ISO/TC 211 N 3188

Replaces N 3075

2011-08-05

Number of pages: 131

ISO/TC 211
Geographic information/Geomatics

ISO reference number: 19160

Title: **Review summary of project 19160, Addressing**

Source: ISO/TC 211/WG 7/PT 19160

Expected action: For information

Type of document: Review Summary

Hyperlink: http://www.isotc211.org/protdoc/211n3188/

Reference: N 3189

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Introduction

Addresses are one of the most common ways of describing a location. Address assignment schemes vary from country to country: in many Euro-centric countries reference to a road network in the address is common, while addresses in countries such as Japan and Korea (though Korea is moving away from this) comprise a hierarchy of administrative areas without reference to a thoroughfare. Addresses are used for a wide variety of purposes: postal delivery, emergency response, customer relationship management, land administration, utility planning and maintenance, to name a few. Refer to Figure 1.

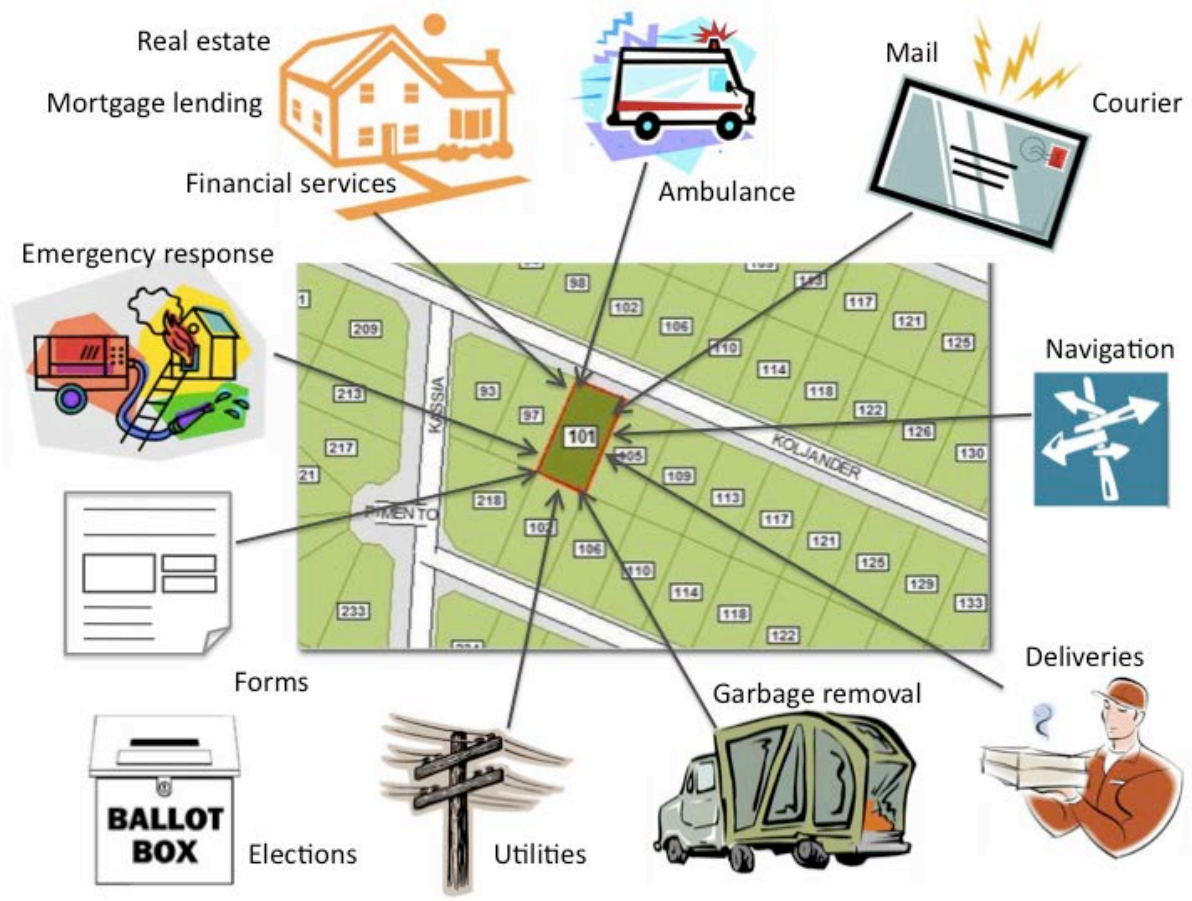


Figure 1. Examples of address uses

Sometimes a geographic overview of addresses at a large scale is required, e.g. land administration and utility planning and maintenance. For mail delivery or emergency response planning, accurately identifying individual delivery points in a suburb or street is priority. In a customer analysis, individual delivery points are sometimes completely discarded and only the place name in the address is of relevance, while for mail delivery and customer analysis addresses tend to also include names of parties and are constrained by the formatting rules (address label). Standardization of such formatting rules has a great impact on the efficiency of address label rendition (writing) and recognition (reading) and therefore on the overall efficiency of the delivery process.

Quite a few stakeholders are involved in address standardization. In the run-up to this project, a workshop considering the issues related to an international address standard was held under the auspices of Working Group 7, *Information Communities*,

of ISO/TC 211, *Geographic information/Geomatics* and was hosted by the National Survey and Cadastre in May 2008 in Copenhagen, Denmark (Coetzee, Cooper and Lind 2008). The workshop brought together people involved in the development of address standards around the world, to give their perspectives on an international address standard. Figure 2 illustrates the variety of stakeholders involved in addressing: for assigning the address (local governments, postal operators, etc.); for using addresses in various ways (customer service providers and electronic business, local and national governments, utility service providers, election commissions, etc.); and finding the address (citizens, delivery and emergency response service providers, etc.). Through the workshop and collaboration with other initiatives, such as the Universal Postal Union's 'Addressing the world – An address for everyone', most of the identified stakeholders were involved in the project. The list of member bodies and liaison organizations, with their nominated experts who participated in the project, is included in Annex B .

Figure 2. Stakeholders in addressing

The benefits of address standardization are well documented, including benefits to the economy, society and governance (CEBR 2006, Barr 2007, Coetzee & Cooper 2007a, Coetzee et al. 2008b, Lind 2007, Nicholson 2007, EURADIN 2009, DECA 2010). These benefits are not restricted to interoperability of existing address data in the developed world, but also provide guidelines to developing countries that still have to develop addressing systems. Thus, participation and perspectives from both developed and developing countries are important.

This review summary is the report prepared by the project team of ISO 19160 and is structured as follows:

The scope of the project is described in clause 1.

Symbols and abbreviated terms are listed in clause 2.

Clause 3 describes the approach that was followed to achieve the two objectives of this project.

In clause 4 the results of the review of existing standards are presented.

Clause 5 contains the recommendations that describe the addressing standardization requirements, the benefits of each of these requirements and the route that should be followed to develop them.

Annex A contains the input received for the review of address standards.

Annex B shows the member bodies and liaison organizations that were represented on the ISO 19160 project team.

The bibliography contains two lists of references: the first is a list of address-related references; the second is a list of references to address standards.

1 Scope

This review summary is a report of the work done as part of the ISO 19160, *Addressing*, stage zero project, which served to enable formal collaboration among addressing stakeholders in order to reach the two objectives stated in the project's proposal (ISO/TC 211 document number N 2737):

Objective 1: Investigate and formulate requirements in relation to addressing.

Objective 2: Make recommendations on whether standards should be developed and if so, how this should be done.

Thus, to confirm: the objective of this project is NOT to write an address standard, but rather to review existing address standards in order to identify international addressing standardization requirements and to make recommendations on how these should be developed.

2 Symbols and abbreviated terms

AFNOR	l'Association Française de Normalisation
AS/NZS	Standards Australia and Standards New Zealand
BSI	British Standards Institution
CEN	European Committee for Standardization / Comité Européen de Normalisation
EBNF	Extended Backus-Naur Form
GML	Geography Markup Language
INSPIRE	Infrastructure for Spatial Information in Europe
ISO/TC 154	ISO/TC 154, *Processes, data elements and documents in commerce, industry and administration in collaboration with UN/CEFACT*
IETF	Internet Engineering Task Force
ISO/TC 211	ISO/TC 211, *Geographic information/Geomatics*
KAF	Korean Address Forum
OASIS	Organization for Advancement of Structured Information Standards
PATDL	Postal Address Template Definition Language
SABS	South African Bureau of Standards
TWG	Thematic Working Group
UML	Unified Modeling Language
UNGEGN	United Nations Group of Experts on Geographical Names
UPU	Universal Postal Union
US FGDC	United States Federal Geographic Data Committee
xAL	Extensible Address Language
XML	Extensible Markup Language
xNAL	Extensible Name and Address Language
xNL	Extensible Name Language
xPIL	Extensible Party Information Language
xPRL	Extensible Party Relationships Language

3 Approach

3.1 Approach to achieving the first objective

In order to investigate requirements in relation to addressing, the project team *reviewed* a number of existing national and international standards. The standards to be reviewed were selected so as to represent different addressing contexts and uses. Refer to Table 1 for the list of standards that were reviewed. The approach enabled the project team to identify requirements that have not yet been addressed in existing address standards. It also ensured that existing standards were taken into account and, where possible, recommended for re-use so that work is not duplicated. The results of the review are described in clause 4, while details about the input to the review are provided in Annex A .

Table 1 includes a justification for the inclusion of each standard in the review. While no formal Japanese addressing standard exists, it was considered important to include the Japanese addressing system in the review because of its unique features. Since a standard could not be referenced, Japanese project experts provided input about the Japanese addressing system.

Table 1. Address standards in the review

Standard	ISO 19112:2003, *Spatial referencing by geographic identifiers*
Referenced as	ISO 19112
Publisher	ISO/TC 211
Publication Date	2003
Level	International
Justification	International standard for spatial reference systems using geographic identifiers, such as gazetteers.
Standard	ISO/TS 15000-5:2005, *Electronic Business Extensible Markup Language (ebXML) - Part 5: ebXML Core Components Technical Specification*, Version 2.01 (ebCCTS)
Referenced as	ISO/TS 15000-5
Publisher	ISO/TC 154
Publication Date	2005
Level	International
Justification	International standard for terminology and core components in electronic business and administration. Includes, for example, a number of different address profiles, each specifying a number of address related fields that should be used together on a form such as an invoice.
Standard	OASIS CIQ v3.0 Approved Committee Specifications CS02
Referenced as	OASIS CIQ
Publisher	OASIS
Publication Date	2008
Level	International
Justification	International address standard, especially interesting for its XML schema.
Standard	UPU S42, *International postal address components and templates*
Referenced as	UPU S42
Publisher	Universal Postal Union (UPU)

Publication Date	2006
Level	International
Justification	International address standard with specific focus on postal mail. A number of countries have already submitted postal address templates that specify how an address should be written on a mail piece. NOTE The European equivalent of UPU S42a is CEN/TS 14142-1:2010, *Postal Services - Address databases - Part 1: Components of postal addresses*, and the equivalend of UPU S42b is CEN/TR 14142-2:2010, *Postal Services - Address databases - Part 2: Element mapping conventions, template design considerations, address templates and rendition instructions*.
Standard	UPU S53, *Exchange of Name and Address Data*
Referenced as	UPU S53
Publisher	Universal Postal Union (UPU)
Publication Date	2009
Level	International
Justification	International address standard with specific focus on postal mail. For the review, UPU S42 and UPU S53 are considered together.
Standard	AS/NZS 4819:2003, *Geographic information – rural and urban addressing*
Referenced as	AS/NZS 4819
Publisher	Standards Australia and Council of Standards New Zealand
Publication Date	2003
Level	Regional (Australia and New Zealand)
Justification	Regional address standard, especially interesting for its rural addressing scheme. NOTE At the time of writing, AS/NZS 4819:2003 was undergoing a major revision.
Standard	INSPIRE *D2.8.I.5 Data Specification on Addresses –Guidelines*
Referenced as	INSPIRE Address
Publisher	INSPIRE TWG Addresses
Publication Date	2010
Level	Regional (Europe)
Justification	Regional address standard that specifies how public authorities of EU member states must make their address data available in order to obtain interoperability within the EU. It is therefore expected to have a significant impact as a data exchange standard within the EU.
Standard	AFNOR XP Z10-011, *Specifications postales – Adresse postale*
Referenced as	AFNOR XP Z10-011
Publisher	AFNOR
Publication Date	1997
Level	National (France)
Justification	National postal address standard from a developed country.
Standard	AS 4590:2006, *Interchange of client information*
Referenced as	AS 4590
Publisher	Standards Australia
Publication Date	2006
Level	National (Australia)
Justification	As 4590 is an important component of Australia's National Address Management Framework.

Standard	BS 7666-0:2006, *Spatial datasets for geographical referencing - Part 0: General model for gazetteers and spatial referencing*
Referenced as	BS 7666
Publisher	British Standards Institute (BSI)
Publication Date	2006
Level	National (UK)
Justification	National address standard from a developed country, based on ISO 19112 above.
Standard	SANS 1883-1, *Geographic information – Address, Part 1: Data format of addresses*
Referenced as	SANS 1883-1
Publisher	South African Bureau of Standards (SABS)
Publication Date	2009
Level	National (South Africa)
Justification	National address standard from a developing country with a wide variety of address types, including free text address types for informal settlements and rural areas.
Standard	SANS 1883-3, *Geographic information – Address*, *Part 3: Guidelines for address allocation and updates*
Referenced as	SANS 1883-3
Publisher	South African Bureau of Standards (SABS)
Publication Date	2009
Level	National (South Africa)
Justification	Guidelines accompanying SANS 1883-1. For the review, SANS 1883-1 and SANS 1883-3 are considered together.
Standard	Draft U.S. Thoroughfare, Landmark, and Postal Address Data Standard
Referenced as	US FGDC Address
Publisher	United States Federal Geographic Data Committee (US FGDC)
Publication Date	2010 (expected)
Level	National (US)
Justification	National address standard from a developed country with a wide variety of address types and a separate part for address data quality.

3.2 Approach to achieving the second objective

The standardization requirements resulting from the first objective were grouped into a number of projects. For each project, the type of document (standard) that should be developed and the route to follow is recommended.

4 Review of existing address standards

4.1 Introduction

Standards support address data interoperability. There are different levels of interoperability, different business sectors where standards are implemented and different regions of applicability (national, regional, international). Some address standards support interoperability through the transfer and exchange of address data in a standardized encoding or format, while others support it through the specification of a standardized address assignment scheme. The differences between standards

are reflected in the different ways in which the reviewed standards deal with address standardization. Refer to Table 2. The reviewed standards facilitate address interoperability through one or more of the following, each of which is discussed in subsequent clauses:

- An **address assignment scheme** identifies the components that make up an address and describes how values are assigned to these components, i.e. how addresses are assigned in the physical world.
- **Terminology** (terms and definitions) that is used to describe the address assignment scheme and/or concepts in the conceptual model.
- A **conceptual model** that describes addresses, i.e. the meaning of concepts and relationships between them. Typically, an address is described as a combination of components or elements, often comprising a hierarchy. Some standards include address classifications (address types). The conceptual model usually reflects the address assignment scheme that is in use in the physical world.
- **Metadata** defines address-specific metadata that provides information about the address data, such as the custodian, lifespan, status, etc. Metadata is used during exchange and maintenance of address data.
- An **encoding** of the conceptual data model, i.e. the format to be used in data files or electronic messages when exchanging one or more address data records, which could include metadata.
- **Address data maintenance**, such as address data quality management, address life cycles and address aliases. Maintenance is based on the conceptual model.
- Specifications for the **rendering** of addresses for display on mail items, forms, maps, etc. The rendering rules are based on the conceptual model.

Table 2. Address standardization in the reviewed standards

	AFNOR XP Z10-011	AS/NZ 4819	AS 4590	BS 7666	INSPIRE Address	ISO 19112	ISO/TS 15000-5	OASIS	SANS 1883-1	SANS 1883-3	UPU S42	UPU S53	US FGDC Address
Address assignment scheme		Y		Y						Y			Y
Terminology	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Conceptual model	Y	Y	Y	Y	Y	Y		Y	Y		Y	Y	Y
Metadata					Y			Y	Y			Y	Y
Encoding			Y		Y			Y				Y	Y
Address data maintenance					Y					Y			Y
Address rendering	Y										Y		

NOTE The complete scope statements of the reviewed address standards and a review of these scope statements are provided in Annex A .

4.2 Address assignment scheme

An address assignment scheme identifies the components that make up an address and describes how values are assigned to these components.

An address assignment scheme establishes the framework of rules, both spatial and non-spatial, adopted by an address authority for assigning addresses within the area it administers. The address assignment scheme includes, as needed, rules governing address numbering, street naming, block definition, sub-addresses (suites, offices, apartments, etc.) and place names. The address assignment scheme may also define address baselines (north-south or east-west lines used as a zero starting point for address numbers) and datum points (origin for numbering), polylines (streets, geometric lines, or other lines used to measure address number assignment intervals and ranges within an address system.), breakpoints (points along a street denoting where an address range beginning and/or endpoint is located) and breaklines (lines that connect breakpoints to indicate where one scheme ends and another starts) to guide address numbering throughout the area.

A number of address assignment schemes are described in Annex A.13. While this is not a comprehensive review of all schemes, it does reflect the wide variety of address assignment schemes in use all over the world. It also includes a scheme described in the book ‘Street Addressing and the Management of Cities’ (Farvacque-Vitkovic 2005), which is a guide for assigning street addresses in areas where they do not exist.

Because of socio-economic, cultural, legal and other implications, there is not a single best address assignment scheme that suits all countries. Therefore it does not make sense to develop an address assignment scheme as an international standard; it would be better to provide guidelines of good practices for address assignment schemes.

4.3 Terminology

Most of the reviewed address standards define an address. INSPIRE Address and BS 7666 specifically define an addressable object, i.e. the object with which the address is associated. In the other standards, whatever the address is associated with, is implied in the address definition. Below are the definitions for the term ‘address’ from the reviewed address standards, as well as the addressable object as defined in these standards.

address

- set of information which, for a postal item, allows the unambiguous determination of an actual or potential delivery point, usually combined with the specification of an addressee and/or a mailee (AFNOR XP Z10-011)

  NOTE The term is defined as ‘postal address’.
- means of identifying a location (company's or private individual's address) (AFNOR XP Z10-011)

- the conventional means of describing, labelling or identifying an address site (AS/NZS 4819)
- means of referencing an object for the purposes of identification and location (BS 7666)
- location of properties based upon address identifiers, usually by road name, house number, postal code (INSPIRE Directive 2007/2/EC)
- the location at which a particular organization or person may be found or reached (ISO/TS 15000-5)
- a physical location or a mail delivery point (OASIS CIQ)
- an unambiguous specification of a point of service delivery (SANS 1883-1)
- set of information which, for a postal item, allows the unambiguous determination of an actual or potential delivery point, usually combined with the specification of an addressee and/or a mailee (UPU S42)

  NOTE 'address' is an alias for 'postal address'.
- specifies a location by reference to a thoroughfare or a landmark; or it specifies a point of postal delivery (US FGDC Address)

addressable object

- a real world object that has a fixed location and which may be identified and referenced by means of one or more addresses (BS 7666)
- spatial object type which can have instances to which it is meaningful to associate addresses in the context of the INSPIRE scope (INSPIRE Address)

Apart from the terms above and terms for address components, which are reviewed in 4.4.1,other terms defined in the standards include terms related to:

- **the delivery process**: *delivery point identifier* (AS 4590, UPU S53), *forwarding address*, *postal delivery identifier* (INSPIRE Address), *return address* (UPU S42), *specific distribution heading* (AFNOR XP Z10-011), *USPS general delivery point* (US FGDC Address);
- **the person or organization involved in an 'addressing transaction':** *addressee* (AFNOR XP Z10-011), *mailee, mail originator, mail submitter, mailer* (UPU S42), *name* (OASIS CIQ), *party* (OASIS CIQ, UPU S42), *payer* (UPU S42), *recipient* (AFNOR XP Z10-011, UPU S42);
- **authorities involved in assigning addresses**: *address authority* (US FGDC Address), *custodian* (AS/NZS 4819), *official address issuing body* (SANS 1883-1), *street naming authority* (BS 7666);
- **services at the address**: *service* (SANS 1883-1), *utility* (AS/NZS 4819);
- **the location of the address:** *address coordinates* (US FGDC Address), *coordinated point* (BS 7666), *geocode* (AS/NXS 4819, AS 4590), *geographic position* (INSPIRE Address); and
- **land administration:** *cadastral property* (SANS 1883-1), *cadastre* (SANS 1883-3), *land and property identifier* (BS 7666), *property* (INSPIRE Address), *parcel of land* (Japan), *public right of way* (BS 7666).

These terms often reveal the specific purpose that the standard aims to achieve. The complete list of terms defined in each of the reviewed address standards can be found in clause A.2 of Annex A .

4.4 Conceptual model

A conceptual model describes concepts and their relationships. It is independent of any implementation details. The conceptual models in the reviewed address standards show relationships between the concepts that are defined in the address standards.

In the reviewed standards the *Unified Modeling Language, UML,* (AS 4590, BS 7666, INSPIRE Address, ISO 19112, OASIS CIQ, SANS 1883-1, UPU S42), *Geographic Mark-up Language, GML,* (INSPIRE Address) and the *Extensible Mark-up Language*, *XML,* (AS 4590, OASIS CIQ, US FGDC Address) are used to describe the relationships between concepts. The diagrams and descriptions of the conceptual models of the reviewed address standards are included in clause A.3 of Annex A .

While two standards define an addressable object in itself (BS 7666 and INSPIRE Address), in the other standards the addressable object is implied in the address definition as being the following:

- location (AFNOR XP Z10-011)
- address site (AS/NZS 4819)

  NOTE: AS/NZS 4819:2003 is meant to allocate addresses to all kinds of geographic objects, including power sub-stations, toilets, utilities, etc.
- location (identifiable geographic place) (ISO 19112)
- organization or person (ISO/TS 15000-5)
- addressee (OASIS CIQ)
- party (OASIS CIQ)
- physical location or mail delivery point (OASIS CIQ)
- point of service delivery (SANS 1883-1)
- actual or potential delivery point (UPU S42)
- addressee and/or mailee (UPU S42)
- location or point of postal delivery (US FGDC Address)

The subsequent two clauses give an overview of components and classifications (address types) of addresses. Refer to A.3 for the complete conceptual models of the reviewed address standards.

4.4.1 Address components

All reviewed address standards describe addresses as a combination of components or elements, often comprising a hierarchy. In the reviewed address standards, the components that make up an address generally fall into one of the eight categories listed below. A summary of the categorization is presented in the subsequent tables by showing for each category some sample addresses, in which the relevant address component is underlined. Clause A.4 of Annex A has a complete categorization of address components from the reviewed address standards.

Table 3. Address components that identify the addressable object or delivery point

Sample address	Standard	Component name
Mr Girard, Flat B, Le Barcoleau, 1 allée LIMOUSINE 91940, LES ULIS	AFNOR XP Z10-011	house
PO Box 312, Paramatta, BC NSW 2150	AS 4590	postal delivery number
389 Chiswick High, Road London	BS 7666	addressable object name
305-0821 茨城県つくば市北郷 1 番 English translation: 305-0821 Ibaraki Ken, Tsukuba Shi, Kitasato, 1 Ban	Japan	*chiban* (parcelnumber)
Carretera Nacional III Madrid-Valencia, Punto kilométrico 9, 28031 Madrid, Spain	INSPIRE Address	locator

Table 4. Address components that reference a real world object

Sample address	Standard	Component name
Ms C Fitzgerald, 51 Jacobson Street, Brisbane, QLD 4000	AS 4590	road name
389 Chiswick High Road, London	BS 7666	street
Carretera Nacional III Madrid-Valencia, Punto kilométrico 9,28031 Madrid, Spain	INSPIRE Address	thoroughfare
100-8918 東京都千代田区霞が関二丁目 1 番 3 号 English translation: 100-8918 Tōkyo To, Chiyoda Ku, Kasumigaseki 2-Chōme, 1 Ban, 3 Gō	Japan	*gaiku fugo* (block code)
Statue of Liberty, Liberty Island, New York, NY	US FGDC Address	Landmark
부산시 부산진구 부산대로 **지하 77** English translation: Jiha 77, Busan- daero, Busanjin-gu, Busan city.	Korean address	Basement

Table 5. Address components that reference a geographical area

Sample address	Standard	Component name
Ms C Fitzgerald 51 Jacobson Street Brisbane QLD 4000	AS 4590	state
389 Chiswick High Road London	BS 7666	locality
305-0821 茨城県つくば市北郷 1 番 English translation:305-0821 Ibaraki Ken, Tsukuba Shi, Kitasato, 1	Japan	*machi-or-aza* (district)
477 Chopin Street, Constantia Park, 0010	SANS 1883-1	place
012151 Ngxingxolo Mooiplaas 5228	SANS 1883-1	village

Table 6. Address components that reference a delivery area

Sample address	Standard	Component name
PO Box 312 Paramatta BC NSW 2150	AS 4590	postcode
PO Box 6943 Birmingham, AL 35305	US FGDC Address	ZIP code
305-0821 茨城県つくば市北郷 1 番 English translation: 305-0821 Ibaraki Ken, Tsukuba Shi, Kitasato, 1	Japan	*yubin bango* (postal code)

Table 7. Address components that specify a kind of mail delivery service

Sample address	Standard	Component name
BP 90432 MONTFERRIER SUR LEZ,34092 MONTPELLIER CEDEX 5	AFNOR XP Z10-011	service for organizations, companies and public services receiving large amounts of mail
PO Box 312 Paramatta BC NSW 2150	AS 4590	postal delivery type code
Maplethorp Farm, 287 Guy Road, RD 2, KAIAPOI 7692	AS 4590	postal delivery type code
11307 TOWER RD NW LVR TELUS, Edmonton, AB, T5G0Y7	Canada	LVR = Large Volume Receiver in Canada
GD STN Main Alliston, ON, L9R1T8	Canada	general delivery in Canada
462 Cedar St, RR 1, Millarville AB T0L1K0	Canada	rural route in Canada
Postnet Suite 87 Private Bag X10 Menlo Park 0102	SANS 1883-1	mail delivery agent
103-8660 郵便事業株式会社 日本橋支店私書箱 30 号 English translation: 103-8660 Japan Post Service Company Nihonbashi Branch PO Box 30	Japan	postal delivery type code

Table 8. Address components that specify a distribution office

Sample address	Standard	Component name
Egevej 14B, Chodov, 149 00 Praha 41	UPU S42	delivery service qualifier
477 Chopin Street, Glenstantia, 0010	SANS 1883-1	post office
012151 Ngxingxolo Mooiplaas 5228	SANS 1883-1	post office

Table 9. Address components that describe proximity

Sample address	Standard	Component name
On the NW corner of Main and Cross Streets, Southampton	INSPIRE Address	descriptive locator
Maropeng, R400 just off the R563 Hekpoort road, Mogale City	SANS 1883-1	informal reference
604-8571 京都市中京区寺町通御池上る上本能寺前町 488 番地 English translation: 604-8571 Kyoto Shi, Nakagyo Ku, Teramachi Dori Oike Agaru Kamihon'nojimaemachi 488	Japan	*tori mei* (traditional street name)

Table 10. Address components for the person or organization at the address

Sample address	Standard	Component name
Ms C Fitzgerald 51 Jacobson Street Brisbane QLD 4000	AS 4590	name
John Jones, Future Marketing, 10Main St, Montreal QC H3Z 2Y7	OASIS	organization name
John Smith, Pitcairn Island, South Pacific (via New Zealand)	UPU S42	given name, surname
305-0044 茨城県つくば市北郷 1 番地 国土地理院 地理 太郎 English translation: 305-0044 Ibaraki Ken, Tsukuba Shi, Kitasato, 1 Geospatial Information Authority of Japan, Chiri Taro	Japan	organization name
305-0044 茨城県つくば市北郷 1 番地 国土地理院 地理 太郎 English translation: 305-0044 Ibaraki Ken, Tsukuba Shi, Kitasato, 1 Geospatial Information Authority of Japan, Chiri Taro	Japan	surname, given name

4.4.2 Classifications of addresses (address types)

Address classification is a common theme in the reviewed address standards. The following different methods of classification were found:

1. Addresses that are classified according to their *content (scheme)*, i.e. the components that make up the address. Examples are rural and urban addresses in AS/NZS 4819, the address types in SANS 1883-1, the address classes in US FGDC Address and the address profiles defined in the registry maintained according to ISO/TS 15000-5. The purpose of the address typically determines its content.

