figure 4-1 Package diagram of Public Transit Data

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-identifical 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.

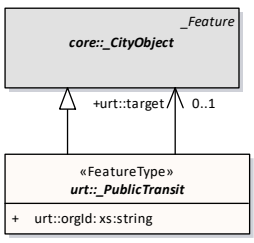


Figure 4-2 Public Transit

Object	Definition
urt::_PublicTransit	Identicable 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.

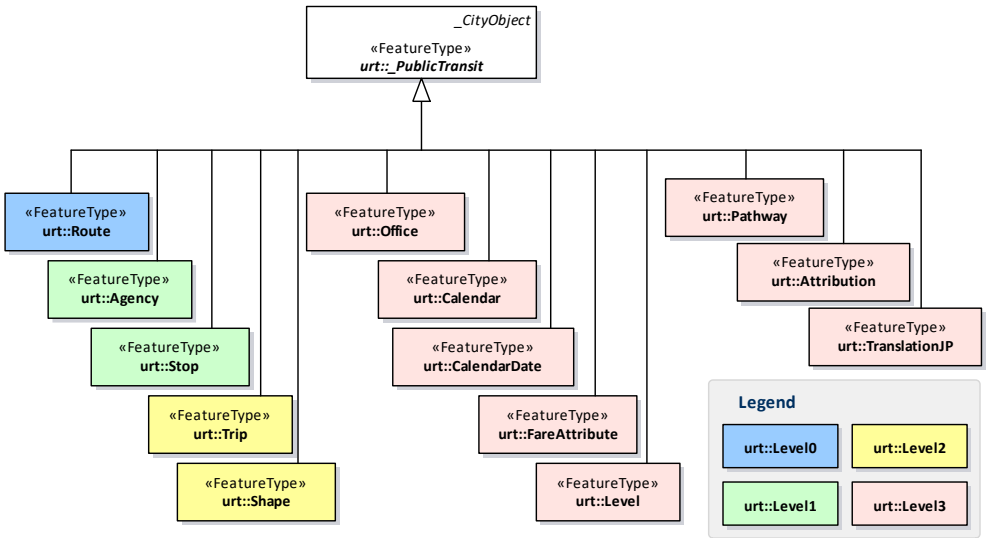


Figure 4-3 Subclasses of Public Transit module

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.

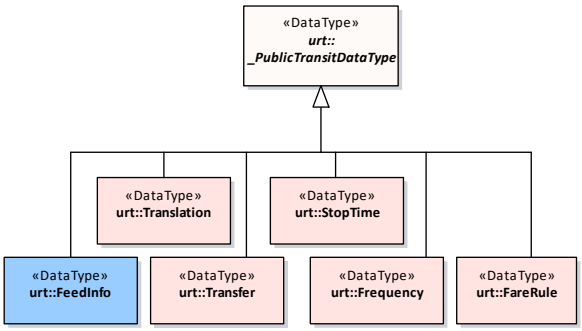


Figure 4-4 DataType classes in Public Transit module

Type	Definition
urt::PublicTransitDataType	A root class for non-identical object defined in Public Transit module.

```
<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>
```