2. Addresses that are classified according to the *addressable object*, i.e. whatever they are associated with. Examples are found in AS 4590 (residential, business, delivery address, etc.), BS 7666 (residential, commercial, agricultural, etc.), OASIS CIQ (Airport, Business, CaravanPark, etc.).

These two methods of classification are not mutually exclusive, e.g. in SANS 1883-1 the content of a street address type and a SA Post Office street address type is different, but the purpose is also different: an address of the street address type is for the purposes of finding the address (when navigating or driving), while an address of the SA Post Office street address type is used for postal mail delivery only.

In some of the reviewed standards address classification is not within the scope, e.g. AFNOR XP Z10-011, INSPIRE Address, UPU S42 and UPU S53. Clause A.5 of Annex A shows details about classification in the reviewed address standards.

4.5 Metadata

Addresses come in many forms. Multiple addresses can describe the same addressable object, and each of those addresses can have a different intended use. A postal address can be different from a location address, and the distinction between them can mean life or death if you use the wrong version when emergency response vehicles must get to an address quickly. Without metadata to understand the address, determining suitability for use can be difficult at best.

Existing national and international standards and guidelines regarding metadata are mentioned in the reviewed standards, including ISO 19115:2003, *Geographic information - Metadata*, ISO 19139:2007, *Geographic information – Metadata – XML schema implementation*, the INSPIRE Metadata Implementing Rules, Regulation 1205/2008/EC, and the Federal Content Standard for Digital Geospatial Metadata (USA). Where not specifically mentioned, the metadata are accounted for through code lists/enumerations, dictionary elements, attributes, and registries of information. Not all mentions of metadata are with regards to addresses specifically, but also include geospatial data in general such as positional accuracy of the location address, temporal information, modification, and exchange information for the dataset, including copyright information, data lineage, use restrictions, contact information and a description of the geographic area that the data represents. Refer to clause A.6 of Annex A for details about metadata in the reviewed address standards.

Addresses can have numerous incarnations and metadata must be included to determine proper use. Vintage, accuracy, use constraints, and coverage also are important elements in address list use. Metadata components from ISO 19115 and ISO 19139 should be incorporated in at least the dataset level, but additional metadata should be defined at the individual address and addressable object level for guidance. Whilst many of the standards examined had some form of metadata, there is no real measure of consistency across them that would make defining a minimum set of metadata elements necessarily acceptable for an international standard. National bodies maintaining address data could conceivably comply with a metadata standard for data exchange, which is very different from collecting and maintaining it at the individual address level internally.

4.6 Encoding

The transfer and exchange of address data takes place through an ecoding of the conceptual model.

Most exchange standards use XML or GML as encoding.

Some standards (INSPIRE Address and US), in addition to specifying encoding and data content, also provide a specification of processes or services that are needed to enable actual exchange. Refer to clause A.7 of Annex A for information about encoding in the reviewed address standards.

Three international exchange standards (by OASIS, UPU and INSPIRE) exist and their scopes may overlap. The exchange requirement is well covered by these

existing international standards and it is not recommended to propose a new one. Instead, it is recommended that guidelines be developed on how users of existing international standards can exchange their data, e.g. to provide interoperability among the UPU, OASIS and INSPIRE standards.

4.7 Address data maintenance

Few of the reviewed standards delve into processes and procedures for address data maintenance; however, the standards that do include this information could provide optional guidance. The information available is comprehensive and likely would be helpful.

If this project recommends the development of a conceptual model, processes and procedures for maintenance should be included because address data are difficult to update and maintain. Any guidance that can be provided by experts would prove helpful but enforcing compliance to address data maintenance is impossible.

4.7.1 Quality management

All address standards support quality of addresses, for example, by ensuring the existence and accuracy of the components of an address. In this review summary quality management refers to the procedures and measures for the development, maintenance and communication of the quality of an address.

Quality management is included in some of the standards, although not all have a specific section labelling it as such. Core elements addressing data quality that can be seen in multiple standards include attribute accuracy, logical consistency, completeness, positional accuracy, and temporal accuracy. One, some, or all appeared in multiple standards. Clause A.8 of Annex A shows the quality management aspects that are included in the reviewed standards.

Addresses are difficult to manage, and where a conceptual model can provide guidance for at least basic quality management, it should be included.

4.7.2 Life cycle

The address life cycle tracks the temporal phases, status and versions of an address. It does not appear in all standards, but there is consistency amongst those standards in which it does appear. All standards that cover the life cycle of an address name some form of potential, proposed, active, and retired elements for documentation (refer to clause A.9 of Annex A). It is universally agreed that temporal tracking of addresses and addressable objects is a critical element in address development and maintenance. Each change to an address or its components must be documented so that one can understand that different versions of some or all elements relate to the same addressable object. The changes do not necessarily have to be physical changes, although they also require tracking.

Following are examples of common changes in an address that can cause confusion without life-cycle documentation:

- A developer designs a subdivision and the address appears on the plans. The date the plans are filed with the county planning board is assigned as the ‘proposed’ date for each address that appears on the plans. The address receives an ‘active’ date when physical construction commences, or an occupancy permit is approved. Thirty years later, the houses are taken by

eminent domain to widen the road. The addresses are given an ‘endLife’ or ‘retired’ address date.

- The property owner of a single house along a street subdivides his property. Multiple houses are built along the street on either side of the original house. The municipality assigns sequential address numbers to all houses along the street, changing the address number of the original property.
- The street type for an address is erroneously recorded as ‘Canterbury Court’ instead of ‘Canterbury Boulevard’. The street type is corrected.
- The postal service changes the postal code to reflect new delivery patterns.

When a unique identifier is associated with each address, and changes are versioned and dated, and the status is documented, one can track different iterations of an address and be confident that each relates to the same addressable object.

4.7.3 Address aliases

Addresses and address components exist in multiple forms. Address data sets must store these alternatives together with their attributes and keep appropriate relationships between them. This calls for the standardization of data structures, terminology and classification for managing multiple addresses of the same addressable object or aliases of the same address component. There are various kinds of aliases, resulting from the diversity of languages, writing systems, urbanization progress, changes to address assignment schemes and specific service requirements, etc.

The reviewed standards support address aliases by (refer to clause A.10 of Annex A):

- the specification of one address form as principal and other as secondary (SANS 1883-3, US FGDC Address);
- the specification of structures for storing addresses in multiple languages (SANS 1883-1);
- the specification of structures for storing addresses in multiple scripts (INSPIRE Address);
- the specification of structures for storing historical and prospective addresses as well as address changes; and
- the provision of dictionaries of valid abbreviations (AFNOR XP Z10-011).

Sometimes multiple address forms are treated as equivalent, for example, in the case of multilingual areas in Belgium and Switzerland. Alternatively, one form of the address is considered as being principal or recommended. Moreover, some existing address reference data sets (e.g. US Zip+4, Royal Mail Alias Product, New Zealand PAF) provide aliases for specific address components that are valid only within the area defined by the postcode. For example, the Royal Mail Alias Product provides names of traditional, administrative and postal counties that have overlapping territories, and relationships between names are set via postcodes.

Managing address aliases is a daily task of people working with address data. Many standards support aliases although it seems that they do not necessarily provide data structures for representing all relationships between various address forms used in various use cases. It seems that various use cases require various structures and if

they are specified in a single standard, care should be taken that the result is not an overly complex data model.

4.7.4 Definitive address datasets (reference dataset)

Definitive address datasets were not applicable in a number of the standards reviewed (refer to clause A.11 of Annex A). Custodians may or may not be identified, or addressing may be decentralised within a country.

There is not enough of a body of known definitive address datasets for inclusion in this review.

4.8 Address rendering (print/write/display)

This requirement calls for the description of rules for the formatting or rendering of addresses on mail items and maps. Rendering rules specify the order and placement of the components of an address on a label. For some address types there can be more than one appropriate rendition, depending on such parameters as language, user preference etc. These include the position of the Arabic numeric characters and Roman alphabetic characters in East-Asian addresses.

Firstly, address rendering standards are important for mailers and mail carriers to streamline mail production and processing. For example, even if the delivery address on a mail item contains all the pieces of information that are required to identify a delivery point, the mail carrier can still regard it as invalid if the arrangement of the components is inappropriate. The correct order of elements for a French address will not necessarily be correct for a US address, and vice versa. Moreover, many Asian address systems use the opposite order of address elements than European ones, placing the root element of the address hierarchy first. Incorrectly addressed mail may not be delivered and increases the costs of delivery. Therefore, mail carriers provide guidelines (‘standards’) on how an address shall be formatted on mail items that are submitted for delivery. By adhering to these rules, mailers increase the success rate of deliveries and reduce the cost of mail processing.

An important application of rendered addresses is the use of automated reading systems for sorting. One well-known aspect of this is optical character recognition; other aspects include algorithms for joined-script analysis and word recognition that are necessary before methods for address decomposition, parsing and address component recognition can be applied, which in turn are required for sorting. The algorithms require specifically defined address structures, which need to remain as consistent as possible in order to achieve the highest possible read rates. Automated mail processing is mostly applicable to a country’s domestic mail, therefore automatic reading systems can usually be adjusted to cater for a specific country.

International mailers have to cope with a variety of address formatting rules coming from various countries, cultures and languages. Their work is much easier when information about various address formats is expressed in a unified and, possibly, computer readable way. This leads to standardized language(s) for the encoding of address formatting information that is readable for computers and humans.

Secondly, there is a requirement for rendering rules that can be applied to addresses that are displayed on maps. The increase in the use of addresses on handheld devices, such as GPS units and mobile maps, has raised the importance of this requirement. Most of the handheld devices on which the addresses are displayed are

sold and used in multiple countries, therefore it is important to be able to specify rendering rules for addresses of more than one country.

In the reviewed standards (refer to clause A.12 of Annex A) rendering rules are typically formulated on the basis of defined elements, classification of address types and classification of address lines. National rendition standards sometimes provide dictionaries (look-up tables) of valid abbreviations that are needed to limit the length of address lines so that they can fit into the address window or meet limitations imposed by a standard (e.g. French 38 characters per line).

The reviewed standards that contain rendering rules are defined by postal operators on a national level. UPU S42 provides a means to keep and exchange national rendering information in a uniform encoding.

While none of the reviewed standards has rendering rules for non-postal processing purposes, vendors of handheld devices seem to have a requirement for these rules. Research is still required to understand how best to formulate these rendering rules for mapping purposes.

4.9 Conclusions

4.9.1 Address assignment scheme

There is not a single best address assignment scheme that is suitable for all countries.

Therefore it would be better to provide guidelines of good practices for address assignment schemes.

4.9.2 Terminology

Terminology is important for communication about and understanding of addressing.

All reviewed address standards include terminology.

Terminology is a minimum requirement in an international address standard.

4.9.3 Conceptual model

The conceptual model describes addressing concepts and relationships between them.

All reviewed address standards include a conceptual model and describe addresses as a combination of components or elements, often comprising a hierarchy. Address classification, either by content (scheme) or by addressable object is a common theme in the reviewed address standards.

A conceptual model should be included in an international address standard. Following terminology, this is the second most important requirement to be included.

4.9.4 Metadata

Metadata is important for the understanding and exchange of address data.

Many of the reviewed address standards define metadata, but it was not possible to identify a minimum set of metadata elements from these.

An international address data standard should make use of existing metadata standards where possible, such as, ISO 19115 *Geographic information – Metadata* or ISO/IEC 11179 (all parts) *Information technology – Metadata registries (MDR)*. If required, address-specific metadata can also be defined.

4.9.5 Encoding

Encoding specifications for the conceptual model and metadata are required to exchange one or more address data records as data files or electronic messages.

Most of the reviewed address standards include an encoding of the conceptual model.

An international address standard should not specify a new encoding but should facilitate interoperability between existing encodings.

4.9.6 Address data maintenance

Address data maintenance is only relevant when an address dataset is maintained.

Few of the reviewed address standards include specifications for the maintenance of address data.

These specifications cannot be enforced by an international address standard, but can provide guidance to countries or regions that want to implement processes and procedures for address data maintenance.

Quality management refers to the procedures and measures for the development, maintenance and communication of the quality of an address.

Some of the reviewed address standards include quality management, such as, attribute accuracy, logical consistency, completeness, positional accuracy and temporal accuracy.

An international address standard should make use of existing quality standards, such as, ISO 19157 *Geographic information – Data quality* and ISO 19158, *Geographic information – Quality assurance of data supply*. If required, address-specific quality management can be defined.

Life cycle tracks the temporal phases, status, and versions of an address.

In the reviewed address standards there is consistency in the requirement to track the life cycle of an address record in the database and, more importantly, of the address in the physical world.

Life cycle elements and a life cycle schema should be included in an international address standard.

Address aliases, such as multilingual addresses, abbreviations in the address or alternative addresses for the same addressable object, are used on a daily basis all over the world.

Many of the reviewed address standards support address aliases.

An international address standard should include support for address aliases in the conceptual model.

A **definitive address dataset** is one of the ultimate goals of an address standard.

However, definitive address datasets were not applicable in most of the address standards reviewed, possibly because custodians were not identified or addressing is decentralised within a country.

There is not enough of a body of known definitive address datasets for inclusion in an international address standard.

4.9.7 Address rendering

Standardizing address rendering streamlines mail production and processing, but there are also benefits for the use and display of addresses on maps, handheld devices, etc.

Some of the reviewed postal address standards include rendering rules. None of the reviewed non-postal standards include address rendering rules for maps and handheld devices, constituting a potential gap.

An international address standard should include specifications for address rendering.

4.9.8 Standardization guidance for national address infrastructures

From the review of the address standards, one can conclude that the following standards are important for a national address infrastructure:

1. A standard for each *address assignment scheme* in use in the country, including the components and how values are assigned to them. This does not imply that there is a single address assignment scheme in use, but rather that the schemes and their areas of jurisdiction are described in a standard. Refer to AS/NZS 4819 and SANS 1883 as an example.
2. A standard for *address data* that can be used by producers and custodians to aggregate and maintain address data. Such a standard should include metadata, quality management, life cycle and address aliases. Refer to US FGDC as an example.
3. A standard for the *transfer and exchange of address data* in electronic form. This exchange could happen between users and producers of address data, or between different users of address data. The electronic form or encoding of address data should be compliant with the standardized address assignment schemes. Refer to the XML schema in US FGDC and AS 4590.
4. A standard by the postal operator with specifications for *the rendering of address labels on mail items*. The components used in the address rendering should be compliant with the standardized address assignment schemes (refer to 1. above), but might have to be extended with components for postal purposes, such as a postcode or postal delivery service. Refer to AFNOR XP Z10-11 as an example and the standard by New Zealand Post (2006).

5 Recommendations

5.1 Introduction

There is a wide range of standards in use around the world, reflected in the address standards reviewed in this stage zero project. Given that these are well integrated into various operational processes and in some cases legally enforced, it is not likely

that they will be changed to comply with a new international standard in the foreseeable future. However, addresses are increasingly used to describe new geographic objects, while they are also increasingly used in new technology such as in-vehicle navigation. At the same time, some countries are trying to rationalise their addressing systems or create a new one. Therefore the goal of these recommendations is to create a suite of international address standards that will facilitate interoperability between existing and future address standards.

The recommendations in the subsequent sub-clauses follow from the conclusion of the review of address standards. Refer to Figure 3. Various potential routes for proceeding with an international address standard were identified in the initiative that led to this project (ISO/TC 211 WG 7 2008). Although this stage zero project has brought together all the relevant stakeholders and has established the necessary credentials for further work to proceed in ISO/TC 211, some recommendations are not within the scope of work of this committee. However, it is recommended that the standards are developed as a suite (different parts of a standard with the same number). Therefore, it is recommended that the projects be developed in ISO/TC 211 or other ISO technical committees, where applicable and desirable as joint projects with other standards organizations and/or ISO technical committees.

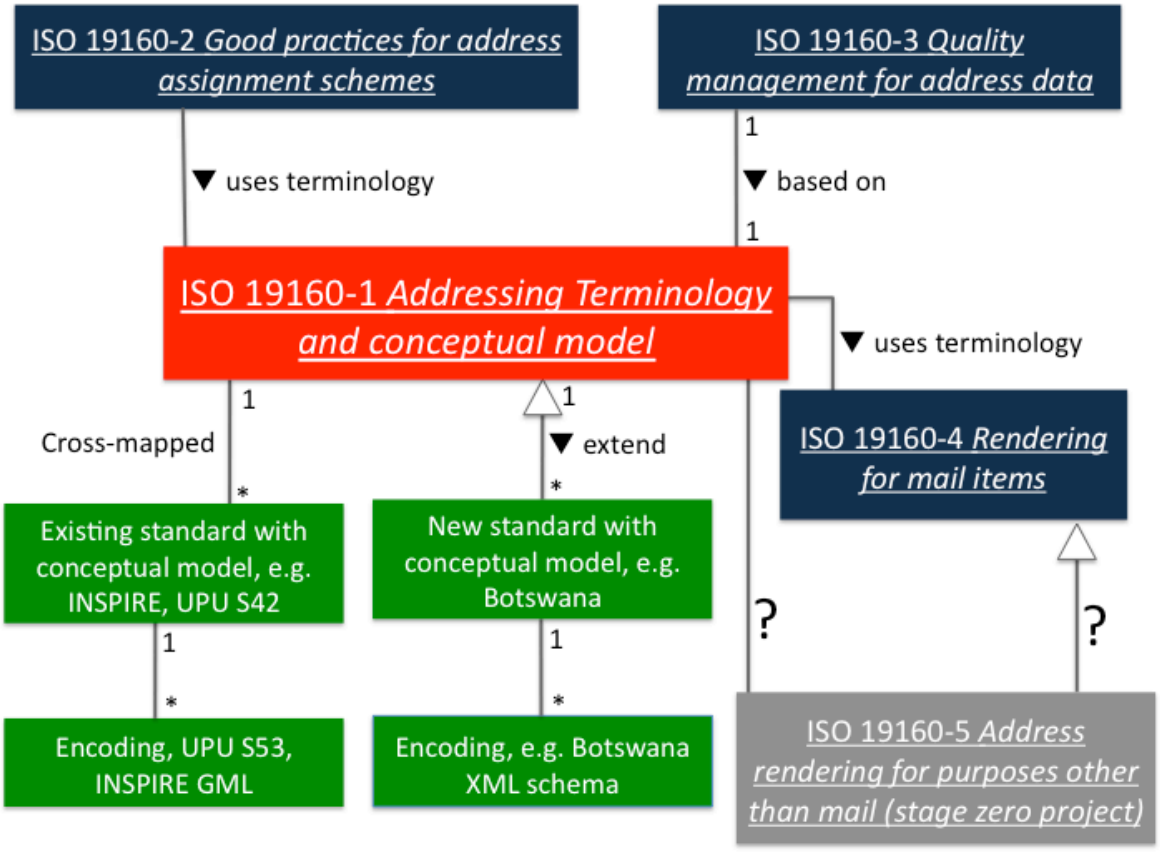


Figure 3. An overview of the recommendations and their relationship to existing standards

NOTE Figure 3 is a UML-like diagram, but does not conform to UML.

5.2 Recommendation 1: ISO 19160-1, Addressing terminology and conceptual model

Recommendation:

First, it is recommended that a conceptual model for addressing be developed together with the terms and definitions that describe the concepts in that model.

The model should not seek to replace conceptual models proposed in other addressing standards. Rather it should endeavour to cross-map between those models. Refer to Figure 4. It will also endeavour to incorporate the components of address assignment schemes for which no formal standard is currently available. Life cycle, metadata and address aliases should be included as identified in this review.

The model shall be usable as a guideline to develop a data product specification.

The model shall be extendable for specific requirements of individual countries or communities.

An implementation of the conceptual model may include:

- an application schema for addresses;
- an address data specification; and
- procedures and measures for creating and maintaining an address dataset.

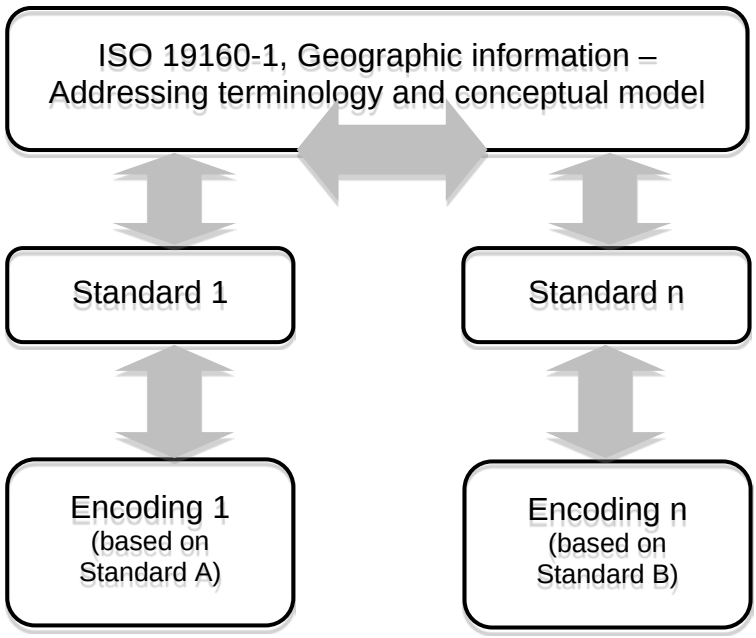


Figure 4. Transforming one encoding to another by cross-mapping through the conceptual model

Proposed plan:

It is further recommended that the proposed conceptual model and terminology be documented in an ISO International Standard to be developed in ISO/TC 211, *Geographic information/Geomatics*, possibly as a joint project together with the Universal Postal Union (UPU), ISO/TC 154, *Processes, data elements and documents in commerce, industry and administration* and other standards organizations.

Potential benefits:

The 19160-1 conceptual model facilitates interoperability between different addressing conceptual models and their encodings. The standard provides guidance for developers of software and information systems in support of such addressing systems.

5.3 Recommendation 2: ISO 19160-2, Good practices for address assignment schemes

Recommendation:

The second recommendation is to develop a good practice document for address assignment schemes. This includes general principles for the maintenance of address data sets.

Proposed plan:

It is recommended an ISO Technical Report be developed in ISO/TC 211, *Geographic information/Geomatics*, possibly as a joint project together with the Universal Postal Union (UPU), the World Bank and other standards organizations. Work on the report could start in parallel with the conceptual model and terminology (first recommendation) or soon thereafter.

Potential benefits:

This report could be used as guidance for countries that want to develop a new addressing system, or want to evaluate or improve an existing addressing system. In addition, the report will provide guidance for developers of software and information systems in support of such addressing systems.

5.4 Recommendation 3: ISO 19160-3, Quality management for address data

Recommendation:

The third recommendation is to develop standards for address management that ensure address data quality. This should include measures to assess and communicate the quality of the address data, such as attribute (thematic) accuracy, logical consistency, completeness, positional accuracy and temporal accuracy. Existing standards on quality management in general should be taken into consideration.

Proposed plan:

It is recommended an ISO International Standard be developed in ISO/TC 211, *Geographic information/Geomatics*, possibly as a joint project together with the Universal Postal Union (UPU) and other standards organizations. Work on the standard could start after the conceptual model and terminology (first recommendation) are well defined and accepted by the committee.

Potential benefits:

Quality standards for addresses will ensure that countries developing or maintaining address data have consistent guidelines to measure and report on the quality and integrity of the data.

5.5 Recommendation 4: ISO 19160-4, International postal address components and templates

Recommendation:

The fourth recommendation is that UPU S42 be adopted as part of this suite of international addressing standards to support interoperability of address rendering rules.

Proposed plan:

It is recommended that UPU S42 be adopted with modifications as an ISO International Standard. The modifications should be aligned with the terminology and conceptual model in ISO 19160-1 and support additional requirements, such as vertical writing. The standard should be adopted after the conceptual model and terminology (first recommendation) are well defined and accepted by the committee, at which time the UPU S42 concepts should be fully integrated in the conceptual model.

Potential benefits:

UPU S42 already covers the important requirement of providing interoperability for information about postal rendering rules clearly and in detail, and is useful for streamlining of global postal services. In addition, with the adoption of the UPU S42 standard, the ISO 19160 suite of address standards will cover all of the important requirements regarding international address standardization

5.6 Recommendation 5: ISO 19160-5, Address rendering for purposes other than mail

Recommendation:

The fifth recommendation is to investigate how addresses are rendered for purposes other than mail, such as in maps (cartographic portrayal) on the Web and on graphic displays of handheld devices and mobile phones. For example, this could be a conceptual model or specification for the rendering of addresses.

Proposed plan:

It is recommended that a stage zero project reviews this issue in ISO/TC 211, *Geographic information/Geomatics*, possibly as a joint project together with ISO/TC 204, *Intelligent transport systems*, and ISO/IEC JTC 1/SC 35, *User interfaces*. Consider including the UPU S42 Postal Address Template Definition Language (PATDL) in the investigation as a basis for address rendering on maps. This recommendation might lead to an ISO Technical Specification or an ISO International Standard.

Potential benefits:

The standard will provide assistance to developers of software for the display of addresses on digital output and in user interfaces.

Annex A Input to the review of address standards

A.1 Scope of the reviewed address standards

The scope statements of the standards that were reviewed are copied into the sub-clauses of this clause. The parts of the scope statements that are important for the review are underlined. As a short overview, Table A.1 shows certain words that are mentioned in the various scope statements. However, this should not be seen as a comparison of the standards as such, since for example, postal or mail items are not mentioned in the scope statement of SANS 1883-1:2009, but the standard does specify five postal address types that are in use by the South African Post Office. As another example, 'exchange' is part of the title of UPU S53:2009, but not mentioned in the scope statement of the current draft version that was reviewed (it will be included in the next version though). Some detailed remarks about the review of the scope statements of the standards are provided further below.

Table A.1 Words that appear in the scope statements

	AFNOR XP Z10-011	AS/NZ 4819	AS 4590	BS 7666	INSPIRE Address	ISO 19112	ISO/TS 15000-5	OASIS	SANS 1883-1	SANS 1883-3	UPU S42	UPU S53	US FGDC Address
Address	Y	Y	Y	Y	Y			Y	Y	Y	Y		Y
Postal/mail items/delivery	Y										Y		Y
Model/schema, components/ elements	Y	Y	Y	Y	Y	Y		Y	Y		Y	Y	Y
Exchange/transfer/interoperability/ harmonization	Y		Y	Y	Y		Y	Y		Y			Y
Address files and databases, address data management	Y		Y		Y	Y □							Y
Address data quality					Y								Y
Address allocation		Y		Y						Y			

* A gazetteer can be considered to be a database

NOTE No formal Japanese addressing standard exists, therefore it is excluded from the review of scope statements.

All standards mention addresses in their scope statement, except for the two standards that are not addressing standards but are related to addressing and were therefore included in the review: ISO 19112:2003 and ISO/TS 15000-5:2005. Refer to Table 1 for a justification for their inclusion in the review. While only a few standards refer to postal or mail items and delivery in their scope statements (AFNOR XP Z10-011, UPU S42, Draft US FGDC Address), most of them include some aspect of addresses for postal delivery in some way or other in the standard.

A common theme in the scope statements is the definition of address elements and components, along with how these should be combined to form addresses. Both UML (BS 7666, INSPIRE Address, ISO 19112, SANS 1883-3) and XML (OASIS CIQ, US FGDC Address) are used to describe relationships between components.

While exchange, transfer, interoperability and harmonization are not mentioned specifically in all scope statements, it can be assumed that standards in general support interoperability and that interoperability is a goal of all the reviewed standards. Interoperability can be facilitated at an abstract level (INSPIRE Address, ISO 19112), or more specifically at an implementation level (XML in OASIS CIQ and GML in INSPIRE Address). A few of the reviewed standards refer to the management of address data in files and address databases (AFNOR XP Z10-011, ISO 19112, INSPIRE Address, US FGDC Address). Two standards mention address data quality in their scope statements (INSPIRE Address and US FGDC Address); three standards refer to address allocation (AS/NZS 4819, BS 7666 and SANS 1883-3).

Aspects of address standardization are sometimes structured into different publications, in different standards or in more than one part of a standard, for example, UPU S42 and UPU S53, AS/NZS 4819 and AS 4590, and SANS 1883-1 and SANS 1883-3.

A.1.1 *AFNOR XP Z10-011, Specification postales – Addresse postale (France)*

This document aims to define an address, address content and formatting rules. It describes and specifies the *various components likely to feature in an address*. It formalises address transcription rules for mail items:

- Definition of the structure of the address (number of lines, number of characters per line);
- Breakdown and sequence of the components on the various lines of the address;
- Abbreviation of certain components where the names exceed the maximum number of characters per line;
- Rules of form.

This document does not discuss the aspects relating to printing of the address on media (font etc.) or the physical and mechanical properties of the media (position of the address on the envelope, envelope format etc.).

In the same way, the following are not part of an address:

- Coded building access information (PIN numbers etc.);
- Geographical information: localisation and road-based headings etc. (examples: motorway A4exit CHAMPS, RN 20 to MONTROUGE etc.), coordinates;
- Marketing information: behavioural qualification of companies or private individuals (lifestyle, type of housing, turnover etc.);
- Authentication data (issuing code) and electronic addressing components (telephone number or computer line etc.)

This document applies to computer file *exchange and transcription of an address onto paper for sending mail items*. The latter are given *as recommendations for the*

establishment and internal management of address files and databases. This document only applies to *French addresses*. Reference should be made to the standards or practices in effect in foreign countries for handling inward mail.

A.1.2 *Australia and New Zealand*

A.1.2.1 AS/NZS 4819:2003, *Geographic information – Rural and urban addressing* (Australa and New Zealand)

This standard establishes *requirements and guidelines for a comprehensive rural and urban addressing system*. It outlines the various *elements of the system* and provides guidelines for the *application of those elements to a range of address site types in both urban and rural areas*. The elements found in this standard are applicable, where appropriate, to all address sites laying within the limits of either the urban or rural addressing system. These elements can be *used to allocate addresses*.

NOTE At the time of writing, AS/NZS 4819:2003 was undergoing a major revision.

A.1.2.2 AS 4590:2006, Interchange of client information (Australia)

This Standard sets out requirements for data elements for the *interchange* of client information. The *data elements* covered comprise *party identification, person details, organization details, addressing, and electronic contact details*.

This Standard focuses only on the interchange of Australian client information and any international client information is beyond the scope of this Standard.

This Standard does not address data interchange syntax.

This Standard applies to *databases* that require a standard definition of the format for datasets relating to the client information. Items such as person/organization details, addressing and contact details are given a data standard that can be utilized by databases.

This Standard does not provide guidance on the principles for interchange message design and how the different parts of the Standard may be assembled into an interchange format. The Standard does not focus on the design of how the data is structured together, or any other data modelling standards. It is focussed primarily on how individual data elements are presented in a common format for interchange of that data.

A.1.3 *BS 7666-0:2006,* Spatial datasets for geographic referencing – Part 0: general model for gazetteers and spatial referencing

BS 7666-0:2006 *Spatial datasets for geographical referencing* is in four parts:

- Part 0: *General model for gazetteers and spatial referencing*;
- Part 1: *Specification for a street gazetteer*;
- Part 2: *Specification for a land and property gazetteer*;
- Part 5: *Specification for a delivery point gazetteer*.

Part 0 defines the *essential components of a gazetteer of geographic locations* and provides a general model of spatial references based upon named spatial units in the

United Kingdom. It defines the attributes of each geographic location to be recorded in a gazetteer, and the metadata associated with the gazetteer.

Part 1 specifies the *logical data structure for a gazetteer of streets*, consistent with Part 0 of this standard, and specifies the data to be recorded and maintained in a gazetteer. It enables *different users of street information to use the same data with consistency of content, accuracy, currency and format*. Different ways of referencing a street are defined so that data can be accessed by street name, description, route number, unique reference number or external cross-reference. It also specifies the means of representing the geometry of the street in terms of coordinates. Three ways are allowed for this with successive levels of detail:

a) by identifying the end points of a street, and representing the street as a single line segment;

b) by breaking the street at its intermediate junctions to create a set of constituent line segments, termed elementary street units;

c) by describing the course of each elementary street unit.

Each of these options is defined by a level of conformance to the standard.

Part 2 specifies *the logical data structure for a gazetteer of land and property*, consistent with Part 0 of this standard. It is based upon the concept of a basic land and property unit (BLPU), and specifies the data to be recorded and maintained in a gazetteer. It also specifies the way in which the boundary of a BLPU may be represented and linked to the gazetteer. *It does not provide a database design or a transfer format.*

Part 5 specifies the *logical data structure and data content for a gazetteer of delivery points*, consistent with Part 0 of this standard. It is intended for purposes of identification, access and validation of service requests. *It does not provide a database design or a transfer format*. It provides a *method of referencing delivery points by means of unique references and descriptive delivery addresses*.

Part 3 Specification for addresses and Part 4 Specification for recording public rights of way of the 2002 edition have been withdrawn, their content having been subsumed in the other parts.

A.1.4 *INSPIRE D2.8.I.5 Data Specification on Addresses –Guidelines*

This document specifies a *harmonised data specification for the spatial data theme Addresses*. It provides the basis for the drafting of Implementing Rules according to Article 7(1) of the INSPIRE Directive (Directive 2007/2/EC). The entire data specification was published as implementation guidelines accompanying these Implementing Rules.

The remainder of the document is structured to provide an overview, information on specification, scope and data product identification in sections 2-4 before presentation of the *application schema* itself and associated narrative in section 5. Sections 6-7 provide information concerning *reference systems, data quality, metadata, delivery and portrayal*. The appendices provide a bibliography, abstract test suite, discussion of address component life cycles, and provide *guidance for member states on how to assign components of the address to classes in the schema*.

The primary audience for this document is technical staff who will be responsible for implementation of the delivery application that will be used to provide data to the specification. The executive summary provides an introduction for managers responsible for the delivery process.

A.1.5 *ISO 19112:2003, Geographic information – Spatial referencing by geographic identifiers*

This standard defines the *conceptual schema for spatial references based on geographic identifiers*. It establishes *a general model for spatial referencing using geographic identifiers, defines the components of a spatial reference system and defines the essential components of a gazetteer*. Spatial referencing by coordinates is addressed in ISO 19111. However, a mechanism for recording complementary coordinate references is included.

This standard enables producers of data to define spatial reference systems using geographic identifiers and assists users to understand the spatial references used in datasets. It *enables gazetteers to be constructed in a consistent manner* and supports the development of other standards in the field of geographic information. It is applicable to digital geographic data, and its principles may be extended to other forms of geographic data such as maps, charts and textual documents.

A.1.6 *ISO/TS 15000-5:2005, Electronic Business Extensible Markup Language (ebXML) - Part 5: ebXML Core Components Technical Specification, Version 2.01 (ebCCTS)*

This Core Components Technical Specification can be employed wherever *business information is being shared or exchanged amongst and between enterprises, governmental agencies, and/or other organisations in an open and worldwide environment*. The Core Components User Community consists of business people, business document modelers and business data modelers, Business Process modelers, and application developers of different organisations that require interoperability of business information. This interoperability covers both interactive and batch exchanges of business data between applications through the use of Internet and Web based information exchanges as well as traditional Electronic Data Interchange (EDI) systems.

This specification will form the basis for standards development work of business analysts, business users and information technology specialists supplying the content of and implementing applications that will employ the UN/CEFACT Core Component Library (CCL). The Core Component Library will be stored in a UN/CEFACT repository and identified in an ebXML compliant registry.

Due to the evolving nature of the UN/CEFACT Core Component Library, the specification includes material that focuses on the business community doing further discovery and analysis work. Some of the contents of this specification are not typical of this type of technical document. However, they are critical for successful adoption and standardization in this area to move forward.

A.1.7 *Japanese addressing system*

No formal Japanese addressing standard exists.

A.1.8 *OASIS CIQ v3.0 Approved Committee Specifications CS02*

The scope of CIQ Specifications is to provide *a metadata specification to represent party related data independent of applications and industry use of party data and that is global (limiting to party name, address, party centric attributes and party relationships) in a standard format*, and does not deal with (out of scope):

- Transactional 'customer/party information' such as recent purchases, payment history, etc.
- Message envelopes that carry CIQ payload
- Formatting of the CIQ represented data
- Privacy and security issues connected to exchanging and storing personal information
- Data exchange methods and procedures for party information
- Messaging protocol for exchange of party information
- Validation/verification of party information
- Formatting, labeling, or sorting of party information
- API specifications

The objective of the OASIS CIQ TC (formed in 2000) is to deliver *a set of XML Specifications for defining, representing, interoperating and managing* 'PARTY (Person or Organisation) CENTRIC INFORMATION' that are truly open, vendor neutral, industry and application independent, and importantly 'Global' (ability to represent international data formats such as different types of party names and addresses used in 241+ countries).

The CIQ family of specifications are designed to represent party data (e.g. name and address) independent of any culture, geographical location, application or industry at an abstract (simple representation of data - free text format) or detailed (complex representation, i.e. breaking the data into its atomic elements - structured format) level from a data integrity and quality perspective and therefore, is truly a 'global' (International) specification for representing party information.

The CIQ TC develops XML industry specifications for the following Party entities. Party entities are defined as modular and reusable components (e.g. Party Name only, Party Address only) in the form of XML Schema (for each component). Users can choose the component to implement:

NAME

Name of a Party (person or an organisation).

OASIS CIQ specification that provides a standard format to represent the name of a party is 'extensible Name Language (xNL)'.

ADDRESS

A physical location or a mail delivery point.

OASIS CIQ specification that provides a standard format to represent an address/location is 'extensible Address Language (xAL)'.

PARTY

A Party could be of two types namely,

Party (person or organization) centric data consists of many attributes (e.g. Name, Address, email address, telephone, qualifications, occupation, identification details, etc) that are unique to a party. A Customer is of type Party.

OASIS CIQ specification that provides a standard format to represent party centric data is 'extensible Party Information Language (xPIL)'.

PARTY RELATIONSHIPS

Pairwise affiliation or association between two people, between two organisations, or between an organisation and a person

OASIS CIQ specification that provides a standard format to represent relationships between two or more parties including the roles of the parties involved in the relationship, is 'extensible Party Relationships Language (xPRL)'.

xPRL supports chains of interlocking pairwise party relationships, linked by common members.

A.1.9 *SANS 1883*

A.1.9.1 SANS 1883-1

This standard specifies and defines the *data elements, as well as the address types that can be constructed from the data elements for South African addresses*. The standard further *defines terms & definitions* related to addresses in South Africa.

This standard is applicable to addresses covering the whole of South Africa.

The standard applies to addresses that describe the physical location of a point of service delivery, and that could be geo-referenced.

The standard includes definitions for *address types that are assigned by the official address issuing body* (such as the street address type), *as well as address types that are commonly in use* (such as the farm and informal address types).

A.1.9.2 SANS 1883-3

This part of SANS 1883 provides guidelines for the *allocation* and maintenance of addresses for the official address types specified in part 1 of this standard. It gives rules, orientation, advice and recommendations relating to the use of part 1. It applies to any area where the development correlates with the underlying cadastre, including previously unaddressed areas.

In terms of address allocation the guidelines specify *how addresses should be arranged geographically*.

For address maintenance the guidelines specify *how addresses should be updated* in the case of name changes, boundary changes, subdivisions, and consolidations.

Existing addresses should not be affected by the adoption of these guidelines. However, where possible, a link between an existing address (not complying to the standard) and a new address (complying to the standard) should be kept.

The guidelines are written with the o*bjective of address data exchange and interoperability*, and thus they do not specify how the data is managed and maintained on a day-to-day basis.

The process of allocating and updating erf numbers falls under the Chief Surveyor General, and is not covered in SANS 1883, even though erf numbers appear as data elements in SANS 1883.

NOTE 'erf' is the term used in South Africa for an urban cadastral property approved by a Surveyor General.

A.1.10 *Universal Postal Union*

A.1.10.1 UPU S42:2006, *International postal address components and templates*

This UPU standard provides a dictionary of the possible *components of postal addresses, together with examples of and constraints on their use*. The standard defines three hierarchical levels of postal address component:

- segments, such as addressee specification, which correspond to major logical portions of a postal address.
- constructs, such as organisation identification, which group elements within segments into units which are meaningful for human interpretation;
- elements, such as organisation name or legal status, which correspond to the lowest level of constructs, i.e., those which are not themselves made up of subordinate elements, though they may be sub-divided for technical purposes
- element sub-types, such as door type or door indicator, representing parts of conceptual elements, such as door, for database storage or to facilitate presentation, or representing multiple instances of conceptual elements for use in defining address element structures or templates

The standard further provides a methodology for the specification of postal address templates, which stipulate *how a postal address is to be written*, including the order in which postal address elements are to appear, required and optional elements, and the presentation or rendition of the elements, subject to constraints on the space available for that task. Languages suitable for human comprehension and computer processing of postal address templates are defined and described.

It also defines a number of useful *terms*, such as delivery address, forwarding address, mailee and mail originator. By providing a standard dictionary of postal address components, this standard is expected to greatly facilitate the formal description of actual address representations and the definition of procedures for mapping between them.

In practice, many address representations, whether in computer databases, in electronic messages or in printed or written form, combine several of the postal address components defined herein into single fields or lines. Considerable intelligence may be required in mapping between different representations, particularly where these are subject to a degree of ambiguity. This standard does *not* specify the length or value range of components.

UPU S42b (2006) describes the address templates for each country, i.e. the specific way an address is formatted in each country, indicating in particular the order in

which the various elements appear. The address templates are supplemented by rendition instructions, specifying *how elements are to be rendered for printing*. This standard does not cover the topic of data protection. Users of the standard are nevertheless reminded that the storage and exchange of personal data are subject to legislation in many countries. The standard may be applied only to the extent that this is compliant with such legislation.

A.1.10.2 UPU S53:2009, *Exchange of Name and Address Data*

This document includes two W3C *XML Schemas*. The first is referred to as the S42 base schema and contains the S42 elements and element sub-types together with the codes that typically represent these elements in S42 templates, both in XML and in natural language. The second uses the S42 base schema and adds a number of complex types and other XML data constructs to describe name and address data sets. These data sets may use S42 elements and element sub-types along with extensions of these elements and element sub-types, composites that may optionally contain information about the elements and element sub-types that make them up, other special data types developed for this standard, and external data. The schemas in full are presented at Annexes A and B.

This document should not be used to transmit name and address data for which appropriate permissions and authorizations have not been obtained, and should not be used to send name and address data to any party not entitled to receive the data. As different jurisdictions have different legal restrictions and accepted business practices, judgments in these matters are the responsibility of the users of this standard.

A.1.11 *US FGDC Thoroughfare, Landmark and Postal Address Data Standards*

This standard covers thoroughfare, landmark, and postal addresses within the United States, including its outlying territories and possessions. It was created to provide *one standard that meets the diverse address data management requirements for local address administration, postal and package delivery, emergency response (and navigation generally), administrative recordkeeping, and address data aggregation*. It was created to provide a systematic, consistent basis for recording all addresses in the United States. It defines the *elements needed to compose addresses and store them within relational databases and geographic information systems*. Additionally, it defines the attributes needed for address documentation, mapping, and quality testing, including address ID's, coordinates, and linear reference locations. It provides a complete taxonomy (systematic classification) of US addresses. The standard includes the idea of the address reference system, and defines its elements and attributes. Within the standard there are *tests and procedures for address data quality testing, error-trapping, and anomaly identification*.

The standard supports seamless *exchange* of address information, and fosters consistent implementation by defining XML models for every address element, attribute, and class, integrated into a single *XML Schema* Document.

A.2 Terminology

In each of the following clauses a list of the terms defined in each of the reviewed address standards is shown. The definitions for some of these terms are provided as part of the results of the review in the main part of the review summary.

A.2.1 *AFNOR XP Z10-011, Specification postales – Addresse postale (France)*

address, postal address, address block, CEDEX, address field, postcode, component, addressee, recipient, place name, specific distribution heading, basic word (street name), merge point, delivery point, special delivery point, geographical point, address structure, thoroughfare, address area

Note: The terms above are listed from the English translation.

A.2.2 *Australia and New Zealand*

A.2.2.1 AS/NZS 4819:2003, *Geographic information – Rural and urban addressing* (Australa and New Zealand)

address (rural and urban), address point, address site, alias address, address site name, centroid, complex site, cul-de-sac, custodian, datum point, discontinuous road, focal section, geocode, GNAF (Geocoded National Address File), jurisdiction, land parcel (also parcel or lot), locality, may, metadata, neighbourhood, numeral plate, principal address, private road, property, public road, redevelopment, right of way, rural address number, rural address number plate, shall, should, start point, suburb, terminal point, urban address number, utility, water access

A.2.2.2 AS 4590:2006, Interchange of client information (Australia)

AS 4590:2006 includes definitions for the address components listed below. Many of the code lists associated with the codes are defined in AS/NZS 4819:2003.

address usage code, physical address indicator, address status code, client address currency details, addressing within a complex, primary address, address site name (e.g. Parliament House), road number, road, postal delivery, locality name (e.g. Richmond), state or territory code, postcode, unstructured address (for addresses that do not conform to AS/NZS4819:2003), country name code, location descriptor (e.g. '3 km past the black stump sign'), delivery point identifier (a unique number created by Australia Post for an address), geocode

A.2.3 *BS 7666-0:2006,* Spatial datasets for geographic referencing – Part 0: general model for gazetteers and spatial referencing

address, *addressable object*, administrative area, basic land and property unit (BLPU), BLPU provenance, coordinate reference system, coordinated point, delivery point, designated street name, elementary street unit, gazetteer, land and property identifier (LPI), land and property gazetteer, locality, location, primary addressable object, public right of way (PROW), secondary addressable object, spatial reference, spatial unit, street, street description, street reference, street naming authority, street number, town, unique property reference number (UPRN), unofficial street name

A.2.4 *INSPIRE D2.8.I.5 Data Specification on Addresses –Guidelines*

An *address* is defined in the INSPIRE directive, while *addressable object*, property and *postal address* are defined in the terminology chapter of INSPIRE data specification itself.

In the application schema, a set of basic data types and features are defined: address locator, address position, address representation, address component as

well as the generic sub-types of address components: administrative unit name, address area name, thoroughfare name and postal descriptor.

A.2.5 *ISO 19112:2003, Geographic information – Spatial referencing by geographic identifiers*

feature, gazetteer, geographic identifier, location, spatial reference, spatial reference system

A.2.6 *ISO/TS 15000-5:2005, Electronic Business Extensible Markup Language (ebXML) - Part 5: ebXML Core Components Technical Specification, Version 2.01 (ebCCTS)*

core component (CC), basic core component (BCC), association core component (ACC), core component type (CCT), aggregate core component, data type, business context, business information entity (BIE), basic business information entity (BBIE), association business information entity (ASBIE), aggregate business information entity

A.2.7 *Japanese addressing system*

jusho (address), *todofuken* (prefecture), *shichoson* (municipality), *machi-or-aza* (district), *gaiku* (block), *gaiku fugo* (block code), *jukyobango* (residence number), *ippitsu no tochi* (parcel of land), *chiban* (parcel number), *banchi* (place number), *yubin bango* (postal code), *katagaki* (sub-address)

A.2.8 *OASIS CIQ v3.0 Approved Committee Specifications CS02*

address, name, party, party relationships

A.2.9 *SANS 1883*

A.2.9.1 SANS 1883-1

address, address type, cadastral property, erf, farm, geographical name, official address issuing body, point of service delivery, service, small holding

A.2.9.2 SANS 1883-3

bulge street, cadastre, cul-de-sac, private street, public street, SG general plan, street name, street name type

A.2.10 *Universal Postal Union*

A.2.10.1 UPU S42:2006, *International postal address components and templates*

address, addressee, component, construct, delivery, delivery address, delivery point, element, forwarding address, mail originator, mail recipient, mail submitter, mailee, mailer, party, payer, *postal address*, postal address component, postal address construct, postal address element, postal address element sub-type, postal address segment, postal address structure, postal address template, poste restante, recipient, rendition instruction, return address, segment, syntactically correct postal address, valid postal address

A.2.10.2 UPU S53:2009, *Exchange of Name and Address Data*

active data dictionary, actual subset, address block, address line block, automatic identifier, composite, cross reference data, data element, delivery point identifier, external data, hash identifier, item, maximum subset, name and address data, name and address data set, representation, roster, standard line address block, subset notation, unique identifier

A.2.11 *US FGDC Thoroughfare, Landmark and Postal Address Data Standards*

address, address number elements, separator element, complete address number, street name elements, complete street name, sub-address elements, complete sub-address, landmark name, complete landmark name, place name, complete place name, state name, ZIP code, ZIP Plus 4, country name, USPS postal address elements, USPS general delivery point, delivery address, address reference system elements (numbering rules, naming rules, and system axis), address ID (unique identifier), address authority, address relations, address coordinates, address parcel elements, address transportation feature elements, address range attributes, address classification, feature type, lifecycle status, official status, anomaly status, side of the street, Z level, location description, mailable address, delivery address type, address lineage attributes

The elements listed above are a summary of the definitions provided in the US FGDC Address. In most cases, the standard provides a definition for the complete element as well as each of the sub-elements.

A.3 Conceptual model

A.3.1 *AFNOR XP Z10-011, Specification postales – Addresse postale (France)*

No diagrams are provided in the English translation of the standard.