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

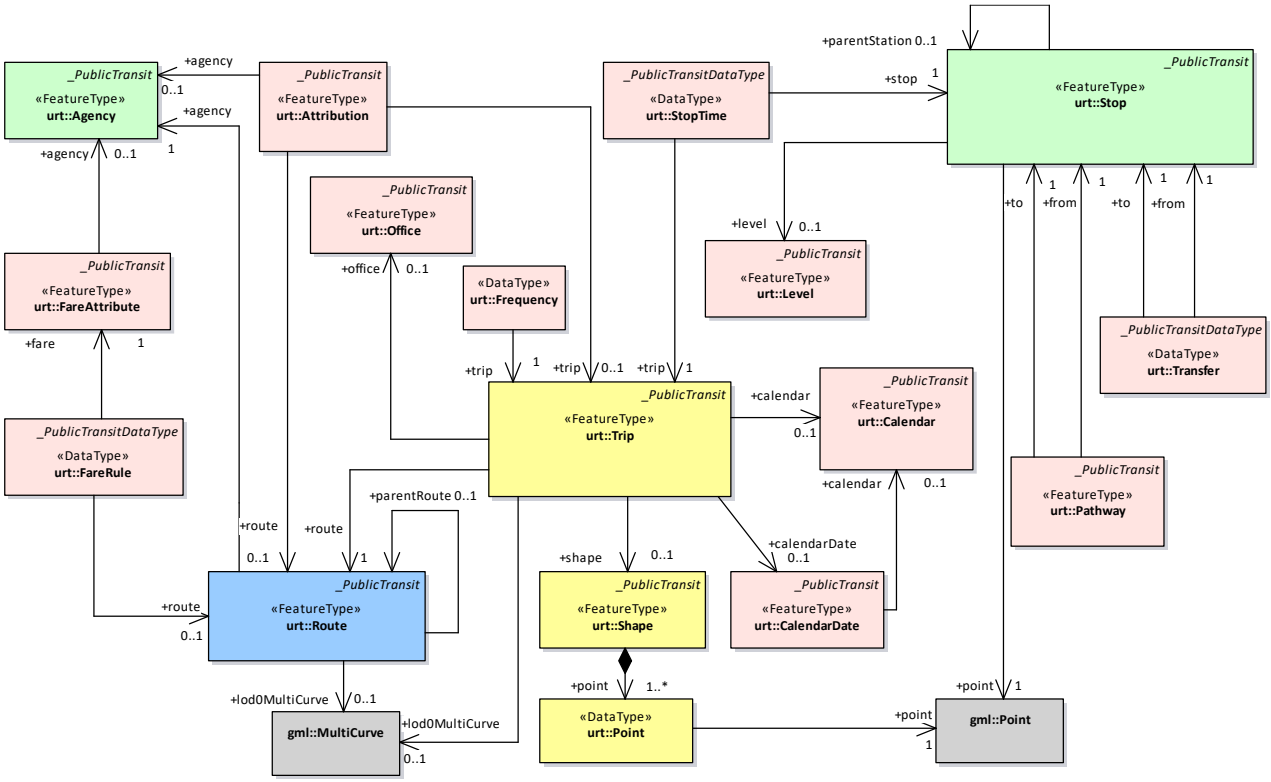


Figure 4-5 Associations between Subclasses of Public Transit module

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.

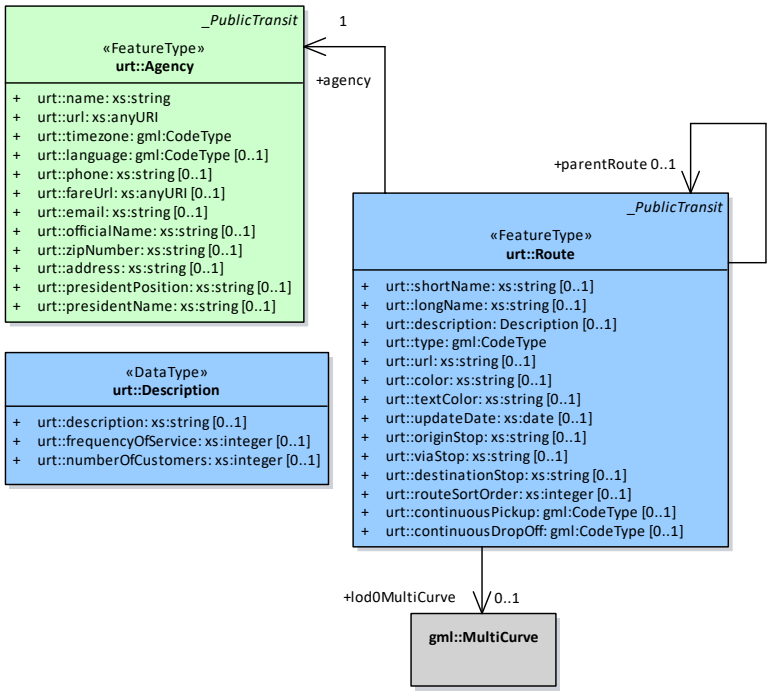


Figure 4-6 UML diagram of *urt::Route* and *urt::Agency*

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 *urt::shortName* or *urt::longName* must be specified, or potentially both if appropriate.
urt::longName	Full name of a route. Either *urt::shortName* or *urt::longName* 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 *urt::color*
urt::updateDate	date of the service schedule changed
urt::orginStop	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 urt::*shape*, on every trip of the route.
urt::continuousDripOff	Indicates that the rider can alight from the transit vehicle at any point along the vehicle's travel path as described by *urt::shape*, 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 *Route.txt* 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="DescriptionPropertyType">
 <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 agecy head office, extended in GTFS-JP.
urt::address	Address of the agency, extended in GTFS-JP.

urt::presitentPosition	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.