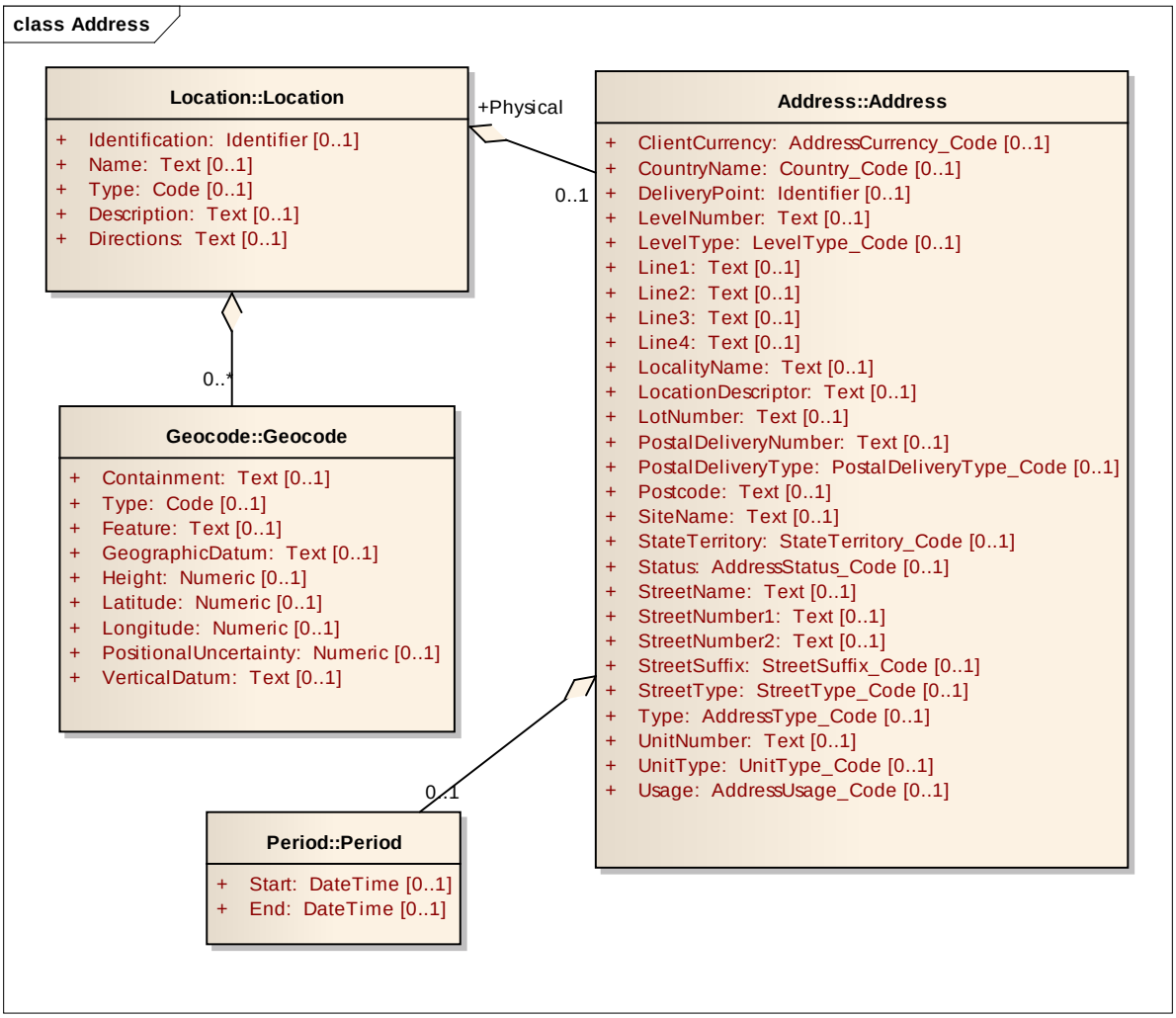
A.3.2 *Australia and New Zealand*

A.3.2.1 AS/NZS 4819:2003, *Geographic information – Rural and urban addressing* (Australa and New Zealand)

There is no UML conceptual model in AS 4819:2003. The model has been developed (and subsequently revised) for AS 4590:2006.

A.3.2.2 AS 4590:2006, Interchange of client information (Australia)

A UML model of AS 4590:2006 has been prepared by the Australian Government Information Management Office to facilitate the interchange of client information. The model does not form part of the standard but incorporates the provisions of the standard. The address component of the UML model is illustrated on 0 below.



The address component of the UML model for AS 4590:2006, prepared by the Australian Government Information Management Office

A.3.3 *BS 7666-0:2006,* Spatial datasets for geographic referencing – Part 0: general model for gazetteers and spatial referencing

UML models are provided in the standard. These show the object classes, the attributes of each class and the associations between classes. Refer to Figure A.1 for an overview of the UML model in this standard.

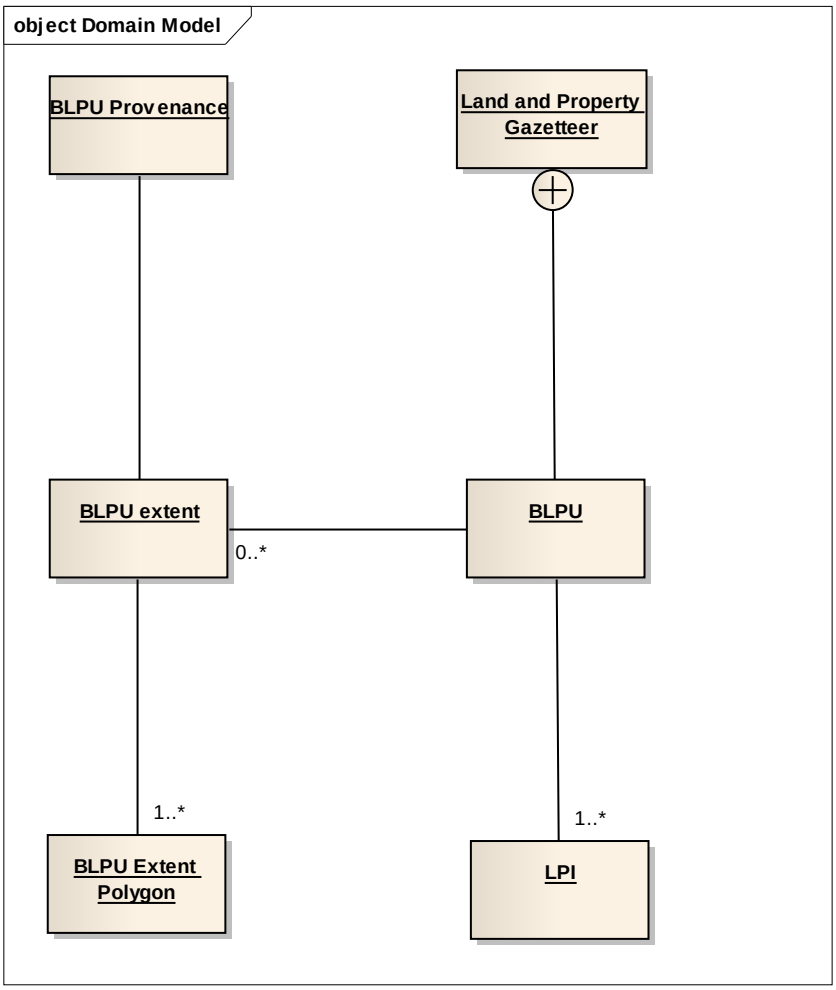


Figure A.1. Overview of the conceptual model defined in BS 7666-0:2006

A.3.4 *INSPIRE D2.8.I.5 Data Specification on Addresses –Guidelines*

The conceptual model of the INSPIRE Data Specification is represented by an application schema in UML notation. Refer to Figure A.2 for an overview. The application schema defines the classes, data types, attributes, associations and restrictions and includes a comprehensive narrative description of the application schema as well as a feature catalogue.

The general model is based on two feature types ‘address’ and ‘address component’. For any address an address point is required, as a spatial representation of the location of the address.

For the address component, four generic subclasses are defined: Administrative unit name, address area name, postal descriptor and thoroughfare name. In an implementation of the specification the each address component can be managed as a proper feature.

The specification also provides mechanisms to represent parent-child relationships between a main address and sub addresses and to represent relations between address components like e.g. ‘Street A is situated within City B’.

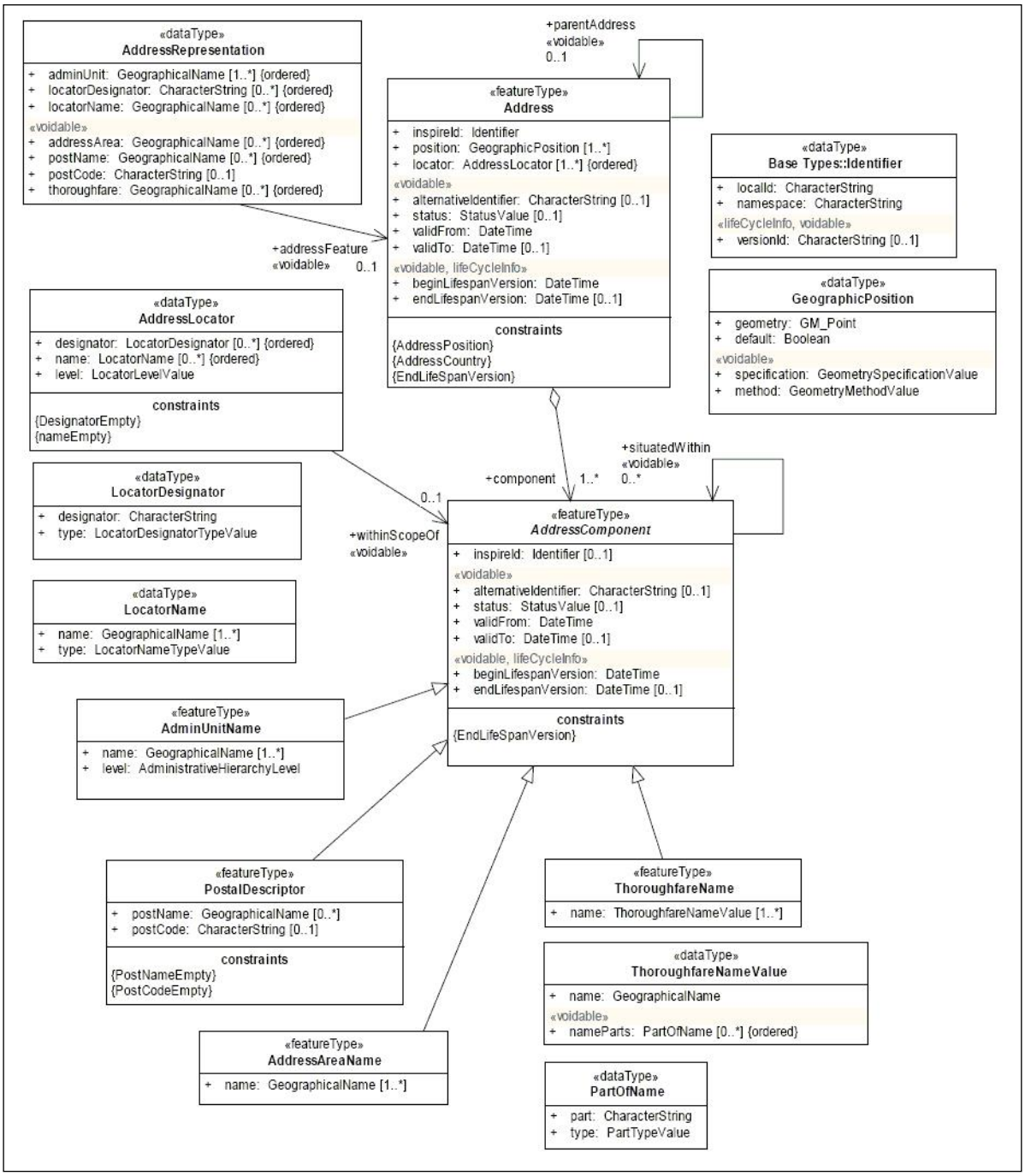


Figure A.2. UML overview of the INSPIRE application schema

A.3.5 *ISO 19112:2003, Geographic information – Spatial referencing by geographic identifiers*

UML models are provided in the standard. These show the object classes, the attributes of each class and the associations between the classes. Two diagrams from the standard are included here; refer to Figure A.3 and Figure A.4.

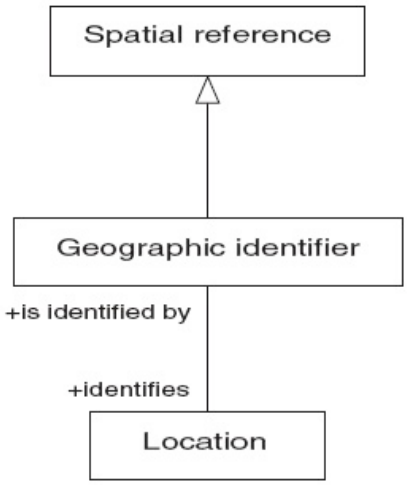


Figure A.3. The concepts of spatial referencing using geographic identifiers

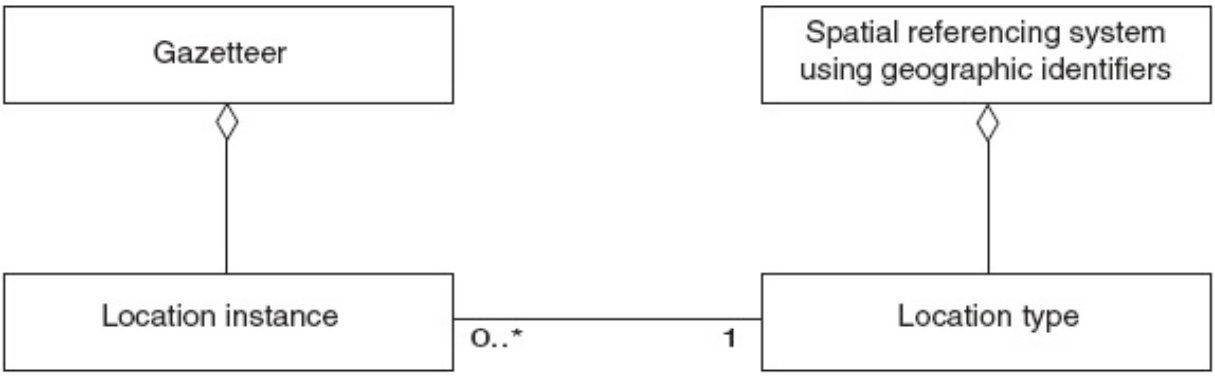


Figure A.4. Spatial referencing using geographic identifiers

A.3.6 *ISO/TS 15000-5:2005, Electronic Business Extensible Markup Language (ebXML) - Part 5: ebXML Core Components Technical Specification, Version 2.01 (ebCCTS)*

Refer to Figure A.5 for an overview of the core components defined in this standard.

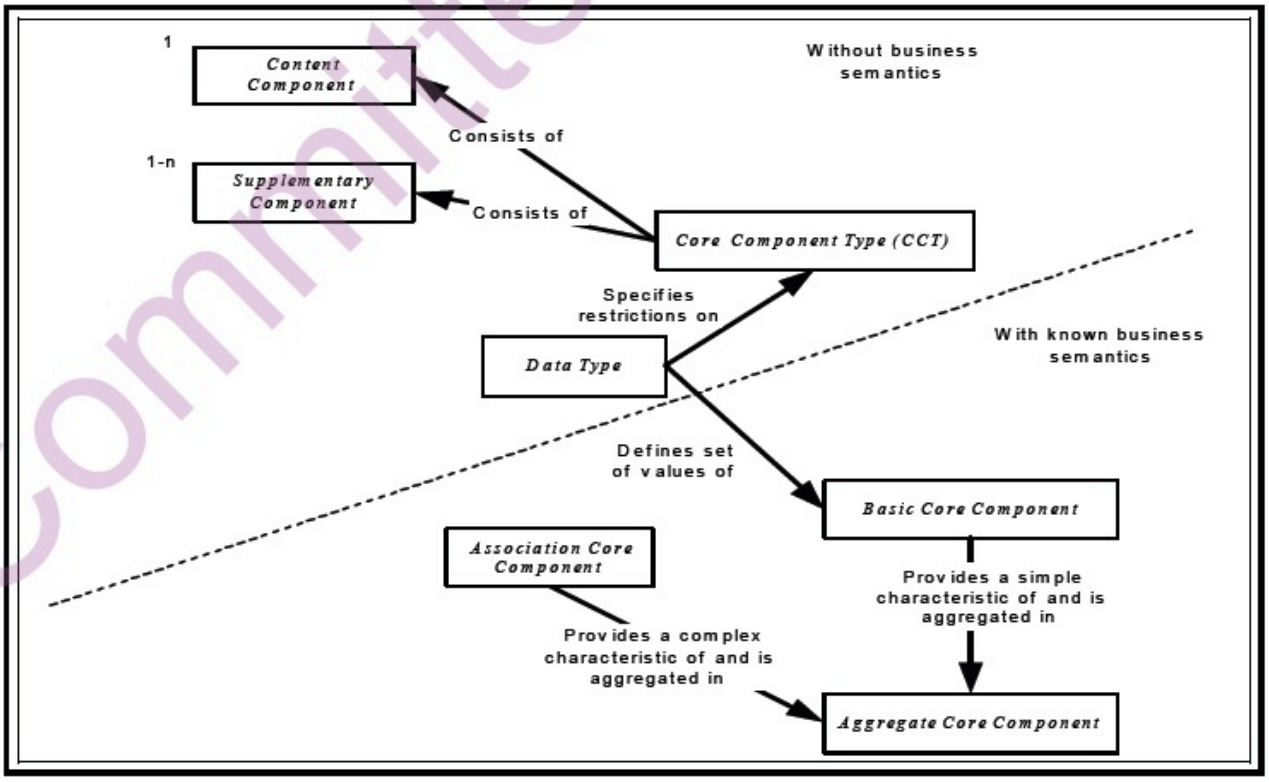


Figure A.5. Core Component Overview

A.3.7 *Japanese addressing system*

The UML class diagram in Figure A.6 shows the relationships between address components in the Japanese addressing system.

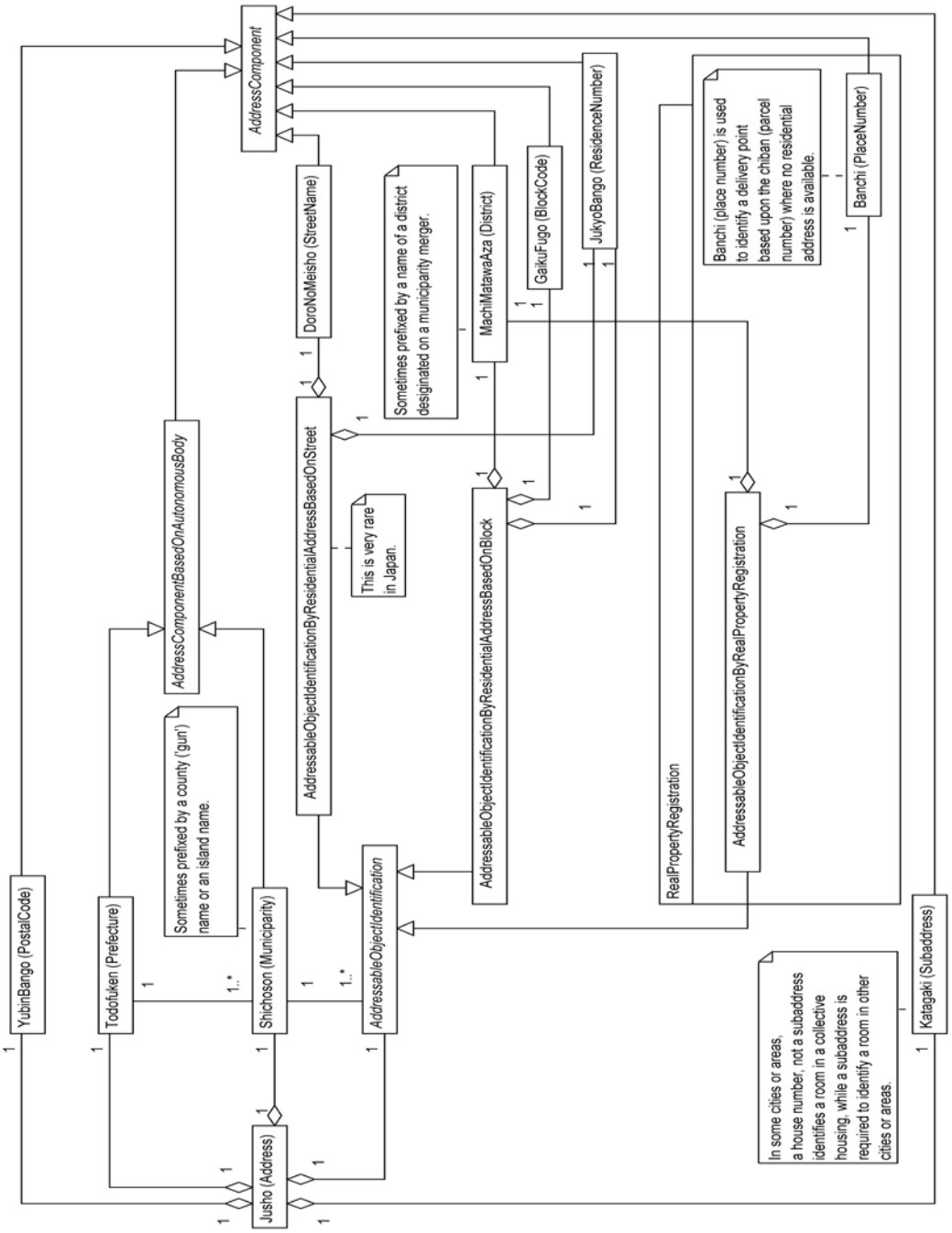


Figure A.6. Conceptual model of the Japanese addressing system

A.3.8 *OASIS CIQ v3.0 Approved Committee Specifications CS02*

Refer to Figure A.7, Figure A.8 and Figure A.9 for the UML models of xAL, xNL, xPIL, respectively.

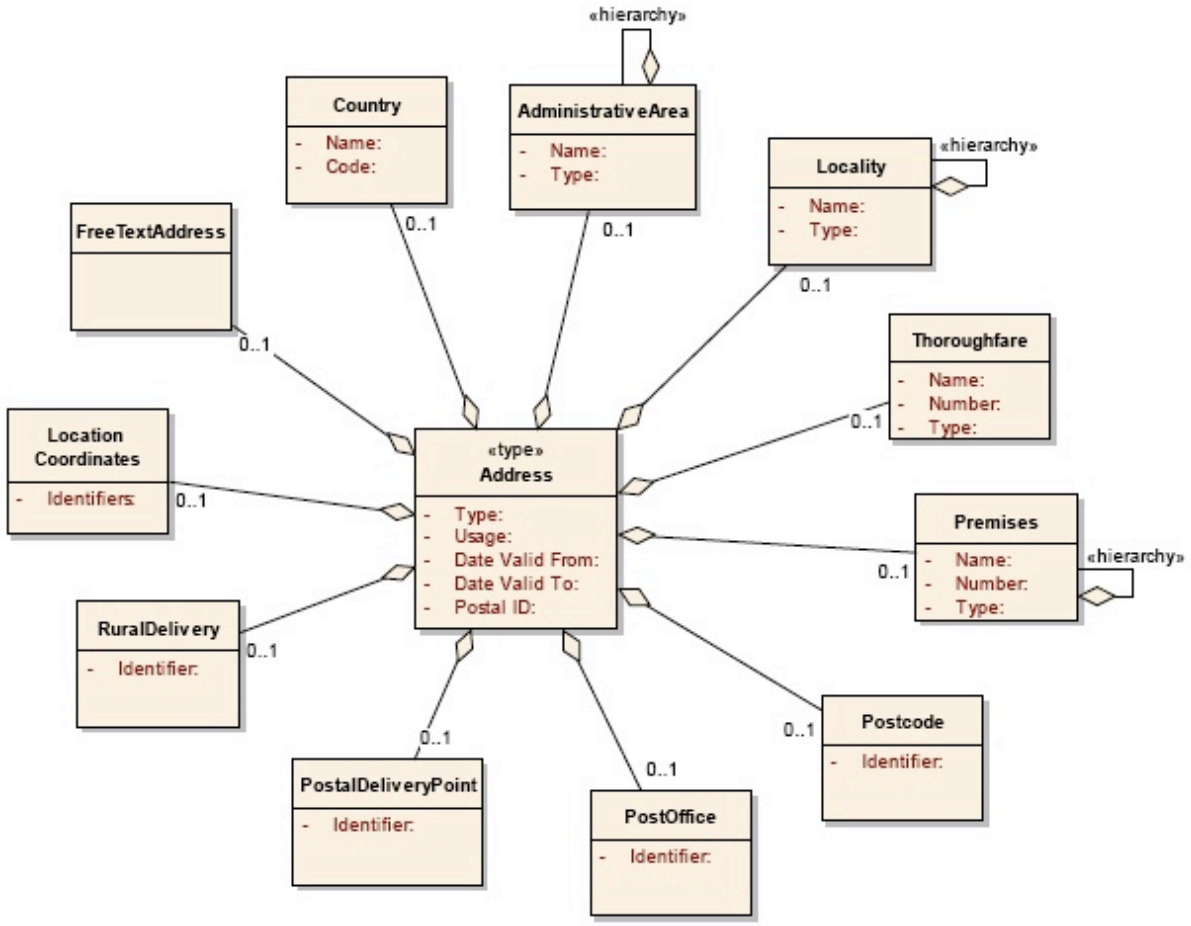


Figure A.7. High Level UML Model of xAL

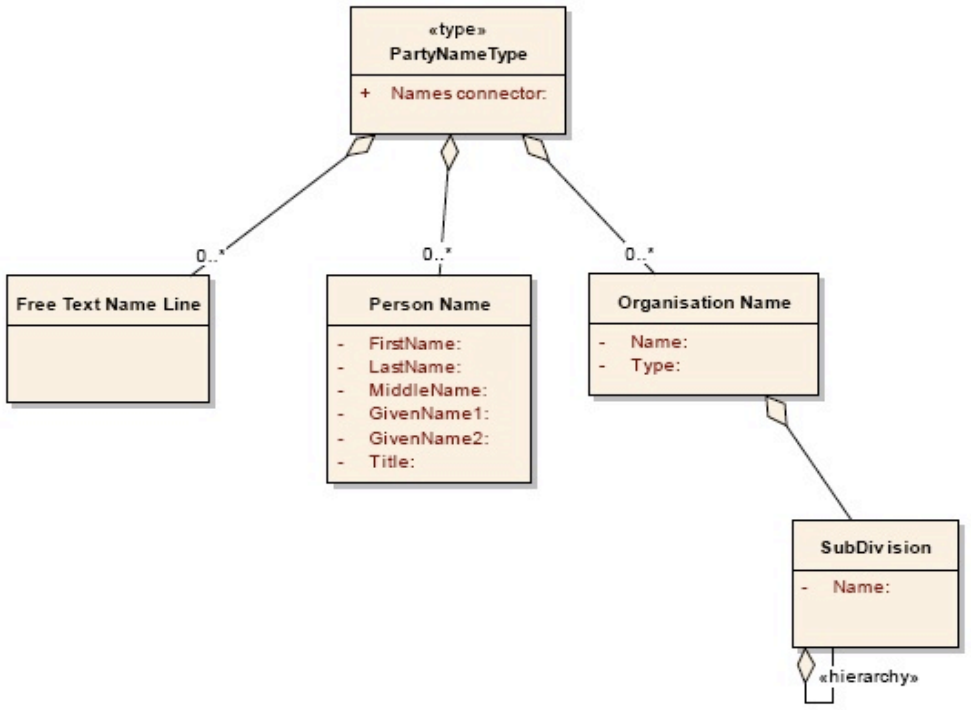


Figure A.8. High level UML model of xNL

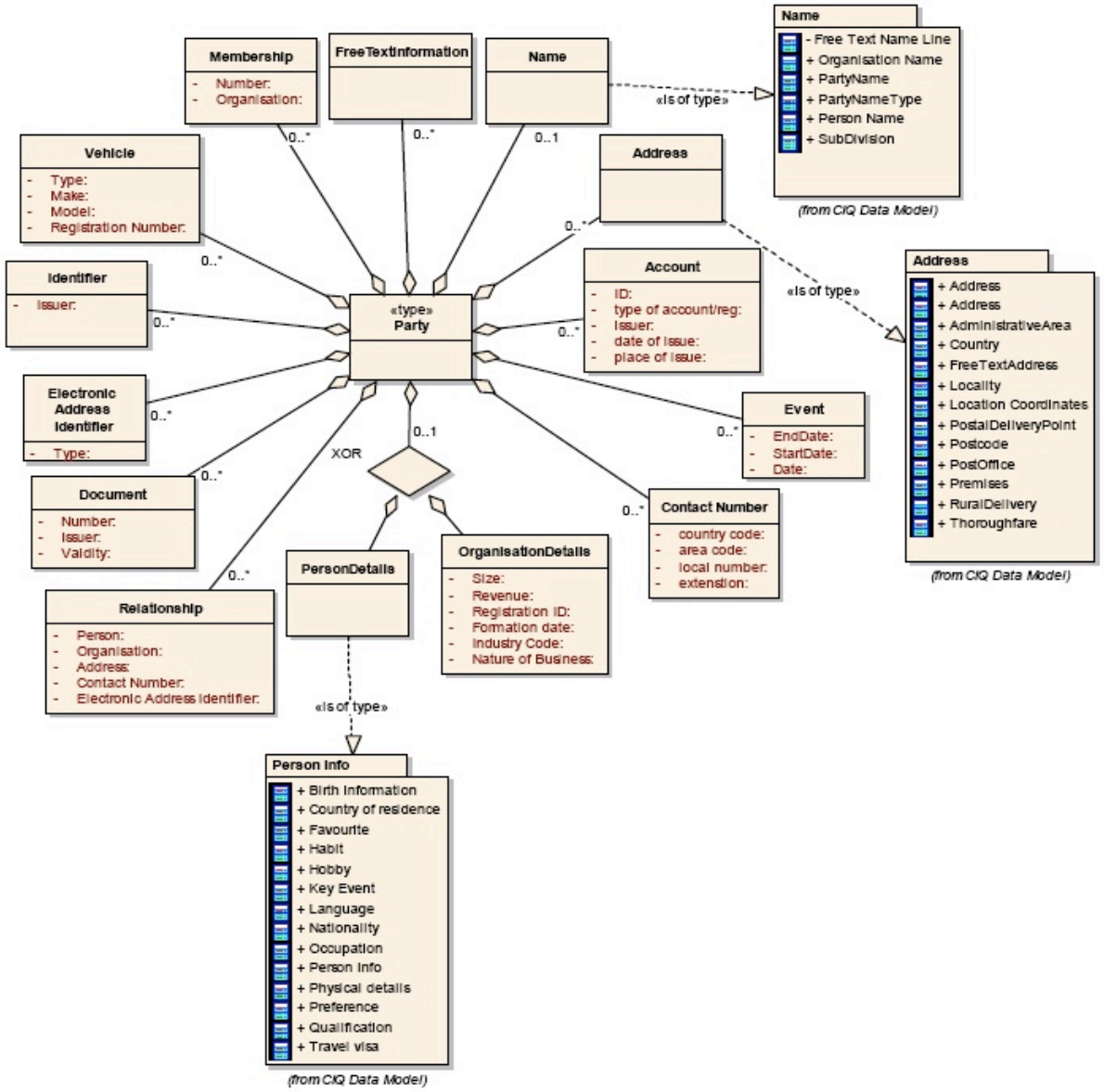


Figure A.9. High level UML model of xPIL

A.3.9 *SANS 1883*

A.3.9.1 SANS 1883-1

Figure A.10, Figure A.11 and Figure A.12 show the UML for the different types of addresses defined in SANS 1883-1.

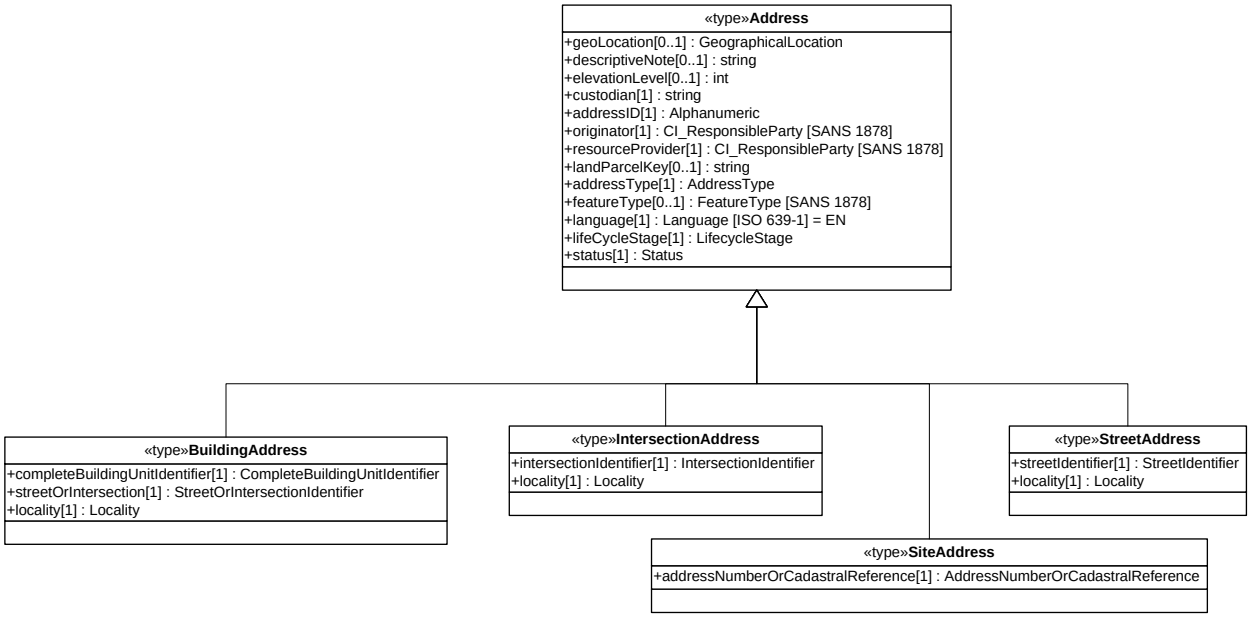


Figure A.10. SANS 1883-1 base address type with derived types for the building, intersection, street and site address types

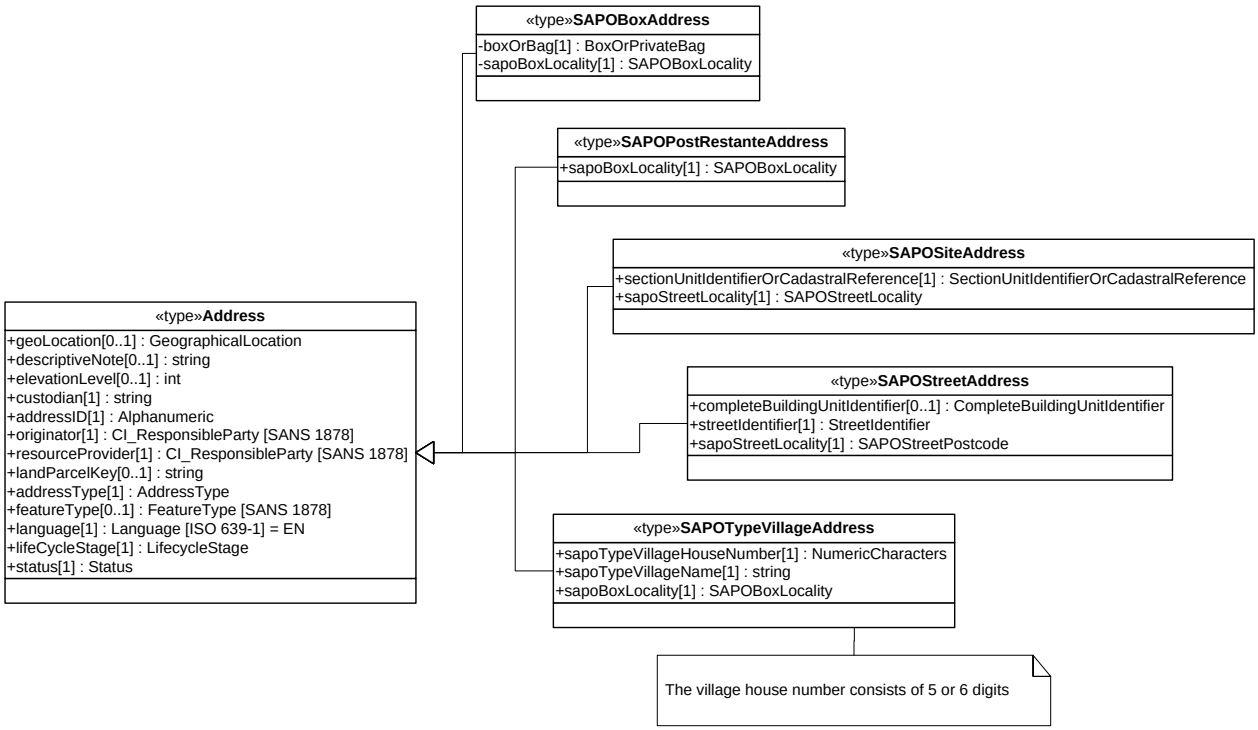


Figure A.11. SANS 1883-1 base address type with derived types for the five SA Post Office address types

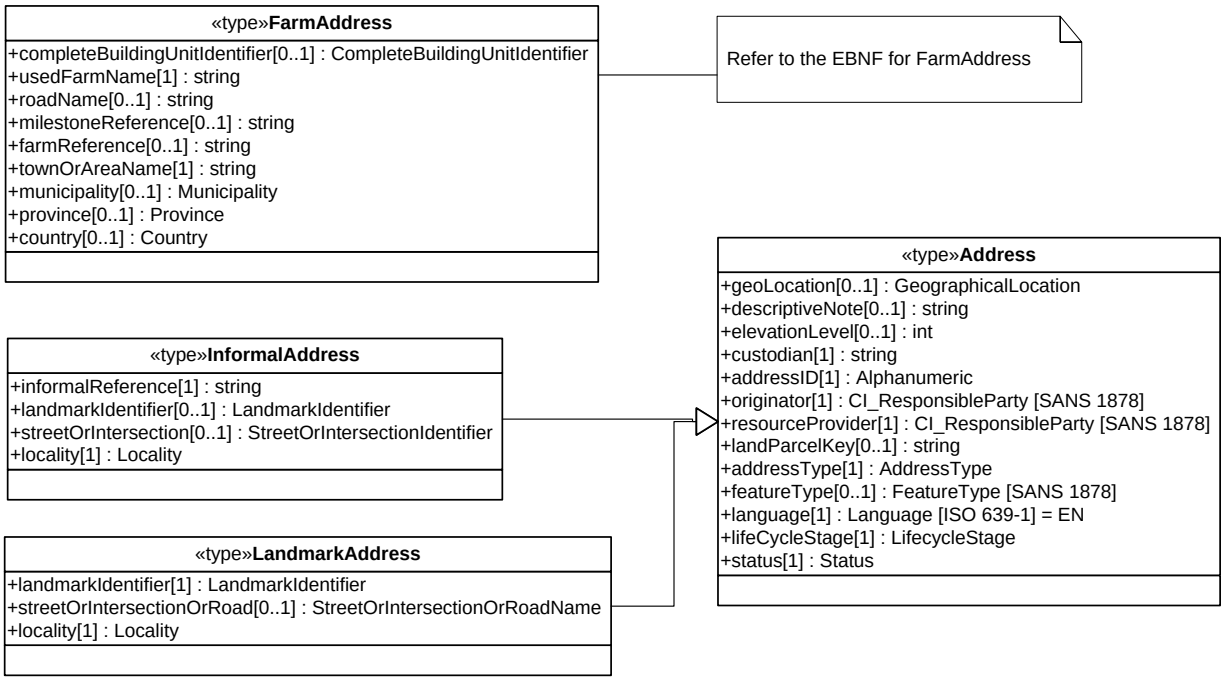


Figure A.12. SANS 1883-1 base address type with derived types for the farm, informal and landmark address types

A.3.9.2 SANS 1883-3

The relationships between components are defined in SANS 1883-1 and referenced in SANS 1883-3.

A.3.10 *Universal Postal Union*

A.3.10.1 UPU S42:2006, *International postal address components and templates*

The main relationship between components in UPU S42:2006 is composition and decomposition. UPU S42:2006 defines the decomposition of a postal address specification into segments, constructs and elements, refer to Figure A.13 and Figure A.14. The list of all UPU S42:2006 components is provided in A.4.10 and illustrates the relationships between components.

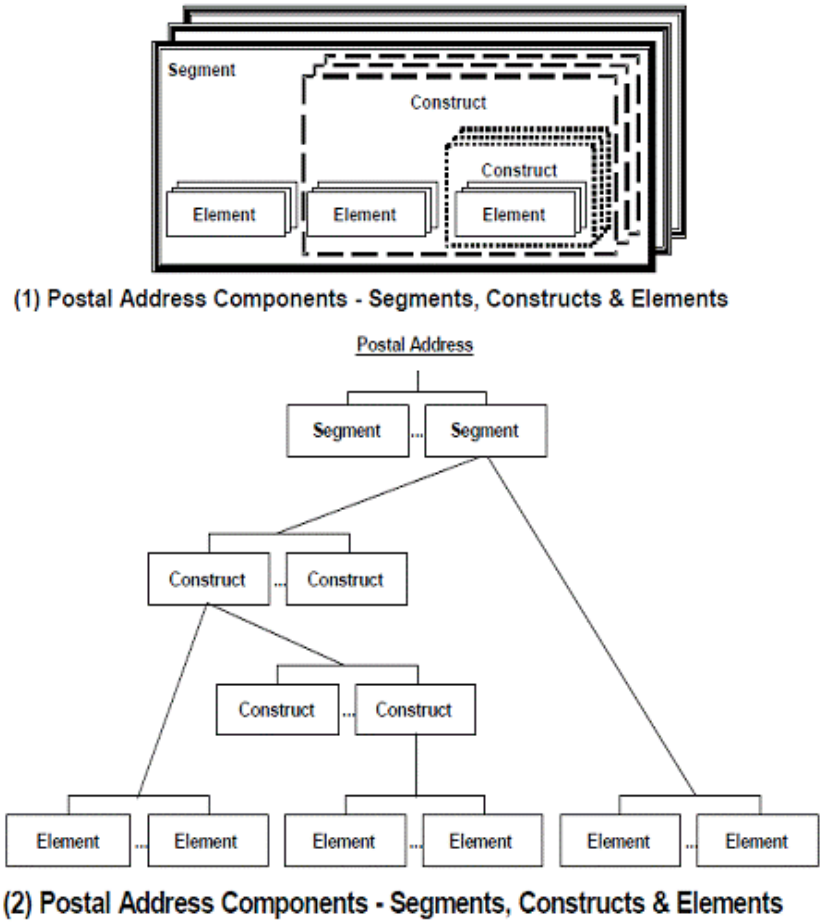
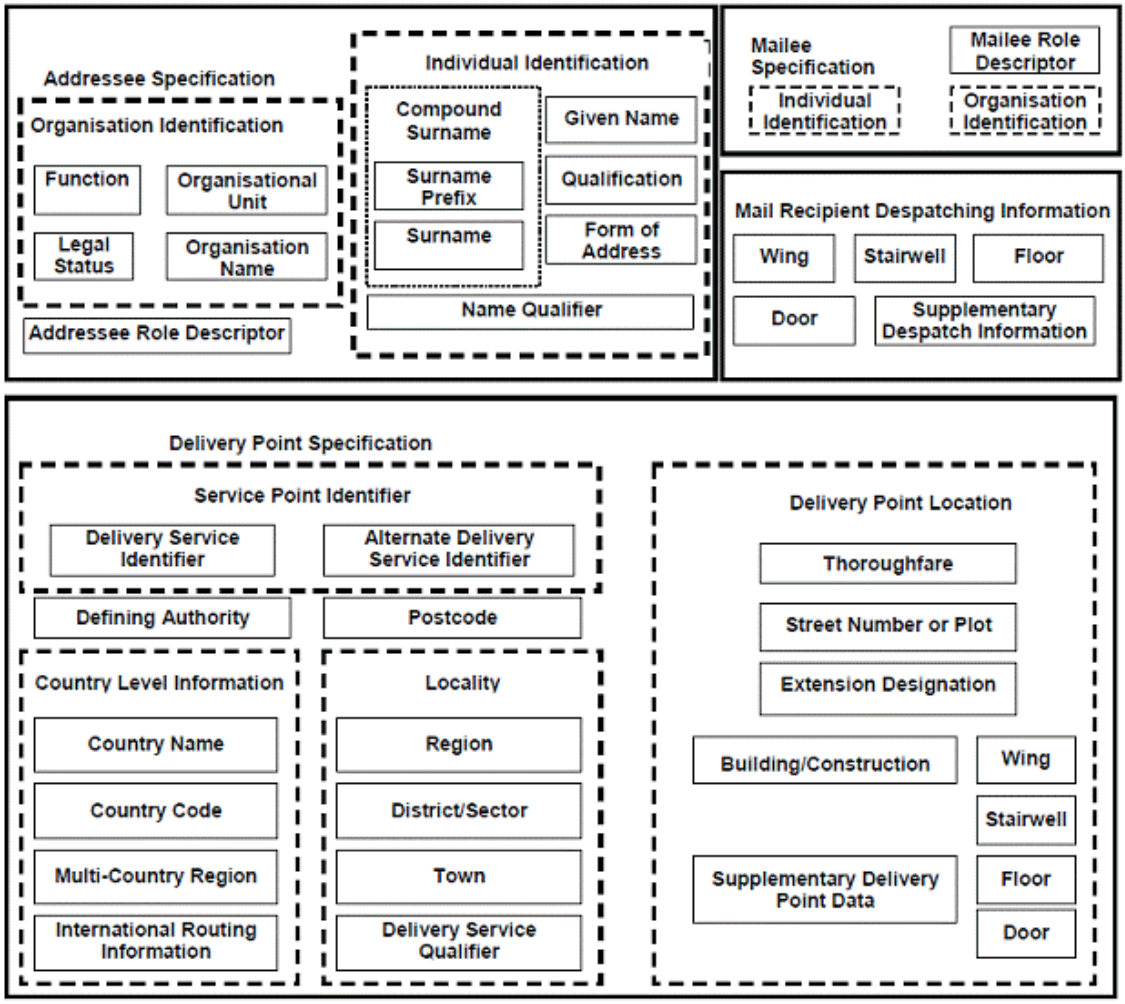


Figure A.13. Relationships between segments, constructs and elements



(3) Postal Address Components

Figure A.14. Relationships between UPU S42:2006 postal address components

A.3.10.2 UPU S53:2009, *Exchange of Name and Address Data*

The relationships between components are defined in UPU S42:2006 and referenced in UPU S53:2009.

A.3.11 *US FGDC Thoroughfare, Landmark and Postal Address Data Standards*

The US FGDC Address uses definitions and examples of 'complex elements' and classes to explain the relationship between the address components. A general diagram of the address relationships for all components is not provided in the standard. However, an XML schema and diagrams are provided XSD data model to the classification parts.

A.4 Address components

All reviewed address standards describe addresses as a combination of components or elements, often comprising a hierarchy. In the reviewed address standards, the components that make up an address generally fall into the categories listed below. Component examples for each category are listed. The list of components or elements that are defined in each of the reviewed standards are listed below.

Address components that represent an identifier for the address, addressable object or delivery point

- *addressable object name* (BS 7666)
- *address number* (AS/NZS 4819, SANS 1883-1, US FGDC Address)
- *alternative identifier* (INSPIRE Address)
- *gaiku fugo (block code) and jukyo bango (residence number)*(Japan)
- *box or private bag number* (SANS 1883-1)
- *building* (SANS 1883-1, UPU S42)
- *door* (UPU S42)
- *house* (AFNOR XP Z10-011)
- *identifier* (global URN) (INSPIRE Address)
- *letter box* (AFNOR XP Z10-011)
- *locator* (INSPIRE Address),
- *banchi (place number)* (Japan)
- *postal delivery number* (AS 4590)
- *postal delivery point* (OASIS CIQ)
- *road number* (AS 4590)
- *street number or plot* (UPU S42)
- *sub-dwelling number or identifier* (AS/NZS 4819)
- *village house* number (SANS 1883-1)
- *USPS Box ID* (US FGDC Address)
- *delivery service identifier (UPU S42)*

Address components that reference a real world object

- *street name* (BS 7666, SANS 1883-1, US FGDC Address)
- *road name* (AS/NZS 4819)
- *thoroughfare name* (AFNOR XP Z10-011, INSPIRE Address, OASIS CIQ, UPU S42)
- *gaiku fugo (block code)* (Japan)
- *landmark name* (SANS 1883-1, US FGDC Address), referred to as an *address site name* (AS/NZS 4819 and AS 4590).

Address components that reference a geographical area

- Names for a place or locality, such as
  - *address area name* (INSPIRE Address)
  - *farm* (SANS 1883-1)
  - *machi-or-aza (district)(Japan)*
  - *locality* (AS 4590, BS 7666, OASIS CIQ)
  - *place (AFNOR XP Z10-011, SANS 1883-1, US FGDC Address)*
  - *village* (SANS 1883-1)

- *district/sector (*UPU S42*)*
- *town* (BS 7666, SANS 1883-1, UPU S42)
- *city* (AS/NZS 4819)

- Names and/or codes for administrative boundaries, such as
  - *administrative area* (BS 7666, OASIS CIQ)
  - *administrative area name* (INSPIRE Address)
  - *todofuken (prefecture)* (Japan)
  - *municipality* (SANS 1883-1)
  - *shichoson (municipality)* (Japan)
  - *province* (SANS 1883-1)
  - *registration division* (SANS 1883-1)
  - *region* (UPU S42)
  - *state* (AS 4590, US FGDC Address)
  - *territory* (AS 4590)
  - *country* (AS 4590, OASIS CIQ, SANS 1883-1, UPU S42, US FGDC Address).
- ISO 19112:2003 defines a general component, the *location type*, which is an identifiable geographic place, such as a country, town or river.

Address components that reference a delivery area

- *postcode* (AS/NZS 4819, AS 4590, OASIS CIQ, SANS 1883-1, UPU S42)
- *ZIP Code* (US FGDC Address)
- *postal descriptor* (INSPIRE Address)
- *yubin bango (postal code)* (Japan)

Address components that specify a kind of mail delivery service

- *postal delivery type code*, e.g. ‘PO BOX’ for Post Office Box and ‘RDS’ for Roadside Delivery (AS 4590)
- *postal delivery type code, e.g.* 私書箱 *, i.e. post office box. (Japan)*
- *delivery service type* (UPU S42)
- *mail delivery agent identifier* (SANS 1883-1)
- *postal delivery point (value of ‘locator level’)* (INSPIRE Address)
- *USPS Box Type, USPS Box Group Type* (US FGDC Address)

Address components that specify a distribution office

- *delivery service qualifier* (UPU S42)
- *post office* (SANS 1883-1, OASIS CIQ)

Address components that describe proximity

- *descriptive locator* (value of 'locatornametype') (INSPIRE Address)
- *farm and informal reference* (SANS 1883-1)
- *kilometre point* (value of 'localdesignatortype') (INSPIRE Address)
- *location descriptor* (AS 4590)
- *supplementary delivery point data* (UPU S42)
- *tori mei (traditional street name) (Japan)*

Address components for the person or organization at the address

- *corporate name* and *title, forename, surname* (AFNOR XP Z10-011)
- *person name* and *organisation name* (OASIS CIQ)
- *organization name, given name, surname prefix, surname, etc.* (UPU S42)
- *organization name, surname, and given name (Japan)*

A.4.1 *AFNOR XP Z10-011, Specification postales – Addresse postale (France)*

The standard identifies address components for the following:

1. Identification of the addressee or recipient:
   - *Private Individual:* status, forename, surname, title, profession/function. Note however that forenames can only be recorded with the consent of the individuals involved.
   - *Company*: legal form, corporate name, main activity, subdivision within the company (division, department etc.), name of establishment.
2. Identification of the merge point
   - *For physical address*:
     - *Identification of the Delivery Point*: internal company transfer code, letter Box access, letter box, entrance to premise or house (corridor, stairwell, floor), premise
     - *Identification of the Geographical Point*: country, territorial units, postcode, locality, place name, thoroughfare, complement to the geographical point (can be Building, Building Entrance or Building Unit)
   - *For special postal address (PO Box etc)*:
     - Specific distribution headings. (PO BOX, CEDEX, poste restante, Post Office Name etc.)

A.4.2 *Australia and New Zealand*

The components defined in AS/NZS 4819:2003 and AS 4950 are tabulated and cross-mapped in Table A.2 below.