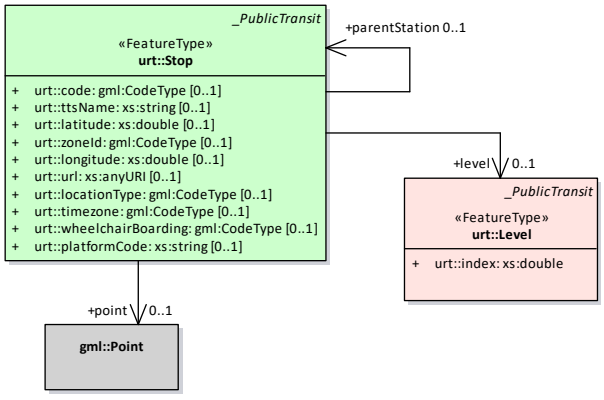


Figure 4-7 UML diagram of *urt::Stop* and *urt::Level*

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

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::wheelchairBoading	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:StopPropertyType" minOccurs="0"/>
     <xs:element name="level" type="urt:LevelPropertyType" minOccurs="0"/>
     </xs:sequence>
  </xs:extension>
 </xs:complexContent>
</xs:complexType>
<xs:element name="Stop" type="urt:StopType" substitutionGroup="urt:_PublicTransit"/>
<xs:complexType name="StopPropertyType">
 <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 *name* in *Level.txt* is mapped to *gml::name*.
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).

```
<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="LevelPropertyType">
 <xs:sequence minOccurs="0">
  <xs:element ref="urt:Level"/>
 </xs:sequence>
 <xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs: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*.

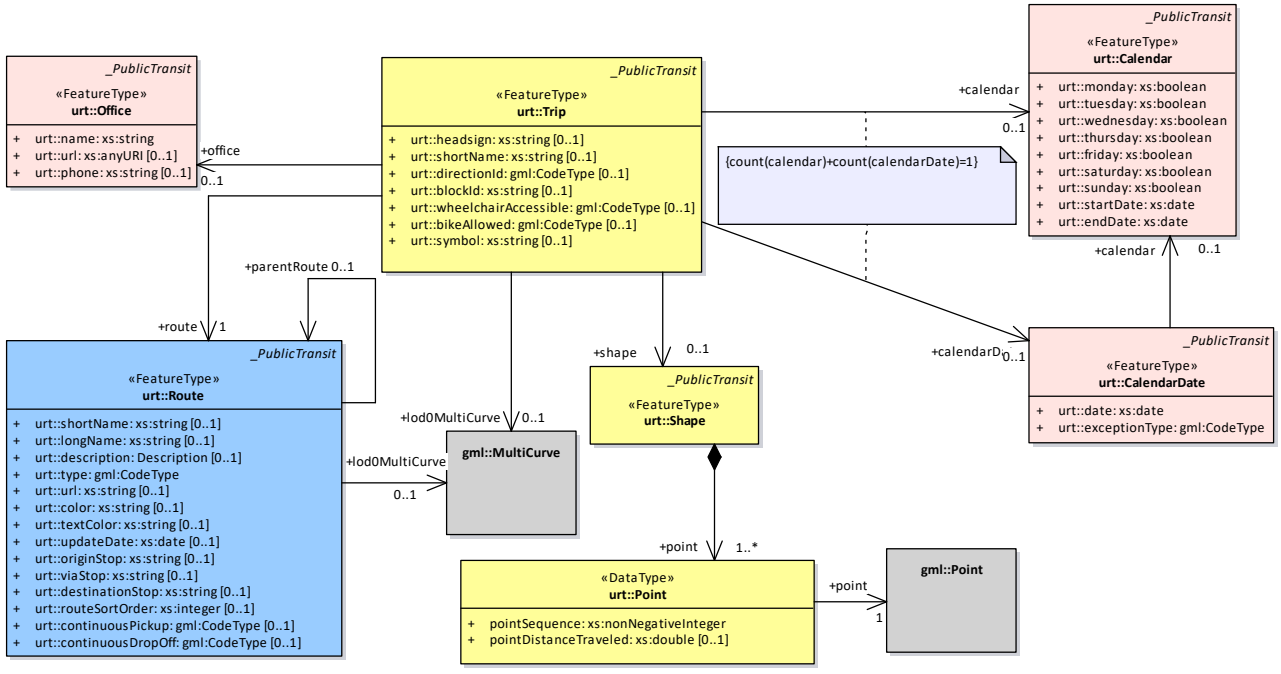


Figure 4-8 UML diagram of *urt::Trip* and related classes

Type	Definition
urt::Trip	A trips for each route. The attribute *desctiption* in *Trip.txt* is mapped to *gml::description*.
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 s*ervice_id* in *Trip.txt* when the trip refers *service_id* in *Calendar.txt* {count(calendar)+count(calendarDate)=1}
urt::calendarDate	Identifies a calendar date when service is available for one or more routes. It matches with s*ervice_id* in *Trip.txt* when the trip refers *service_id* in *CalendarDate.txt* {count(calendar)+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 *urt::Shape* 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="ShapePropertyType">
 <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="PointPropertyType">
 <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 urt::*startDate* and *urt::endDate*. Note that exceptions for particular dates may be listed in *urt::CalendarDate*
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="CalendarPropertyType">
 <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: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>
```