Table A.2 AS/NZS 4819:2003 and AS 4590:2006 address components

AS/NZS 4819:2003	AS 4590:2006		
Address Components	**Primary Groupings**	**Secondary Groupings**	**Address Components**
			Address usage code
			Physical address indicator
			Address status code
	Client address currency details		Client address currency code
Creation Date (includes time)			Address start date
			Address start time
Retirement Date (includes time)			Address end date
			Address end time
Sub-dwelling unit type	Addressing within a complex	Sub-dwelling unit type	Sub-dwelling unit type code
Sub-dwelling number or identifier			Sub-dwelling unit number
Level type		Level	Level type code
Level number of sub-dwelling			Level number
		Complex road number	Complex road number 1
			Complex road number 2
Private road name		Complex road	Complex road name (e.g. name of private road within a complex)
			Complex road type code
			Complex road suffix code
Utility name			Secondary complex or utility name (e.g. name of a building within a campus)
Address site name	Primary address		Address site name (e.g. Parliament House)
Single rural address number or single urban address number or urban address number range		Road number	Lot number
			Road number 1
			Road number 2
Road name		Road	Road name
Road type			Road type code
Road suffix			Road suffix code
		Postal delivery	Postal delivery type code
			Postal delivery number
Locality			Locality name
State/Territory			State or territory code
Postcode			Postcode
Country			Country name code
	Unstructured address (for addresses that do not conform to AS/NZS 4819:2003)		Unstructured address line 1
			Unstructured address line 2
			Unstructured address line 3
			Unstructured address line 4
			Location descriptor e.g. '3 km past the black stump sign')

AS/NZS 4819:2003	AS 4590:2006		
Address Components	**Primary Groupings**	**Secondary Groupings**	**Address Components**
			Delivery point identifier (a unique number created by Australia Post for an address)
Address site feature	Geocode		Geocode feature
Datum			Geocode geographic datum
			Geocode vertical datum
Latitude			Geocode latitude
Longitude			Geocode longitude
			Geocode height
Accuracy value			Geocode positional uncertainty
Containment			Geocode containment

A.4.3 *BS 7666-0:2006,* Spatial datasets for geographic referencing – Part 0: general model for gazetteers and spatial referencing

The following components are identified in the standard:

- Secondary addressable object name
- Primary addressable object name
- Street name
- Locality name
- Town name
- Administrative area name

A.4.4 *INSPIRE D2.8.I.5 Data Specification on Addresses –Guidelines*

The overall concept of the INSPIRE data specification is that an address has a 'locator', e.g. an address number, that enables a user to distinguish it from the neighbour addresses, as well as a geographic position, which enables an application to locate the address spatially. An address may have several locators, for example, some French addresses have up to six locators.

- *address locator:* Human readable designator or name.
- *geographic position:* Position of a characteristic point which represents the location of the address according to a certain specification, including information on the origin of the position.

To identify the address unambiguously in a wider context an address must be associated with a number of 'address components' that define its location within a certain geographic area. Each of the address components represents a spatial identifier as for example the name of a road, district, postcode, municipality, region or country. Four generic subclasses of address components are defined:

- *administrative unit name*: An address component which represents the name of a unit of administration where a Member State has and/or exercises jurisdictional rights, for local, regional and national governance.
- *address area name*: An address component which represents the name of a geographic area or locality that groups a number of addressable objects for addressing purposes, without being an administrative unit
- *thoroughfare name*: An address component which represents the name of a passage or way through from one location to another.
- *postal descriptor*: One or more names created and maintained for postal purposes to identify a subdivision of addresses and postal delivery points.

A.4.5 *ISO 19112:2003, Geographic information – Spatial referencing by geographic identifiers*

The following components are defined:

- *gazetteer*: A directory of geographic identifiers describing location instances, or a directory of instances of location types in a spatial reference system.
- *location type*: A type of identifiable geographic place, such as country, town, or river.
- l*ocation instance*: An instance of a location type, e.g. 'South Africa' is a location instance of the location type 'country'.
- *spatial referencing system using geographic identifiers*: A related set of one or more location types, together with their corresponding geographic identifiers. These location types may be related to each other through aggregation or disaggregation, possibly forming a hierarchy.

A.4.6 *ISO/TS 15000-5:2005, Electronic Business Extensible Markup Language (ebXML) - Part 5: ebXML Core Components Technical Specification, Version 2.01 (ebCCTS)*

The specification describes a methodology for developing a common set of semantic building blocks that represent general types of business data and provides for the creation of new business vocabularies and restructuring of existing business vocabularies. An address is an example of such business data. The methodology allows the harmonization of core components across business domains and sectors, creating a concise and well-defined glossary of business terms, business data semantic definitions, and structuring of data exchanges. The standard does not define address-specific components but defines generic business data components from which address-specific components can be developed.

A.4.7 *Japanese addressing system*

The following components are used in the Japanese addressing system:

todofuken (prefecture), *shichoson* (municipality), *machi-or-aza* (district), *banchi* (place number) *gaiku fugo* (block code), *doro no meisyo* (street name), *jyukyo bango* (residence number), *katagaki* (sub-address)

A.4.8 *OASIS CIQ v3.0 Approved Committee Specifications CS02*

OASIS CIQ comprises XML schemas for names, addresses and party information. For this purposes, xNL, xAL and xPIL are defined:

xNL defines an XML structure to represent party name data. An example of a Party is ‘customer’. A party could be a ‘Person’ or an ‘Organisation’. An Organisation’ could be educational institutions, namely, school, university or college, clubs, associations, industry groups, not-for-profit bodies, consortiums, etc. Components of xNL are:

- PartyNameType
- FreeTextNameLine
- PersonName
- OrganisationName
- Subdivision

xAL defines an XML structure to represent address data. Components of xAL are:

- Address
- Country
- AdministrativeArea
- Locality
- Thoroughfare
- Premises
- Postcode
- PostOffice
- PostalDeliveryPoiint
- RuralDelivery
- LocationCoordinates
- FreeTextAddress

xPIL defines an XML structure to represent party-centric data. Party-centric data includes name, address, e-mail address, telephone numbers, identification details, vehicle details, account details, etc. These unique attributes of a party assist in uniquely identifying a party. Components of xPIL are:

- Membership
- FreeTextInformation
- Name
- Address
- Account
- Event
- ContactNumber
- OrganisationDetails
- PersonDetails
- Relationship
- Document
- ElectronicAddressIdentifier
- Identifier

- Vehicle

A.4.9 *SANS 1883*

A.4.9.1 SANS 1883-1

The standard defines the following address data elements:

Address number data elements
- Address number
- Address number prefix
- Address number suffix
- Cadastral reference
- Complex element: Complete address number
- Complex element: Street number range

Street name data elements
- Intersection reference
- Milestone reference
- Road name
- Street name
- Street name directional
- Street name modifier
- Street name type
- Complex element: Complete street name
- Complex element: Intersection identifier
- Complex Element: Street identifier
- Complex element: Street name and type

Building data elements
- Building identifier
- Complex name
- Floor identifier
- Floor type
- Unit identifier
- Unit type
- Complex element: Complete building unit identifier
- Complex element: Floor element
- Complex element: Unit element

Landmark data elements
- Landmark name
- Landmark reference
- Complex element: Landmark identifier

SA Post Office data elements
- Mail delivery agent identifier
- SA Post Office box number
- SA Post Office private bag number
- SA Post Office-type village house number

Locality data elements
- Country code
- Country name
- Farm name
- Farm reference
- Informal reference
- Municipality
- Province
- Recorded name
- Registration division
- SA Post Office box postcode
- SA Post Office – post office
- SA Post Office street postcode
- SA Post Office-type village name
- Section identifier
- Town name
- Used farm name
- Used name
- Complex element: Locality
- Complex Element: Place name
- Complex element: SA Post Office box locality
- Complex element: SA Post Office postcode
- Complex element: SA Post Office street locality

A.4.9.2 SANS 1883-3

The components defined in SANS 1883-1 are referred to in this standard. No additional components are defined.

A.4.10 *UPU*

A.4.10.1 UPU S42:2006, *International postal address components and templates*

Three types of components are defined: segments, constructs and elements. Relationships between the components are described in Table A.3 .

Segments

A named group of related postal address constructs and/or postal address elements with a specific defined function. There are four segments:

- addressee specification (optional)
- mailee specification (optional)
- mail recipient despatching information (optional)
- delivery point specification (mandatory)

Constructs

The combination of postal address elements, which together form a logical portion of a postal address. There are seven constructs:

- addressee specification
- country level information
- delivery point location
- individual identification
- organisation identification
- locality
- service point identifier.

Elements

The base entity of a postal address that has a well-defined conceptual meaning and representation and has significance for customer or postal processing purposes.

Address component elements in UPU S42:2006 have been assigned identifiers, as shown below:

Table A.3 Identifiers assigned to UPU S42:2006 address component elements

Id	Address component element	Id	Address component element
00	organisation name	17	district/sector
01	legal status	19	delivery service identifier
02	organisational unit	20	alternate delivery service identifier
03	function	21	thoroughfare
04	addressee role descriptor	24	street number or plot
05	form of address	26	building/construction
06	given name	28	extension designation
07	surname prefix	29	wing
08	surname	30	stairwell
09	name qualifier	31	floor
10	qualification	32	door
11	mailee role descriptor	33	supplementary despatch information
12	defining authority	34	supplementary delivery point data
13	postcode	35	delivery service qualifier
14	country name	41	country code
15	region	43	multi-country region
16	town	44	international routing information

UPU S42:2006 also defines element sub-types that can indicate parts or instances of elements.

A.4.10.2 UPU S53:2009, *Exchange of Name and Address Data*

The components defined in UPU S42:2006 are referred to in this standard. No additional components are defined.

A.4.11 *US FGDC Thoroughfare, Landmark and Postal Address Data Standards*

The US FGDC Address defines both simple and complex address components for:

- Address Number Elements

- Address Number Prefix, Address Number, Address Number Suffix, Separator Element, Complete Address Number, Address Number Range

- Street Name Elements
  - Street Name Pre Modifier, Street Name Pre Directional, Street Name Pre Type, Street Name, Street Name Post Type, Street Name Post Directional, Street Name Post Modifier, Complete Street Name
- Subaddress Elements (apartments, offices, suites, etc.)
  - Subaddress Type, Subaddress Identifier, Subaddress Element, Complete Subaddress
- Landmark Name Elements
  - Landmark Name, Complete Landmark Name
- Place, State, and Country Name Elements
  - Place Name, Complete Place Name, State Name, ZIP Code, ZIP Plus 4, Country Name
- USPS Postal Address Elements
  - USPS Box Type, USPS Box ID, USPS Box, USPS Box Group Type, USPS Box Group ID, USPS Route, USPS Address, USPS General Delivery Point
- USPS Address Lines
  - Delivery Address, Place, State, ZIP

A.5 Classification of addresses (address types)

A.5.1 *AFNOR XP Z10-011, Specification postales – Addresse postale (France)*

Address classification is not in the scope of this standard.

A.5.2 *Australia and New Zealand*

A.5.2.1 AS/NZS 4819:2003, *Geographic information – Rural and urban addressing* (Australa and New Zealand)

The standard describes two types of addresses, each including a different number of components:

- Rural address: simple (non-complex) addresses, Complex (non-simple) addresses, utility addresses and ranged addresses
- Urban address: rural address with land access only, rural address incorporating postcode and country options and suitable for delivery overseas.

A.5.2.2 AS 4590:2006, Interchange of client information (Australia)

AS 4590:2006 refers to legacy addresses which are addresses that do not conform to AS/NZS 4819:2003 (usually because they were created before the standard was established).

In addition, AS 4590:2006 includes the address component 'address usage code', which identifies the role or use of the address in relation to the client. They include

- primary property address
- secondary property address
- residential
- temporary accommodation
- business
- address when overseas
- delivery address
- postal/correspondence address

A.5.3 *BS 7666-0:2006,* Spatial datasets for geographic referencing – Part 0: general model for gazetteers and spatial referencing

BS 7666-0:2006 classifies addressable objects corresponding to the addresses, according to their type. A high-level classification is defined as follows:

- Residential
- Commercial
- Mixed residential and commercial
- Unclassified
- Land
- Agricultural
- Service and public
- Transport and utility

A more detailed classification can by provided in the implementation, with details of the classification described in the metadata.

A.5.4 *INSPIRE D2.8.I.5 Data Specification on Addresses –Guidelines*

The INSPIRE data specification has its focus on the address itself and does not attempt to define or classify the addressable object(s) to which it is possibly related.

The specification does thus not include any classification of addresses into different ‘address types’, based on the purpose of the address or the type of addressable object (e.g. like ‘postal address’ or ‘location address’).

Also no classification or types of addresses are defined based on different types of schemas or rules used to compose an address from a set of address components (e.g. like ‘postal address’, ‘street addresses’, ‘area addresses’ or ‘rural address’).

A.5.5 *ISO 19112:2003, Geographic information – Spatial referencing by geographic identifiers*

Address classification is not applicable to this standard.

A.5.6 *ISO/TS 15000-5:2005, Electronic Business Extensible Markup Language (ebXML) - Part 5: ebXML Core Components Technical Specification, Version 2.01 (ebCCTS)*

The International Trade and Business Processes Group of UN/CEFACT maintains a library of business information entities (e.g. store address, business address, etc.), each built from core components (e.g. street name, city, etc.).

A.5.7 *Japanese addressing system*

In Japan addressing and addresses depend on three kinds of laws and differ between urban area and rural areas:

1. The concept of *jusho* (address) is defined in the *minpo* (Civil Code), i.e. the place where the person or judicial person mainly exists is his/her '*jusho* (address)'.
2. *Jusho* (address) based on *jukyo hyoji* (indication of residential address). Inside some urban areas, *jusho* (addresses) are assigned according to the *jukyo hyoji ni kansuru horitsu* (act on indication of residential addresses), the Addressing Act. This act was established in 1962 in order to improve the complex address in urban area and is applied to addresses or location indications of offices or other facilities in urban area.
3. *Jusho* (address) based on *chiban* (parcel number). In other areas, addresses are determined using the *chiban* (parcel number) in real estate registration conducted according to the *fudosantokiho* (real property registration act). The *chiban* (parcel number) used inside the address is called *banchi* (place number).
4. *Jusho* (address) used inside state-owned land.

A.5.8 *OASIS CIQ v3.0 Approved Committee Specifications CS02*

The AddressTypeList has the following elements:

- Airport
- Business
- CaravanPark
- CommercialPark
- CommunityDevelopment
- EducationalInstitution
- Entertainment
- Hospital
- Location
- Marina
- MilitaryBase
- OverseasMilitary
- Port
- Primary
- RecreationalPark
- Resort
- RetirementVillage
- Rural
- Secondary
- ShoppingCentre
- SportingCentre
- Urban

A.5.9 *SANS 1883*

A.5.9.1 SANS 1883-1

The following twelve types of address, each constructed from a different combination of address elements, are defined.

- Building address
- Farm address
- Informal address
- Intersection address
- Landmark address
- SA Post Office box address
- SA Post Office poste restante address
- SA Post Office site address
- SA Post Office street address
- SA Post Office-type village address
- Site address
- Street address

A.5.9.2 SANS 1883-3

Address classification is not within the scope of this part of the standard.

A.5.10 *UPU*

A.5.10.1 UPU S42:2006, *International postal address components and templates*

Address classification is not in the scope of this standard.

A.5.10.2 UPU S53:2009, *Exchange of Name and Address Data*

Address classification is not in the scope of this standard.

A.5.11 *US FGDC Thoroughfare, Landmark and Postal Address Data Standards*

The standard classifies addresses according to their syntax, that is, their data elements and the order in which the elements are arranged. The four broad groups of address classes are Thoroughfare, Landmark, Postal Delivery, and General. Further breakdowns and a summary of components are provided below:

1. Thoroughfare address classes
   - Numbered Thoroughfare Address
     - The address must contain a complete address number, complete street name, place name, and state name.
   - Intersection Address
     - The address must contain two or more complete street names separated by separator elements, place name, and state name.
   - Two Number Address Range
     - The address must contain two complete address numbers separated by a hyphen (first number must be greater than second), a complete street name, place name, and state name.
   - Four Number Address Range

- The address must contain four complete address numbers, representing the left low, left high, right low, and right high complete address numbers for the block or transportation segment. The address must also contain a complete street name, place name, and state name.

- Unnumbered Thoroughfare Address
  - The address must contain a complete street name (without a complete address number predecessor), place name, and state name.

2. Landmark address classes

- Landmark Address
  - The address must contain a complete landmark name (without a complete address number predecessor or complete street name), place name, and state name.
- Community Address
  - The address must contain a complete address number, a complete landmark name (or complete place name), place name, and state name. The address must not contain a complete street name.

3. Postal delivery address classes

- USPS Postal Delivery Box
  - The address must contain a USPS Box, USPS Route, place name, and state name.
- USPS Postal Delivery Route
  - The address must contain a USPS Address (Rural Route, Highway Contract, or overseas military format), a place name, and state name.
- USPS General Delivery Office
  - The address must contain a USPS General Delivery Point, place name, and state name.

4. General address classes

- General Address Class
  - The general address class handles all of the above classes for files in which the various classes may be mixed together. This class may also include addresses that do not conform to any of the above classes.

A.6 Metadata

A.6.1 *AFNOR XP Z10-011, Specification postales – Addresse postale (France)*

Metadata is not in the scope of this standard.

A.6.2 *Australia and New Zealand*

A.6.2.1 AS/NZS 4819:2003, *Geographic information – Rural and urban addressing* (Australa and New Zealand)

The standard does not treat quality management, life cycle, and metadata as separate components, however it does deal with some of their aspects by the requirement to register positional accuracy of geocoding on an address level by means of either accuracy value (maximal distance from) or containment (yes/no), and temporal information about creation, deletion, or modification.

A.6.2.2 AS 4590:2006, Interchange of client information (Australia)

The data elements in this standard have been defined according to a set of metadata components that are based on ISO/IEC 11179-3:2003, *Information technology -- Metadata registries (MDR) -- Part 3: Registry metamodel and basic attributes*. The metadata components of each data element are *name, synonymous name, definition, source standards, data type* (e.g. alphanumeric, alphabetic, alphabetic upper case, numeric), *representation class* (e.g. code, date, text, etc), *field size maximum, representation layout, domain values* (i.e. the set of representations of permissible instances of the data element) *and guide for use and examples*. In instances where non-standard code descriptions are used, it is required that the descriptions be accompanied by metadata as agreed by involved parties.

A.6.3 *BS 7666-0:2006,* Spatial datasets for geographic referencing – Part 0: general model for gazetteers and spatial referencing

BS 7666-0:2006 specifies the following mandatory metadata elements for a gazetteer:

- *name*: name of the gazetteer;
- *scope*: description of the content of the gazetteer, including the rules for inclusion or exclusion;
- *territory of use*: geographic domain of the street gazetteer;
- *gazetteer owner*: the organization or organizations with overall responsibility for the gazetteer;
- *custodian*: organization or organizations responsible for the compilation and maintenance of the data in the gazetteer;
- *coordinate system*: coordinate reference system used in the gazetteer to describe position;
- *current date*: the date at which the gazetteer can be considered to be current.

It also has provision for the following optional metadata elements:

- *coordinate axis units: unit of measure of coordinates;*
- *metadata date: date of last update of metadata;*
- *classification scheme(s):any classification schemes used in the gazetteer;*
- *state coding scheme: the coding scheme used to define the logical state of a object recorded in the gazetteer;*

- *language: the language(s) used in the gazetteer for names;*
- *character set: any non-English character set(s) used to record entries in the gazetteer;*
- *external cross-referencing scheme(s): any external cross-referencing schemes used in the gazetteer to reference the object, other than that defined in this Standard.*

A.6.4 *INSPIRE D2.8.I.5 Data Specification on Addresses –Guidelines*

The metadata in this standard have been defined according to INSPIRE Metadata Implementing Rules and ISO 19115 so they can be implemented according to ISO 19139 (this standard provides XML examples).

The metadata describing a spatial data set or a spatial data set series related to the theme *Addresses* comprise the metadata elements required by Regulation 1205/2008/EC (implementing Directive 2007/2/EC of the European Parliament and of the Council as regards metadata) for spatial datasets and spatial dataset series as well as some additional specified metadata elements.

A.6.5 *ISO 19112:2003, Geographic information – Spatial referencing by geographic identifiers*

Metadata is in the standard, but reference is also made to ISO 19115, *Geographic information – Metadata*. Metadata is defined for location instances, specifically.

For a spatial reference system:

- *domainOfValidity*: geographic area within which the reference system occurs. Mandatory.
- *overallOwner*: authority with overall responsibility for the spatial reference system. Mandatory.

For a location type:

- *definition*: the way in which location instances are defined. Mandatory.
- *territoryOfUse*: geographic area within which the location type occurs. Mandatory.
- *owner:* name of organization or class of organization able to create and destroy location instances. Mandatory

For a gazetteer:

- *scope:* description of the location types contained in the gazetteer. Optional.
- *territoryOfUse:* geographic domain covered by the gazetteer. Mandatory.
- *custodian:* name of the organization responsible for maintenance of the gazetteer. Mandatory.
- *coordinateSystem:* name of coordinate reference system used in the gazetteer for describing position. Optional.

For a location instance:

- *temporalExtent:* date of creation of this version of the location instance. Optional.

- *geographicExtent:* description of the location instance. Mandatory.
- *administrator:* name of organization responsible for defining the characteristics of the location instance

A.6.6 *ISO/TS 15000-5:2005, Electronic Business Extensible Markup Language (ebXML) - Part 5: ebXML Core Components Technical Specification, Version 2.01 (ebCCTS)*

This standard contains metadata for registries of information. The metadata are for geographic data in general. The metadata included/described are for a registry class, including version, replacement, status, administrative, status, association, representation and descriptive information, as well as change history.

A.6.7 *Japanese addressing system*

Metadata is not applicable in the review of the Japanese addressing system.

A.6.8 *OASIS CIQ v3.0 Approved Committee Specifications CS02*

Metadata is not addressed (only *DataQuality* attribute, see above) as such, however, some of the code lists/enumeration could be regarded as providing metadata about an address (see examples below).

Metadata is not defined for addresses specifically, however, the specification is extensible: 'All elements in Name, Address and Party namespaces support extensibility by allowing for any number of attributes from a non-target namespace to be added.' (3.9 in the specification). Thus one could add any number of metadata items.

Below a few code lists/enumerations as examples.

- *AddressTypeList*: Airport, Business, Caravan Park, Community Development, Educational Institution, Entertainment, Hospital, Location, Marina, Military Base, Overseas Military, Port, Primary, Recreational Park, Resort, Retirement Village, Rural, Secondary, Shopping Centre, Sporting Centre, Urban
- *AddressUsageList*: Business, Billing, Communication, Contact, Mailing, Personal, Postal, Residential
- *AdministrativeAreaTypeList*: City, State, Territory, Province
- *SubAdministrativeAreaTypeList*: County, District, Province, Region
- *LocalityTypeList*: Municipality, Post Town, Place, Suburb, Town, Village, Area, Zone

There are quite a few more, including code lists for country or locality names, types of delivery, types of post offices, etc.

A.6.9 *SANS 1883*

A.6.9.1 SANS 1883-1

The standard contains metadata for addresses specifically. The following attributes for an address are included:

- *coordinateReferenceSystem*: Coordinate reference system which is usually single but may be compound (ISO 19111:2007). Mandatory only if the location of the address is included.
- *descriptiveNote*: Free text that describes how to identify the service delivery point accurately when one is there. Optional.
- *elevationLevel*: Ordinal indicating the level above or below ground. Mandatory only if the address type contains a CompleteBuildingUnitIdentifier.
- *pointOfObservation*: Relative position to the physical structures and/or other electronic data according to which the address point location was captured. Refers to the latitude and longitude. Mandatory.
- *custodian*: The party that accepts accountability and responsibility for the data and ensures appropriate care and maintenance of the resource. Mandatory.
- *originator*: The party who created the resource, i.e. a reference to the original source from where the resource provider obtained the data, and where the address was created. Mandatory.
- *resourceProvider*: The party that supplies the resource, i.e. the organization that provides or distributes the address dataset. The organization could either be a source of original address data, a collator of address datasets, an organization that adds value to the addresses, or an agent acting as distributor on behalf of the custodian. Mandatory.
- *addressType*: The type of the address as specified in section 6 of this standard. Mandatory.
- *lifeCycleStage*: The life cycle stage of the address. Mandatory.
- *status*: Whether the address was assigned by the official address issuing body (official and official alternate), or an unofficial variant (unofficial). Mandatory.

A.6.9.2 SANS 1883-3

SANS 1883-3 specifies that for metadata, one should use SANS 1878-1:2005, South African spatial metadata standard Part 1: Core metadata profile, which is the South African profile (subset) of ISO 19115:2003, Geographic information – Metadata.

A.6.10 *UPU*

A.6.10.1 UPU S42:2006, *International postal address components and templates*

Metadata is not in the scope of this standard.

A.6.10.2 UPU S53:2009, *Exchange of Name and Address Data*

Supports some metadata in the structure called a ‘roster’. The roster carries information about the dictionary of elements effectively used in the carried dataset and some statistics of the dataset.

A.6.11 *US FGDC Thoroughfare, Landmark and Postal Address Data Standards*

The standard mentions metadata extensively throughout the document and specifically states that the transfer of data always needs to be accompanied by copyright information, use restrictions, contact information, data lineage information, known data defects and a description of the geographic area that the data represents. The standard recommends using the Federal *Content Standard for Digital Geospatial Metadata*, which provides a uniform, consistent and well-known way to express those things amongst others.

A.7 Encoding

This clause deals with the following questions:

1. What is encoded? Is a *data model* specified?
2. Which *encoding* is defined?
3. Which *exchange scenarios* are supported by the encoding?

In addition to the above, *special characteristics* of the reviewed standards related to address data exchange are described.

A.7.1 *AFNOR XP Z10-011, Specification postales – Addresse postale (France)*

Encoding is not within the scope of this standard.

A.7.2 *Australia and New Zealand*

An encoding is not defined in AS/NZS 4819:2003 and AS 4590:2006.

An XML schema has been developed for AS 4590:2006 by the Australian Government Information Management Office. The schema does not form part of the standard but incorporates the provisions of the standard.

A.7.3 *BS 7666-0:2006,* Spatial datasets for geographic referencing – Part 0: general model for gazetteers and spatial referencing

Encoding is not in the scope of this standard.

A.7.4 *INSPIRE D2.8.I.5 Data Specification on Addresses –Guidelines*

Data specification: The Data Specification on Addresses defines a generic UML-based application schema, including explanatory text and examples for each feature, attribute and association.

Encoding: GML Application Schema is default for all INSPIRE themes

Exchange Scenarios: The INSPIRE directive is the legal framework for the INSPIRE Data Specifications. According to the rules in the directive, any public authority in the EU that holds address data is obliged to make these data available in the common data format defined by the specification for addresses.

Special characteristics: Outcomes relevant to the exchange of address data are not limited to the Data Specification on Addresses but are also contained in other Implementing Rules. It is unique by providing Legal Framework. As mentioned public bodies in the EU member states are obliged to make their address data available in the specified format and under conditions not restricting their use. This obligation is

supported by specification of rules for Data and Service Sharing (access cannot restrict data use) and Network Services such as Download and Transformation Services, Discovery & View Services and envisioned Invoke Services.

A.7.5 *ISO 19112:2003, Geographic information – Spatial referencing by geographic identifiers*

Encoding is not in the scope of this standard.

A.7.6 *ISO/TS 15000-5:2005, Electronic Business Extensible Markup Language (ebXML) - Part 5: ebXML Core Components Technical Specification, Version 2.01 (ebCCTS)*

Encoding is not in the scope of this standard.

A.7.7 *Japanese addressing system*

Encoding is not applicable for the review of the Japanese addressing system.

A.7.8 *OASIS CIQ v3.0 Approved Committee Specifications CS02*

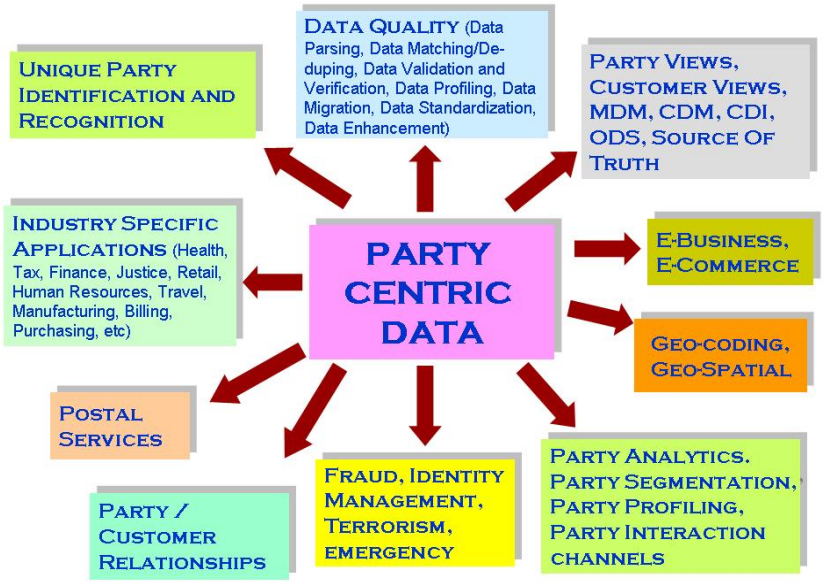


Figure A.15. OASIS Party centric data

Data specification: xNAL defines its own data model.

Encoding: XML defined by XML Schema

Exchange Scenarios: supports wide range of exchange scenarios as shown in Figure A.15.

A.7.9 *SANS 1883*

A.7.9.1 SANS 1883-1

The current scope of SANS 1883-2 states that the standard specifies how address records shall be stored in databases and how address data shall be transferred or exchanged between organizations. Geocoding, data cleaning and/or address

verification are examples of where this transfer and exchange are required. The standard specifies how addresses complying with SANS 1883-1 shall be exchanged in various encoding formats.

While the scope above mentions various **encoding** formats, the SABS XML group is currently working on an **XML schema** based on SANS 1883-1. In other words, SANS 1883-2 could well be limited to an XML encoding only. The XML schema has not yet been made available to the public. Initial findings are that the semi-structured nature of XML is suitable for the EBNF that was used in SANS 1883-1 to define address elements and types.

A.7.9.2 SANS 1883-3

SANS 1883-3 provides guidelines for allocating and maintaining addresses, so it does not deal with the transfer and exchange of address data.

A.7.10 *UPU*

A.7.10.1 UPU S42:2006, *International postal address components and templates*

S42 defines XML-based Postal Address Template Definition Language (PATDL) that provides encoding for postal address rendering rules and differs from other encoding standards used to encode address components and metadata. Rendering rules are expressed and the basis of address components defined in S42a.

A.7.10.2 UPU S53:2009, *Exchange of Name and Address Data*

Data specification: The UPU S42:2006 dictionary of elements is included as default but the standard is open for external dictionaries of elements.

Encoding: XML defined by XML Schemas

Exchange Scenarios: post to post, mailer to post, post to mailer, and mailer to mailer. A post-to-post scenario could include transmission of information concerning undeliverable addresses; a mailer-to-post scenario could involve transmission of electronic data pertaining to each piece in a mailing; a post-to-mailer scenario could consist in the dissemination of change of address information; a mailer-to-mailer scenario could send a name and address file to be incorporated with other similar files in a planned mailing

Special characteristics: In addition to exchange of name and address data S53 enables also transfer of rendering rules (UPU S42:2006 PATDL templates).

A.7.11 *US FGDC Thoroughfare, Landmark and Postal Address Data Standards*

Data specification: defined in the ‘Content and Classification’ part of the standard and implemented in XML Schema.

Encoding: XML defined by XML Schema. Two packages of data are carried: ‘address data’ and metadata.

Exchange Scenarios: There is a complete section on Data Exchange. The purpose of this section is three-fold: to provide a template for the XML documents and metadata that will move addresses from place to place, to provide information on preparing address data to be packaged, and to provide information on un-packaging

address data that has been received. The address standard is designed to be flexible enough to fit within current data sharing methods. There are two basic forms of sharing data between parties:

- Monolithic, in which all records are in the exchange package.
- Transactional, in which the exchange package records include commands to add or remove a record from the local copy of all records.

The Standard supports both of these forms, using a slightly modified structure to enable transactional exchanges.

Special characteristics: In addition the standard provides specification of processes that have to be implemented by data producers and consumers to export and import data.

A.8 Quality Management

A.8.1 *AFNOR XP Z10-011, Specification postales – Addresse postale (France)*

Quality management is not in the scope of this standard.

A.8.2 *Australia and New Zealand*

A.8.2.1 AS/NZS 4819:2003, *Geographic information – Rural and urban addressing* (Australa and New Zealand)

The standard does not treat quality management, life cycle, and metadata as separate components, however it does deal with some of their aspects by the recommendation to register positional accuracy of geocoding on an address level by means of either accuracy value (maximal distance from) or containment (yes/no), and temporal information about creation, deletion, or modification.

A.8.2.2 AS 4590:2006, Interchange of client information (Australia)

This standard includes a data element to transfer the *geocode positional accuracy* measures identified in AS/NZS 4819:2003. In addition, the standard provides guidance and examples to help ensure the appropriate usage of each data element.

A.8.3 *BS 7666-0:2006,* Spatial datasets for geographic referencing – Part 0: general model for gazetteers and spatial referencing

BS 7666-0:2006 mandates a quality report and specifies the quality aspects to be reported:

- lineage
- currency
- positional accuracy
- attribute accuracy
- completeness
- logical consistency

A.8.4 *INSPIRE D2.8.I.5 Data Specification on Addresses –Guidelines*

This standard includes a description of data quality elements and sub-elements as well as the associated basic data quality measures to be used to describe data related to the spatial data theme *Addresses.* Additionally, recommendations on minimum data quality are included for specific elements.

Data quality information can be described at level of spatial object (feature), spatial object type (feature type), dataset or dataset series. Data quality information at spatial object level is modelled directly in the application schema. Data quality elements include completeness, positional accuracy, logical consistency, temporal accuracy, and thematic accuracy. Table A.4 shows data quality elements and their scopes.

Table A.4 Quality elements

Data Quality Element	Data Quality Sub Element	Scope(s)
Completeness	Commission	dataset
Completeness	Omission	dataset
Positional accuracy	Absolute of external accuracy	dataset
Logical consistency	Conceptual consistency	spatial object type
Logical consistency	Domain consistency	spatial object type
Temporal accuracy	Temporal consistency	spatial object type
Thematic accuracy	Non-qualitative attribute correctness	spatial object type

A.8.5 *ISO 19112:2003, Geographic information – Spatial referencing by geographic identifiers*

Quality management is not in the scope of this standard. By implication other ISO/TC 211 standards on quality apply.

A.8.6 *ISO 15000-5:2005, Electronic Business Extensible Markup Language (ebXML) - Part 5: ebXML Core Components Technical Specification, Version 2.01 (ebCCTS)*

Quality management is not in the scope of this standard.

A.8.7 *Japanese addressing system*

Quality management is not applicable in the review of the Japanese addressing system.

A.8.8 *OASIS CIQ v3.0 Approved Committee Specifications CS02*

Data quality is managed in the standard through the *DataQuality* attribute whereby users can define the quality of the address data ‘at the time’ when the address data is represented in xAL. For example, if the address data is free format text and is not structured, the quality of the address data is ‘poor’. Improvement to the quality of the address data represented in xAL is outside the scope of xAL.

But: ‘This specification does not mandate any data verification rules or requirements to address the quality of address data represented in xAL. It is entirely up to the data exchange participants to establish them.’ (3.8.2 and 3.8.3 in the specification)

And: ‘CIQ specifications are not a quality enhancing process as commonly understood or akin to a certificate of test results against some objective specification.’ (from the General Introduction and Overview)

The data quality sections for the name (xNL) and the address (xAL) are identical (the data quality section for the address, 4.8., refers the reader to the data quality section for the name, i.e. 3.8). Please note that xAL provides a metadata structure to represent any address data in a standard and consistent manner to enable the use of address data for various purposes. One of the biggest challenges in industry is consistent representation and use of address data to support various needs and this is what xAL is aiming to address.

The xAL schema allows for data quality information to be provided as part of the entity using an attribute *DataQuality* that can be set to either ‘*Valid*’ or ‘*Invalid*’ (default values), if such status is known. If the *DataQuality* attribute is omitted, it is presumed that the validity of the data is unknown. Users can customise the *DataQuality* code list to add more data quality attributes (e.g. confidence levels) if required.

The specification also makes provision to define partial data quality where some parts of the content are correct and some are not or unknown.

(Reference: 4.6 Data Quality and 3.8 Data Quality in the specification)

A.8.9 *SANS 1883*

A.8.9.1 SANS 1883-1

Quality management is not in the scope of this standard.

A.8.9.2 SANS 1883-3

SANS 1883-3 provides guidelines for allocating and maintaining addresses, so it does not deal with quality management of address data. It does specify that for metadata, one should use SANS 1878-1:2005, South African spatial metadata standard Part 1: Core metadata profile, which is the South African profile (subset) of ISO 19115:2003, Geographic information – Metadata.

A.8.10 *UPU*

Quality management is not in the scope of this standard.

A.8.11 *US FGDC Thoroughfare, Landmark and Postal Address Data Standards*

This standard defines data quality and provides ways to measure each element, attribute, and classification. Five core elements of quality are included in the standard: attribute (thematic) accuracy, logical consistency, completeness, positional accuracy, and temporal accuracy, all with specific regards to an address quality measure.

(Reference 7.8 Appendix H (Informative): Quality Measures By Data Quality in the standard)

A.9 Life cycle

A.9.1 *AFNOR XP Z10-011, Specification postales – Addresse postale (France)*

Life cycles are not in the scope of this standard.

A.9.2 *Australia and New Zealand*

A.9.2.1 AS/NZS 4819:2003, *Geographic information – Rural and urban addressing* (Australa and New Zealand)

This standard includes temporal information about creation, deletion, or modification of an address.

A.9.2.2 AS 4590:2006, Interchange of client information (Australia)

This standard includes a currency code data element to detail the relationship between a person and an address. Its four options indicate whether it is the person's prior, current, future or temporary address. The standard also includes date and time fields to record when an address started being used (address start date and time) and when an address stopped being used (address end date and time).

A.9.3 *BS 7666-0:2006,* Spatial datasets for geographic referencing – Part 0: general model for gazetteers and spatial referencing

BS 7666-0:2006 contains a simple life cycle for all entities, specifying the recording of the following:

- entry date (when it was recorded)
- update date (when the record was last updated)
- start date (when the entity came into being)
- end date (when the entity ceased to exist)

A.9.4 *INSPIRE D2.8.I.5 Data Specification on Addresses –Guidelines*

This standard does cover the lifecycle of addresses. It takes into consideration that although the lifecycle of an address sometimes will broadly mirror the life-cycle of the addressable object to which it relates, there are also many instances where an address or one of the components that make up an address may change in response to events unrelated to physical changes in the property.

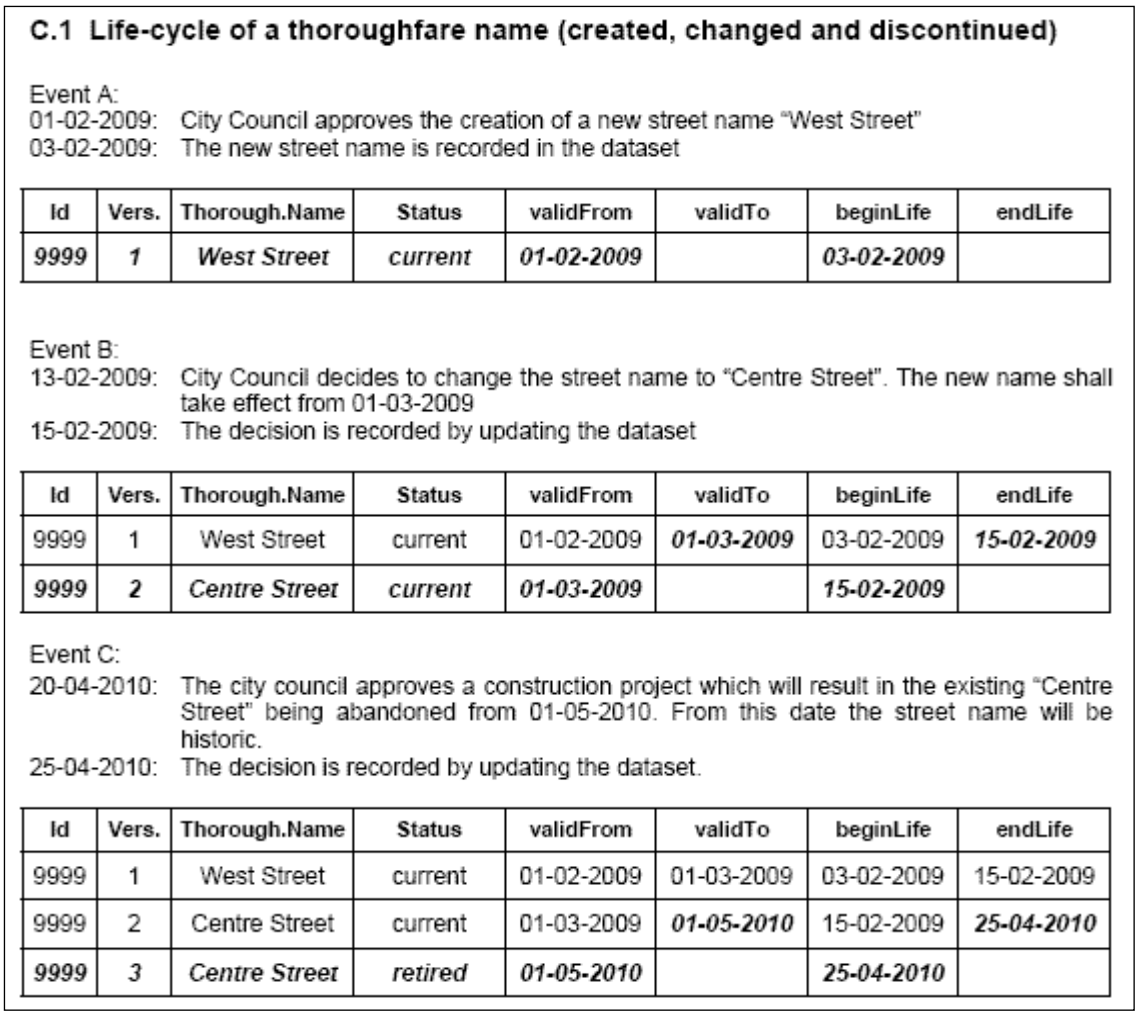
Examples of such cases include:

- the municipal authority may create an address for a property that has not yet been built;
- a new occupier may wish an existing property to be known by a new name;
- the postal service may make a change to a postcode to reflect new delivery patterns;
- an error in the recording of an address component or attribute may need to be corrected.

The INSPIRE Data Specification application schema distinguishes between, two sets of life cycle attributes:

- attributes that relate to a spatial object and its version in the dataset (represented by the attributes beginLifespanVersion and endLifespanVersion)
- attributes that reflects the status and validity of the real world phenomena (represented by 'status', 'validFrom' and 'validTo'), for example of the address, the postcode or the thoroughfare name.

The concept is illustrated in the example in Figure A.16.



C.1 Life-cycle of a thoroughfare name (created, changed and discontinued)

Event A:
01-02-2009: City Council approves the creation of a new street name "West Street"
03-02-2009: The new street name is recorded in the dataset

Id	Vers.	Thorough.Name	Status	validFrom	validTo	beginLife	endLife
9999	*1*	*West Street*	*current*	*01-02-2009*		*03-02-2009*	

Event B:
13-02-2009: City Council decides to change the street name to "Centre Street". The new name shall take effect from 01-03-2009
15-02-2009: The decision is recorded by updating the dataset

Id	Vers.	Thorough.Name	Status	validFrom	validTo	beginLife	endLife
9999	1	West Street	current	01-02-2009	*01-03-2009*	03-02-2009	*15-02-2009*
9999	*2*	*Centre Street*	*current*	*01-03-2009*		*15-02-2009*	

Event C:
20-04-2010: The city council approves a construction project which will result in the existing "Centre Street" being abandoned from 01-05-2010. From this date the street name will be historic.
25-04-2010: The decision is recorded by updating the dataset.

Id	Vers.	Thorough.Name	Status	validFrom	validTo	beginLife	endLife
9999	1	West Street	current	01-02-2009	01-03-2009	03-02-2009	15-02-2009
9999	2	Centre Street	current	01-03-2009	*01-05-2010*	15-02-2009	*25-04-2010*
9999	*3*	*Centre Street*	*retired*	*01-05-2010*		*25-04-2010*	

Figure A.16. From INSPIRE D2.8.I.5 Data Specification on Addresses – Guidelines, Annex C

A.9.5 *ISO 19112:2003, Geographic information – Spatial referencing by geographic identifiers*

ISO 19112:2003 specifies the recording of the temporal extent (date of creation) of all location instances.

A.9.6 *ISO/TS 15000-5:2005, Electronic Business Extensible Markup Language (ebXML) - Part 5: ebXML Core Components Technical Specification, Version 2.01 (ebCCTS)*

Life cycles are not in the scope of this standard.

A.9.7 *Japanese addressing system*

Life cycles are not applicable in the review of the Japanese addressing system.

A.9.8 *OASIS CIQ v3.0 Approved Committee Specifications CS02*

The address life cycle is covered in the address standard whereby one can define the current status of the address, i.e. whether it is currently in use, was in use in the past, or will be in use at some date in the future, planned, current or used, retired or historic, etc.

It is defined as a user customizable attribute where users can define the lifecycle and also the validity of the address.

The lifecycle stages are defined by the user, as an address can be used for various purposes and there is no assumption that an address standard should define all potential lifecycle of addresses as they are used for various purposes in the community. Users define the lifecycle in metadata through codelists in xAL. Users can define a lifecycle code list and can also control the use of the code list to support various applications (as each application might want to use only a snippet of the code list or want to add more to the general code list for lifecycle of address) by defining business rules through generic code/context value association standard that is also available as part of xAL.

A.9.9 *SANS1883*

A.9.9.1 SANS 1883-1

This standard covers the life cycle, and a lifecycle stage is defined as an attribute of an address of type Enumeration. The different life cycle stages are:

UnknownStage (0): The life cycle stage is unknown.

Future (1): The address has been planned as a point of service delivery, but is not yet in use (before becoming Active).

Active (2): The address is available or in use as a point of service delivery, i.e. the address is in use.

Retired (3): The address was used at some stage but is not in use any longer, e.g. an address that is replaced by a subdivision or consolidation i.e. the address is not used anymore.

Also the metadata contains mandatory lifecycle information:

lifeCycleStage: The life cycle stage of the address. Mandatory.

status: Whether the address was assigned by the official address issuing body (official and official alternate), or an unofficial variant (unofficial). Mandatory.

A.9.9.2 SANS 1883-3

SANS 1883-3 provides guidelines for allocating and maintaining addresses, which includes life-cycle issues such as maintaining addresses and archiving deprecated and superseded addresses.

A.9.10 *Universal Postal Union*

A.9.10.1 UPU S42:2006, *International postal address components and templates*

Life cycles are not in the scope of this standard.

A.9.10.2 UPU S53:2009, *Exchange of Name and Address Data*

Life cycles are not in the scope of this standard.

A.9.11 *US FGDC Thoroughfare, Landmark and Postal Address Data Standards*

The status of the life cycle specifically for an address is referenced in the standard. Associated with it are: Lifecycle status (potential, proposed, active, retired). Additionally, it contains start date, end date, and future date.

A.10 Address aliases

A.10.1 *AFNOR XP Z10-011, Specification postales – Addresse postale (France)*

A dictionary of valid abbreviations is provided.

A.10.2 *Australia and New Zealand*

A.10.2.1 AS/NZS 4819:2003, *Geographic information – Rural and urban addressing* (Australa and New Zealand)

AS/NZS 4819:2003 requires that one form of address should be treated as principal and other as aliases. It points out that valid aliases may identify alternative accesses to address site (mailing, front door, large truck). The standard provides some cases when other valid aliases may occur, like section of highway overlapping with local road, corner address with multiple accesses etc. Invalid aliases are those with incorrect spellings of components. A number of various examples is provided to help custodians of addresses to categorize address forms as principal, valid alias and invalid alias.

A.10.2.2 AS 4590:2006, Interchange of client information (Australia)

New Zealand Post Standard, AS 4590:2006 support aliases in the form of dictionary abbreviations. The standard recognizes that overseas addresses have many formats and may require special character sets. To accommodate this, the standard makes provision for four unstructured lines to record overseas address details. Not all lines need to be used. Clause 4.4.1 includes examples of the four unstructured lines being used to represent overseas addresses

A.10.3 *BS 7666-0:2006,* Spatial datasets for geographic referencing – Part 0: general model for gazetteers and spatial referencing

Address aliases are not within the scope of this standard.

A.10.4 *INSPIRE D2.8.I.5 Data Specification on Addresses –Guidelines*

The INSPIRE Data Specification for Addresses does not systematically support a comprehensive concept of address aliases.

The specification includes a support for representation of alias addresses or address components that have their origin in different languages.

This is done by means of the generic INSPIRE data type ‘Geographical name’ (refer to Figure A.17), that supports the concept where the proper noun related to a specific feature could be represented in different languages and scripts. The Geographical name data type is used in all name-based attributes of an address or address component e.g.: apartment, building, or site name, thoroughfare name, address area name, administrative unit name, and postal name.

It is also possible to represent address aliases by using the specification’s attribute ‘status’ by using the value of ‘alternative’. According to the definition this status represents an address that is in common use, but is different from the master address determined by the official body that allocates addresses or by the dataset custodian.

Finally, outside the address application schema, several ‘alias’ address instances or components referring to the same addressable object, could be linked via the generic INSPIRE identifier (inspireid).

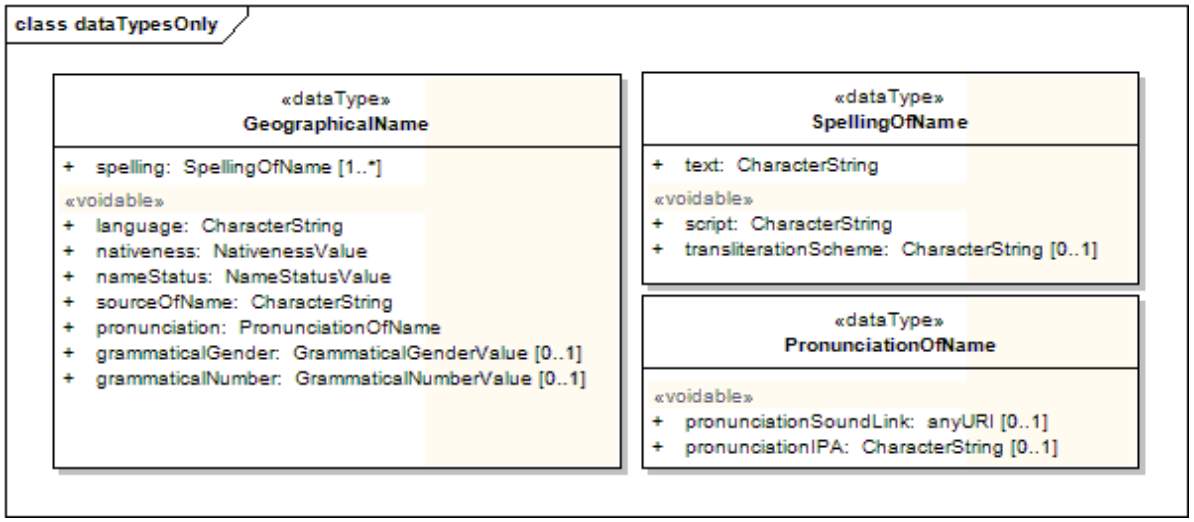


Figure A.17. From INSPIRE Data Specification on Geographical names

A.10.5 *ISO 19112:2003, Geographic information – Spatial referencing by geographic identifiers*

The data model includes one or more optional ‘alternative geographic identifier’ element(s) as part of a location instance. The data type of this element is a CharacterString and the domain of allowable values is free text, a number or a code. Thus the ‘alternative geographic identifier’ could be used for alternative identifiers or names (aliases) in different languages.

A.10.6 *ISO/TS 15000-5:2005, Electronic Business Extensible Markup Language (ebXML) - Part 5: ebXML Core Components Technical Specification, Version 2.01 (ebCCTS)*

Address aliases are not within the scope of this standard.

A.10.7 *Japanese addressing system*

Address aliases are not applicable in the review of the Japanese addressing system.

A.10.8 *OASIS CIQ v3.0 Approved Committee Specifications CS02*

Address aliases are not within the scope of the standard (xAL).

A.10.9 *SANS 1883*

A.10.9.1 SANS 1883-1

SANS 1883-1 defines a mandatory attribute 'language', which is the ISO 639-1 two-letter code that indicates which one of the official languages should be used for the street name type (e.g. Street or Road), street name modifier (e.g. Extension) and the street name directional (e.g. South or Western). The language attribute is set to 'EN' by default.

It is interesting to note that many of the African languages do not have an equivalent for most of the street name types, such as 'Street', and therefore the English word is used.

A.10.9.2 SANS 1883-3

SANS 1883-3 deals extensively with names in multiple languages, prospective addresses (e.g. for new townships), name changes and retaining the names of address components that have been superseded. All of these are forms of aliases. SANS 1883-3 states that the different language versions for a particular address should be stored in multiple address records'. Refer to Figure A.18.