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.

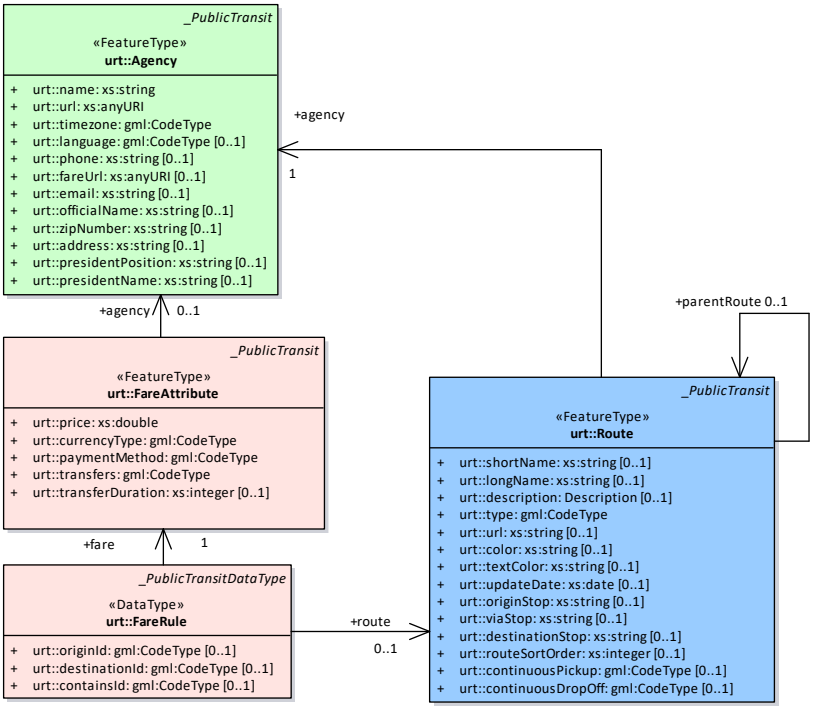


Figure 4-9 UML diagram of *urt::FareAttribute* and *urt::FareRule*

Type	**Definition**
urt::FareAttribute	Detailed information of the fare
Property	**Definition**
urt::price	Fare price
urt::currencyType	Currency used to pay the fare
urt::paymentMethod	Indicates when the fare must be paid.
urt::transfers	Indicates the number of transfers permitted on this fare.
urt::transferDuration	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 can be left empty
urt::agency	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::Stop*Time is a class to describe times that a vehicle arrives at and departs from stops for each trip.

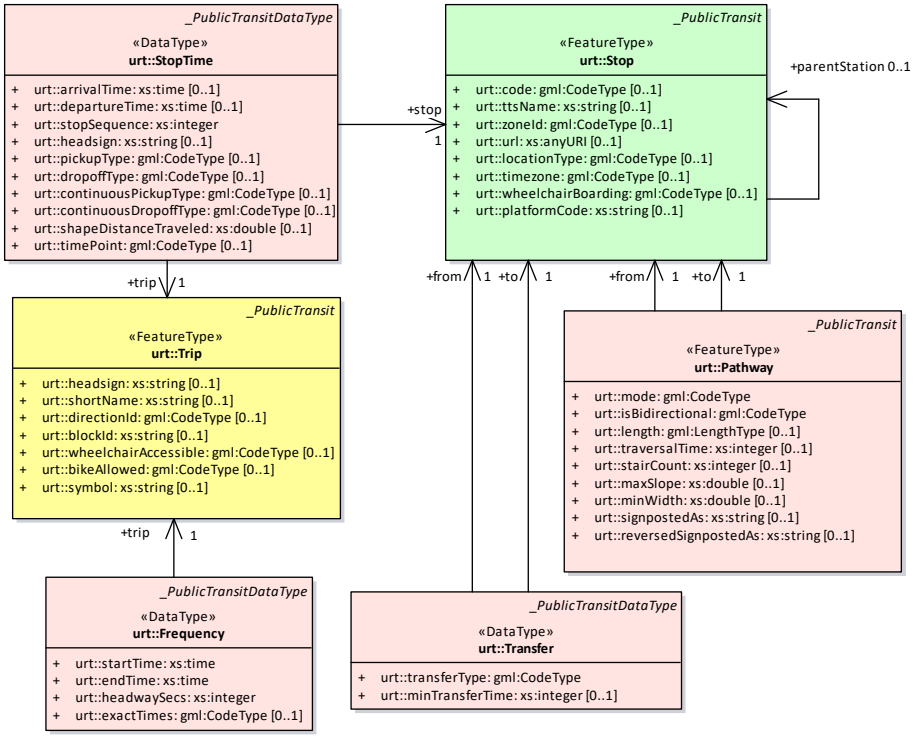


Figure 4-10 UML diagram of *urt::StopTime*, *urt::Frequency*, *urt::Transfer* and *urt::Pathway*

Type	**Definition**
urt::StopTime	Arrival and departure time at the stop
Property	**Definition**
urt::arrivalTime	Arrival time at a specific stop for a specific trip on a route.
urt::depatureTime	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 *urt::StopTime* to the next *urt::StopTime* in the trip's *stopSequence*.
urt::continuousDropoffType	Indicates that the rider can alight from the transit vehicle at any point along the vehicle's travel path as described by *urt::Shape*, from this *urt::StopTime* to the next *urt::StopTime* in the trip's *urt::stopSequence*.
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="StopTimePropertyType">
 <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 *urt::startTime* and *urt::endTime*.
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="FrequencyPropertyType">
 <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 (*urt::from* and *urt::to*) 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 (*urt::from* and *urt::to*) 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:StopPropertyType"/>
    <xs:element name="to" type="urt:StopPropertyType"/>
    </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. Forthermore, 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.

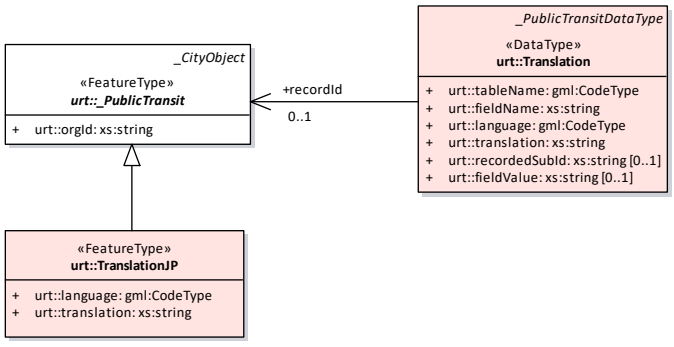


Figure 4-11 UML diagram of *urt::Translation* and *urt::TranslationJP*

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 *urt::recordId* and *urt::recordSubId*, 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 *urt::orgId*.
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.

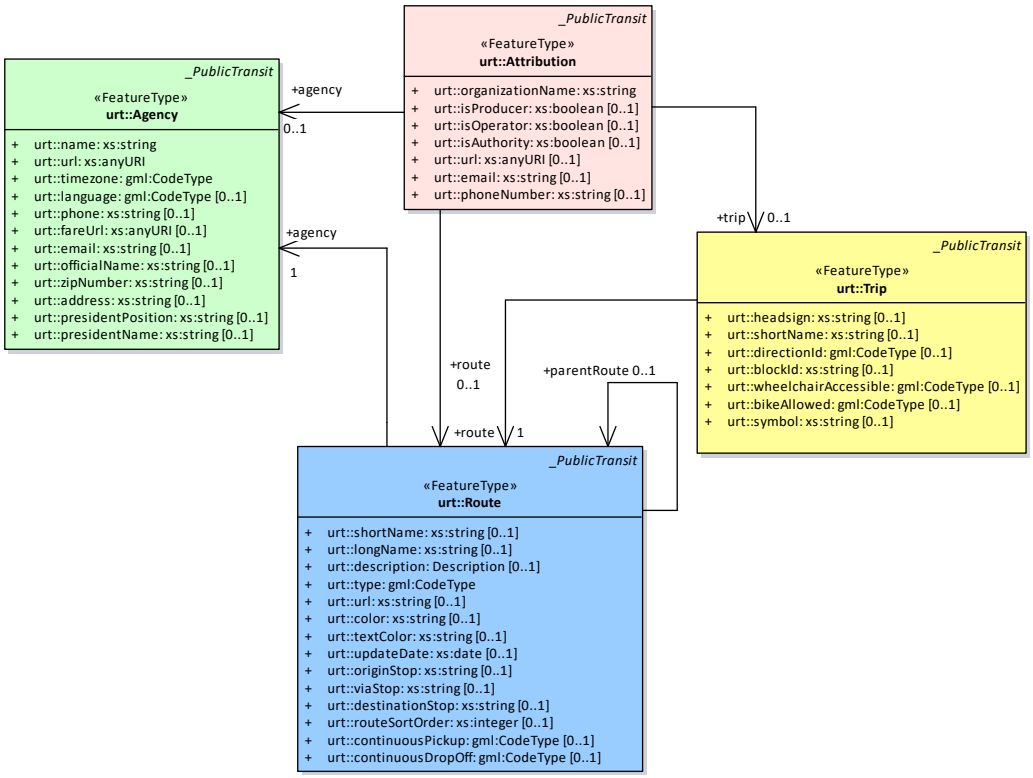


Figure 4-12 UML diagram of *urt::Attribution* and related classes

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: *false*: Organization doesn't have this role, *true*: Organization does have this role.
urt::isOperator	The role of the organization is operator. Valid options are: *false*: Organization doesn't have this role, *true*: Organization does have this role.
urt::isAuthority	The role of the organization is authority. Valid options are: *false*: Organization doesn't have this role, *true*: 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="AttributionPropertyType">
 <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**.

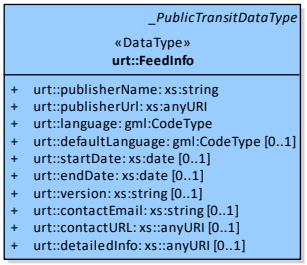


Figure 4-13 UML diagram of *urt::FeedInfo*

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::endData	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.

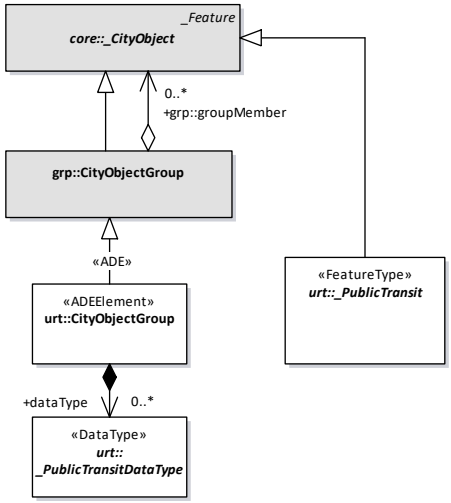


Figure 4-14 UML diagram of *urt::CityObjectGroup*

Extended properties of CityObjectGroup

Property	Definition
urt::dataType	Association to contain DataType instances directly under the CityObjectGroup

```
<xs: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="1.4.0">
 <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 ================== -->
 <!-- ========================================================================= -->
 <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>
 <!-- ========================================================================= -->
 <xs:complexType name="TargetPropertyType">
  <xs:sequence minOccurs="0">
   <xs:element ref="core:_CityObject"/>
  </xs:sequence>
  <xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
 </xs:complexType>
 <!-- ========================================================================= -->
 <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: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>
<!-- ========================================================================== -->
<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:StopPropertyType" minOccurs="0"/>
     <xs:element name="level" type="urt:LevelPropertyType" minOccurs="0"/>
     </xs:sequence>
  </xs:extension>
 </xs:complexContent>
</xs:complexType>
<xs:element name="Stop" type="urt:StopType" substitutionGroup="urt:_PublicTransit"/>
<xs:complexType name="StopPropertyType">
 <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="LevelPropertyType">
 <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="TripPropertyType">
  <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="ShapePropertyType">
  <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: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="OfficePropertyType">
 <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="CalendarPropertyType">
 <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:StopPropertyType"/>
     <xs:element name="to" type="urt:StopPropertyType"/>
     </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>
<!-- ========================================================================== -->
<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="TranslationJPPropertyType">
 <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="AttributionPropertyType">
 <xs:sequence minOccurs="0">
  <xs:element ref="urt:Attribution"/>
 </xs:sequence>
 <xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>
<!-- ========================================================================== -->
<!-- ================     DataType 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="FeedInfoPropertyType">
 <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="TranslationPropertyType">
 <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="FareRulePropertyType">
  <xs:sequence>
   <xs:element ref="urt:FareRule"/>
  </xs:sequence>
 </xs:complexType>
 <!-- ================== Extended attribute for CityObjectGroup ================= -->
 <xs:element name="dataType" type="urt:PublicTransitDataTypePropertyType"
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 Committee Specification WG Using Open Data Toyama-->
<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/cityo
bjectgroup/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:zoneId>1_1</urt:zoneId>
    <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>
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      </gml:Point>
     </urt:point>
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    </urt:Point>
   </urt:point>
   <urt:point>
    <urt:Point>
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     <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>
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      </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>
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    <urt:publisherName>富山県富山市</urt:publisherName>
    <urt:publisherUrl>https://www.city.toyama.toyama.jp/</urt:publisherUrl>
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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 *Stop* attribute *locationType*			
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 *Stop* attribute *wheelchairBoarding*			
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 *Route* attribute *type*			
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 *Trip* attribute *directionId*			
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 *Trip* attribute *wheelchairAccessible*			
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 *Trip* attribute *bikeAllowed*			
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 *StopTime* attribute *pickupType*			
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 *StopTime* attribute *dropoffType*			
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 *StopTime* attribute continuousP*ickupType*			
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 *StopTime* attribute continuousD*ropoffType*			
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 *StopTime* attribute *timePoint*			
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 *Calendar* attribute *monday, tuesday, wednesday, thursday, friday, saturday, and sunday*
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 *CalendarDate* attribute *exceptionType*			
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 *FareAttribute* attribute *paymentMethod*			
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 *FareAttribute* attribute *transfer*			
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 *Frequency* attribute *exactTimes*			
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 *Transfer* attribute *transferType*			
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 *Pathway* attribute *mode*			
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 *Pathway* attribute *isBidirectional*			
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 *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	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 *currencyUnit*
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 *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

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Revision History

Date	Release	Author	Paragraph modified	Description
2019/3/20	0.9		All	Document created
2019/5/7	1.0		All	Add elements and properties to ensure consistency with Basic Surveys Concerning City Planning (Part 1, Part 2, and Part 3) Add temporal attribute to accumulate and utilize time series datasets (Part1, part2, Part 3 and Part4) Import and extend grp::CityObjectGroup for object collection to mention the purpose or usage of the collection (Part1) Rename or add properties for clarification (Part 1) Add associations to describe global city model as LOD extension (Part 4) Modify UML diagrams and XML Schemata based on the modifications above (Part1, part2, Part 3 and Part4) Modify text description for clarification and Correct editorial errors (Through the document)
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	Add remarks to that of featureType classes. Change global element of feature attributes to local elements not to use the mechanism of “hook”. Delete “_GenericApplicationPropertyOf…” elements of dataType classes.
			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.