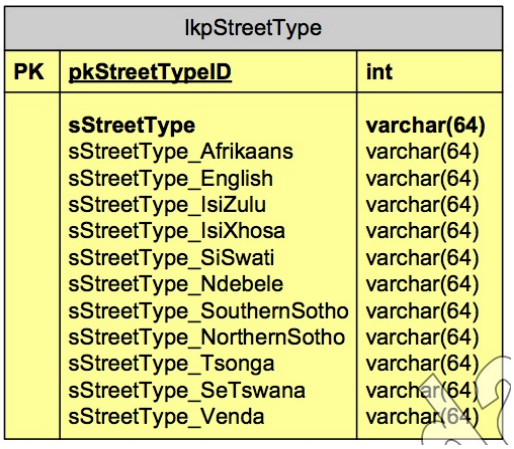


Figure A.18. SANS 1883-3, Accommodating different languages in the lkpStreetType table

A.10.10 *UPU*

A.10.10.1 UPU S42:2006, *International postal address components and templates*

Not within the scope of the standard.

A.10.10.2 UPU S53:2009, *Exchange of Name and Address Data*

UPU S53:2009 supports aliases by defining data structure that can store alternates. This data structure is provided in element 'item' and its child element 'representation' (refer to Figure A.19). 'Item' stores various name and address representations of the same addressable object that are linked via 'ItemIdentifier'. Various aliases of the same address can be carried in various representations.

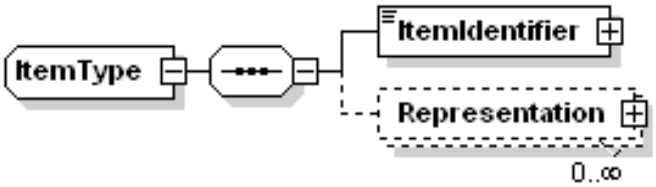


Figure A.19. The data type for aliases in UPU S53:2009

A.10.11 *US FGDC Thoroughfare, Landmark and Postal Address Data Standards*

Address alias management is not covered as separate issue.

It notes that:

- If aliases or abbreviated versions of address components are needed for a specialized purpose such as mailing or emergency dispatch, the variants can be created in views or export routines.
- The Related Address ID element can be used to link address alias to its official form.

Moreover, each address should have status assigned that qualifies. Status can take one of the following three values:

Official
The address or name as designated by the Address Authority*.*

Alternate or Alias
An alternate or alias to the official address or name that is also in official or popular use. The Related Address ID *can be used to link an alternate or alias to the* Address ID *of the official address. There are two types of alternate or alias names, official and unofficial, each of which has subtypes.*

> ***Official Alternate or Alias:*** *These are alternate names designated by an official* Address Authority*. Subtypes include, but are not limited to:*
> – Official Renaming Action of the Address Authority
> *An Address Authority may replace one address or name with another, e.g. by renaming or renumbering. The prior, older address should be retained as an alias, to provide for conversion to the new address.*
> – Alternates Established by an Address Authority

An Address Authority may establish a name or number to be used in addition to the official address or name. For example, a state highway designation (State Highway 7) may be given to a locally-named road, or a memorial name may be applied to an existing street by posting an additional sign, while the local or original name and addresses continue to be recognized as official.

Unofficial Alternate or Alias: *These are addresses or names that are used by the public or by an individual, but are not recognized as official by the Address Authority: Some examples include, but are not limited to:*
– Alternates Established by Colloquial Use in a Community
An address or name that is in popular use but is not the official name or an official alternate or alias.
– Unofficial Alternates Frequently Encountered
In data processing, entry errors occur. Such errors if frequently encountered may be corrected by a direct match of the error and a substitution of a correct name.
– Unofficial Alternates In Use by an Agency or Entity
For data processing efficiency, entities often create alternate names or abbreviations for internal use. These must be changed to the official form for public use and transmittal to external users.
– Posted or Vanity Address
An address that is posted, but is not recognized by the Address Authority (e.g. a vanity address on a building).

Verified Invalid
An address that has been verified as being invalid, but which keeps appearing in address lists. Different from Unofficial Alternate Names in that these addresses are known not to exist.

A.11 Definitive address datasets (reference dataset)

A.11.1 *AFNOR XP Z10-011, Specification postales – Addresse postale (France)*

Definitive address datasets are not within the scope of this standard.

A.11.2 *Australia and New Zealand*

A.11.2.1 AS/NZS 4819:2003, *Geographic information – Rural and urban addressing* (Australa and New Zealand)

This standard provides requirements and guidelines that should be used in creation and maintenance of the reference data sets. It does not identify a specific custodian, but states local governments shall maintain responsibility for addressing. The standard lists a number of feature types that should be considered as types of addressable objects and requires that all of them shall have addresses assigned and registered accordingly.

A.11.2.2 AS 4590:2006, Interchange of client information (Australia)

This standard identifies the data elements required for the interchange of client information. It does not nominate a specific definitive address data set nor a specific custodian.

A.11.3 *BS 7666-0:2006,* Spatial datasets for geographic referencing – Part 0: general model for gazetteers and spatial referencing

The purpose of BS 7666-0:2006 is to provide a specification for a definitive address dataset.

A.11.4 *INSPIRE D2.8.I.5 Data Specification on Addresses – Guidelines*

The main purpose of the INSPIRE Data Specification on Addresses is required to facilitate the interoperability of address information between the Member States. The specification therefore targets any address dataset and custodian and does not explicitly promote the concept of having one definitive reference address dataset or base in each country, region or city.

However, the INSPIRE directive forms the legal framework for the data specifications. A number of the principles behind the directive relate to the concepts and benefits of practice in the member states of having a single source of reference data. Refer to Figure A.20.

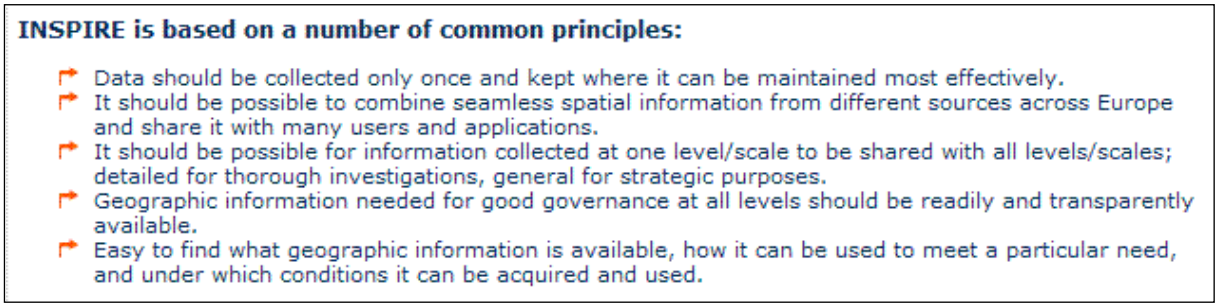


Figure A.20. INSPIRE principles from INSPIRE home page

The INSPIRE implementing rules that will be mandatory for the EU member states, is expected to encourage directly towards a best practice according to the principle of one definitive address dataset.

For example, the requirement to provide access to address datasets and services according to the implementing rules will be easier and less costly for the member states to comply with if public bodies only hold a single reference dataset.

A.11.5 *ISO 19112:2003, Geographic information – Spatial referencing by geographic identifiers*

It is highly likely that many reference datasets are associated with this standard. Custodians of the datasets vary, depending on the type of gazetteer.

A.11.6 *ISO/TS 15000-5:2005, Electronic Business Extensible Markup Language (ebXML) - Part 5: ebXML Core Components Technical Specification, Version 2.01 (ebCCTS)*

Definitive address datasets are not within the scope of this standard.

A.11.7 *Japanese addressing system*

This clause describes how addresses and address data are maintained in Japan.

***Chihojichiho* (Local Autonomy Act)**

In Japan, the management of districts are carried out by *shichoson* (municipalities) as mandated under law. This law, the *chihojichiho* (Local Autonomy Act) specifies that, a *shichoson* (municipality) can create or abolish a *machi-or-aza* (district) with the approval of the municipal council. After gaining this approval, the mayor of the *shichoson* (municipality) shall notify the prefectural governor of the changes, and the prefectural governor will then publish this information as an official announcement.

***Fudosantokiho* (Real Property Registration Act)**

Real property registration of land and buildings is based on the *fudosantokiho* (Real Property Registration Act) and is managed by the Registry Office under the Ministry of Justice. The registry office notifies the *shichoson* (municipality) of any changes to land and building registration based on the *chihozeiho* (local tax act). This notification enables the municipalities to know the land and building numbers, which are essential for *jusho* (address) management.

Conversely, the creation or abolition of a *machi-or-aza* (district) by a *shichoson* (municipality) is reflected in the land registry record. Occasionally, the Registry Office adjusts these, through renumbering or adding offset-numbers to the *machi-or-aza* (district) number when *machi-or-aza* (district) integration takes place, and to avoid confusion or ambiguities in the numbering.

The Registry Office has completed the computerization of the land registry record books and they have been available on the Internet for browsing (as a paid service) since 2005. Digitization of maps including cadastral maps, etc. is ongoing.

***Jukyo hyoji ni kansuru hiritsu* (act on indication of residential address)**

Based on the *jukyo hyoji ni kansuru horitsu* (act on indication of residential address), *shichoson* (municipalities) specify ordinances and their enforcement regulations in order to establish more concrete procedures. The ordinances and their enforcement regulations are mostly same contents though there might be the differences of *jukyo bango* (residence number), the start point of *kiso bango* (frontage number), numbering distance intervals, building definition, etc.

Municipalities, however, also have self-initiatives for the creation of *jukyo hyoji* (indication of residential address). The creation of *jukyo hyoji* can be applied as a whole or independently for each a *machi-or-aza* (district). Even if the districts are adjacent they could use different addressing schemes.

When applied, the *shichoson* (municipality) shall use the *jukyo hyoji* (indication of residential address) for their administrative services. The *shichoson* (municipality) shall also provide an address indication plate on each corner of the *gaiku* (block).

Other

Based on the *juminkihondaichoho* (basic residential book act), *shichoson* (municipalities) compile *juminkihondaicho* (basic residential record books) listing the name date of birth, gender, address, etc. of residents in the municipality. These listings are used to provide services to the citizens and in some instances, used to verify residency within the municipality. Previously, each municipality developed the basic residential books independently. Today, as part of e-Government initiatives, a database of all basic residential books covering every municipality was developed. Since 2002, this database has been shared among the municipalities over a secure dedicated network. Identification cards containing an integrated circuit (IC) are distributed to each resident and used for electric applications and verification

procedures. The address database, however, is not open to the public due to the protection of personal information.

A.11.8 *OASIS CIQ v3.0 Approved Committee Specifications CS02*

There is no reference dataset associated with this standard. The purpose of this standard is for 'defining, representing, interoperating, and managing' party centric information, including addresses. The focus is on representing an address data in a standard manner without losing its content and quality and for the exchange of that data through XML. The xAL specification does not depend or is not prescribed to work on any address dataset. It has been tested to work on address data from most countries. For example, Google Maps and Google Earth use xAL for representing address data globally.

A.11.9 *SANS 1883*

A.11.9.1 SANS 1883-1

Custodians for address data still have to be assigned in South Africa. The South African Geographic Names Council is responsible for ensuring one name per feature and they have delegated the mandate of assigning unique street names and addresses to the municipalities (local authorities). The South African Post Office is responsible for postal addresses. How the custodians maintain the address dataset is not applicable. A ballpark estimate of completeness by Coetzee & Cooper (2007b) is that only 50% of the country's addresses are stored in an address database (not necessarily all in the same database).

A.11.9.2 SANS 1883-3

Definitive address datasets are not in the scope of this standard.

A.11.10 *Universal Postal Union*

A.11.10.1 UPU S42:2006, *International postal address components and templates*

Definitive address datasets are not in the scope of this standard.

A.11.10.2 UPU S53:2009, *Exchange of Name and Address Data*

Definitive address datasets are not in the scope of this standard.

A.11.11 *US FGDC Thoroughfare, Landmark and Postal Address Data Standards*

There is no single reference dataset within the United States. Addresses in the United States are not assigned at the national level; any nationwide dataset is an aggregate of addresses from county or local municipalities. There are 2 reference datasets associated with the standard. The US Postal Service (USPS) and the US Census Bureau both maintain nationwide address files (as do numerous private sector companies). How the USPS and the Census Bureau maintain their datasets and the measure of completeness is not applicable. The standard does provide profiles to conform with the USPS publication 28, and the National Emergency Numbering Association requirements.

A.12 Address rendering (print/write/display)

A.12.1 *AFNOR XP Z10-011, Specification postales – Addresse postale (France)*

Chapter 5 'Address transcription' carries formatting rules expressed in human language by defining the content of 6 named address lines. The split into lines is provided in form of decision table depending on address type and presence or absence of some elements. French address elements are defined before specification of formatting rules. Strict rules on address size (no more than 6 lines and no more than 38 characters) are supported by comprehensive dictionaries of standardized abbreviations.

A.12.2 *Australia and New Zealand*

A.12.2.1 AS/NZS 4819:2003, *Geographic information – Rural and urban addressing* (Australa and New Zealand)

Rendering is not in the scope of this standard.

A.12.2.2 AS 4590:2006, Interchange of client information (Australia)

Rendering is not in the scope of this standard.

However, it includes informative Annex E providing formatting rules from Australia Post in specifying for each element its position in formatted address. Refer to Figure A.21. For example the position of the locality name is defined as follows:

> *Requirement:*
>
> Considered an essential element of an address.
>
> *Position within address:*
>
> The locality name is the first item located in the last line of the address, together with the State abbreviation and postcode.
>
> *Format/presentation:*
>
> This information must be printed in upper case, with no punctuation. Generally, the locality name is not to be abbreviated, however certain elements of the locality name may be abbreviated based on common acceptance, i.e. MT for Mount and ST for Saint.

Moreover it provides examples of formatted addresses for various address types with identification of address elements as on figure below.

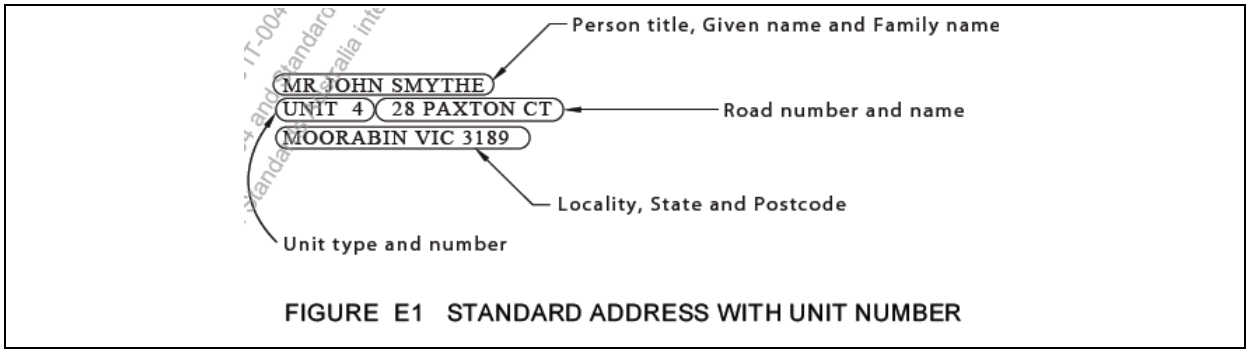


Figure A.21. Standard address with unit number

Similarly, **New Zealand Post Standard** provides formatting rules by specifying for each element its position and illustrating various nuances with examples. Refer to Figure A.22.

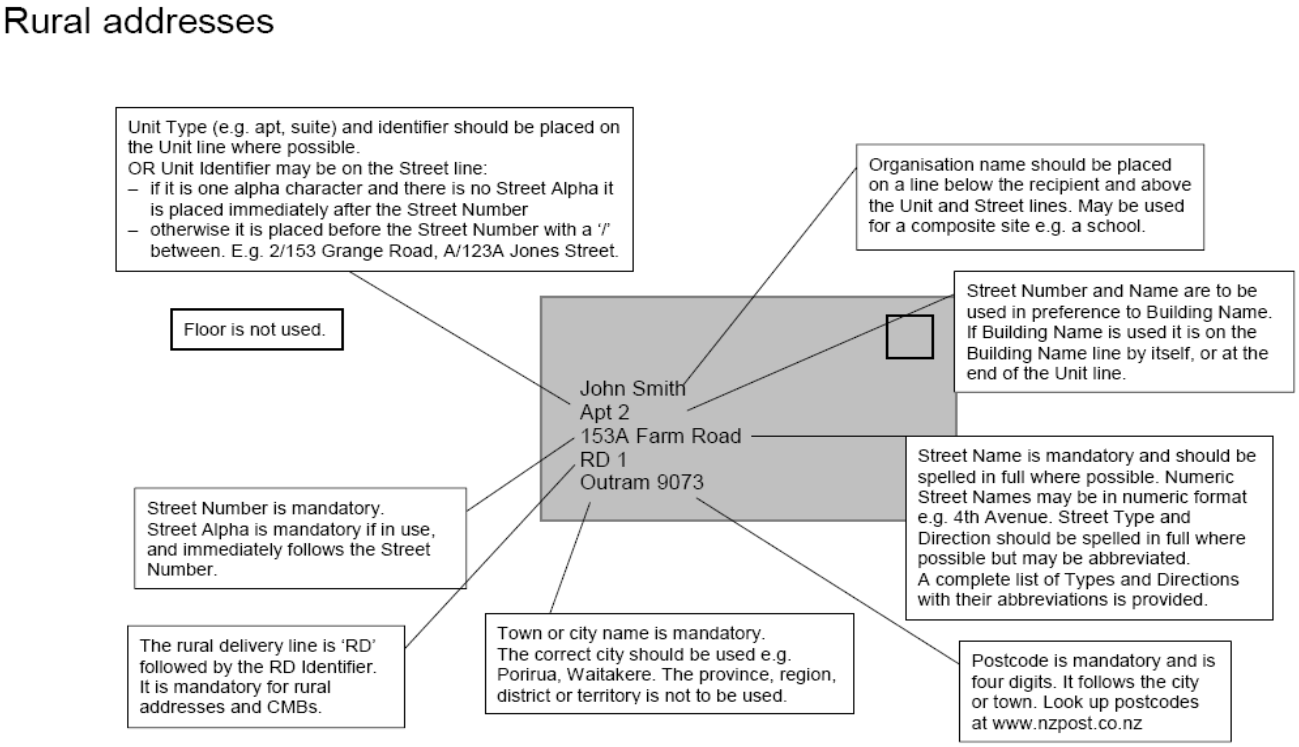


Figure A.22. Rural addresses (New Zeland Post 2006)

It should be noted that in both cases formatting rules are expressed basing on separately defined elements. They assume a classification of addresses and refer to rules of abbreviation.

A.12.3 *BS 7666-0:2006,* Spatial datasets for geographic referencing – Part 0: general model for gazetteers and spatial referencing

Rendering is not in the scope of this standard.

A.12.4 *INSPIRE D2.8.I.5 Data Specification on Addresses –Guidelines*

Rendering is not in the scope of this standard.

A.12.5 *ISO 19112:2003, Geographic information – Spatial referencing by geographic identifiers*

Rendering is not in the scope of this standard.

A.12.6 *ISO/TS 15000-5:2005, Electronic Business Extensible Markup Language (ebXML) - Part 5: ebXML Core Components Technical Specification, Version 2.01 (ebCCTS)*

Rendering is not in the scope of this standard.

A.12.7 *Japanese addressing system*

In Japan, there are several ways in which addresses are rendered in practice. Therefore, there is no standard for address rendering. *Jusho* (address) rendering uses the opposite order of components to that of Western countries. For example, the following order applies in urban and rural areas of Japan, respectively:

Urban areas: *yubin bango* (postal code), *todofuken* (prefecture), *shichoson* (municipality), *machi-or-aza* (district), *gaiku fugo* (block code), *jukyo bango* (residence number)

Rural areas: *yubin bango* (postal code), *todofuken* (prefecture), *shichoson* (municipality), *machi-or-aza* (district), *banchi* (place number)

There is variation in address rendering in Japanese language because:

- Chinese and Arabic numerals are mixed.
- Single byte (half-width) characters and double byte (full-width) characters can be mixed.
- In the case of the *machi-or-aza* (district) with a related numeric part, sometimes only the related numeric part is used independently of the name part, even though the *machi-or-aza (district)* has a proper name and has no direct relation with any numeric part.

There is also variation in alphabet or notation conversion, e.g. ISO 3602:1989, *Documentation -- Romanization of Japanese (kana script)* is rarely used in Japan. People can easily recognize the identical addresses; however, it is not always easy for computers to recognize the address structure. For example, the *jusho* (address) in Figure A.23 and Figure A.24 is from the same *machi-or-aza* (district), i.e. the underlined part.

Case 1:
Ibaraki Ken, Tsukuba Shi, Karima, 2530 Banchi 2
茨城県つくば市苅間２５３０番地２
茨城県つくば市苅間 2530 番地 2
茨城県つくば市苅間二五三〇番地二
Ibaraki Ken, Tsukuba Shi, Karima, 2530 Banchi no 2
茨城県つくば市苅間２５３０番地の２
茨城県つくば市苅間 2530 番地の 2
茨城県つくば市苅間二五三〇番地の二
Ibaraki Ken, Tsukuba Shi, Karima, 2530-2
茨城県つくば市苅間 2530-2

Figure A.23. Examples of Japanese address rendering

Case 2:

Tōkyō To, Chiyoda Ku, Kōjimachi Roku-Chōme, 1 Ban, 25 Gō

東京都千代田区麹町六丁目一番二十五号

東京都千代田区麹町六丁目一番二五号

Tōkyō To, Chiyoda Ku, Kōjimachi 6-Chōme, 1 Ban, 25 Gō

東京都千代田区麹町６丁目１番２５号

東京都千代田区麹町 6 丁目 1 番 25 号

Tōkyō To, Chiyoda Ku, Kōjimachi 6-Chōme, 1-25

東京都千代田区麹町六丁目 1-25

Tōkyō To, Chiyoda Ku, Kōjimachi, 6-1-25

東京都千代田区麹町 6-1-25

Figure A.24. Examples of Japanese address rendering

As shown in Figure 24, Case1 is based on a *chiban* (parcel number), and Case2 is based on *jukyo hyoji* (indication of residential address). The term '*Roku*' in Case2 means 'six' in Japanese. Officially, '*Roku-Chome*' is a proper noun and part of the *machi-or-aza* (district) name, however it is usually treated as a number in the presentation of an address. The number is represented by a double byte (full-width) Japanese kanji-character, a double byte (full-width) numeric character or a half-width numeric character. In traditional Japanese, the name of a unit such as *Banchi* (place name), *Go* (number) and so on is added after the number. A hyphen may also used to separate the numbers to add clarity to the rendering presentation.

Another difference from European address rendering is the existence of vertical writing. Although Figure A.24 shows Japanese addresses in horizontal writing for comparison with romanized addresses, vertical writing is also frequently used. This is because the traditional writing was vertical in Japan. Addresses can be rendered either vertical or horizontal. Address rendering is deeply subjective to culture and history. See also Wikipedia article on vertical writing (Wikipedia 2011a).

A.12.8 *OASIS CIQ v3.0 Approved Committee Specifications CS02*

Rendering is not in the scope of this standard.

A.12.9 *SANS 1883*

A.12.9.1 SANS 1883-1

The EBNF definitions for address types in SANS 1883-1 to some extent define the order in which address elements appear in an address. However, the standard does not specify how addresses shall be split into lines and it does not go into the details of specifying that in English addresses the number goes before the street name (333 Pretorius Street), while in Afrikaans addresses it is the other way round (Pretoriusstraat 333). The reality in South Africa is that in bulk mailing, addresses are rendered differently, depending on a customer's language preference. Rendering is not included in the scope of SANS 1883-1, but the rendering rules for South African addresses are provided by the SA Post Office in a UPU S42:2006 template.

A.12.9.2 SANS 1883-2

SANS 1883-3 provides guidelines for allocating and maintaining addresses, so it does not deal with the rendering of addresses.

A.12.10 *Universal Postal Union*

A.12.10.1 UPU S42:2006, *International postal address components and templates*

UPU S42:2006 supports address rendering in two ways. First, in Part A, it provides languages (human and computer readable) for expression of address formats together with definitions of postal address elements. Second, in Part B, it provides country specific address templates expressed in languages and elements defined in Part A.

UPU S42:2006 defines two languages for expressing address renditions: a computer readable Postal Address Template Definition Language (PATDL) and a human readable Natural Language Template Notation (NLT).

PATDL is defined by an XML Schema. It allows encoding of address line composition from elements and specification of conditions (triggers) on which a line is or is not to be rendered. Specification of address lines includes also rules for delimiting (for example, the requirement for a dash between door and street number).

Example:

In a typical address template one will find the definition of street and PO Box lines with the condition that the street line shall be rendered when element ‘thoroughfare’ is populated and the PO Box line shall be rendered when element ‘delivery service identifier’ is populated. This logic, encoded in PATDL, will look as follows:

```
<lineSelect>
    <isPopulated>U40.19</isPopulated>
    <lineName lineNumber="009">post office box</lineName>
    <isPopulated>U40.21</isPopulated>
    <lineName lineNumber="009">thoroughfare with plot</lineName>
</lineSelect>
```

It reads as:

If element U40.19 (‘delivery service identifier’) is populated then render the ‘post office box’ line.
If element U40.21 (‘thoroughfare’) is populated then render the ‘thoroughfare with plot’ line.

The thoroughfare line will be specified as follows.

```
<lineData>
 <lineName lineNumber="009">thoroughfare with plot</lineName>
 <lineComponent>
        <elementData>
               <elementId>U40.21</elementId>
               <elementDef>thoroughfare</elementDef>
               <requiredIfSelected>Y</requiredIfSelected>
               <fldJustify>L</fldJustify>
               <posStart>001</posStart>
        </elementData>
        <elementData>
               <elementId>U40.24</elementId>
```

```
                <elementDef>street number or plot</elementDef>
                <fldJustify>L</fldJustify>
                <posStart>001</posStart>
            </elementData>
        </lineComponent>
    </lineData>
```

The same rules encoded in NLT will be:

```
<
! case 1 for post office box address !
<[\(40.19 delivery service identifier)\]>
<[\(40.21 thoroughfare)[40.24 street number or plot]\]>
>
Test for the choice block, first condition is (40.19)
Test for the choice block, second condition is (40.19)
```

Note that for the sake of the example above the address line is very simple and does not include details like street type, directional, door etc.

In addition to basic address rendering rules PATDL can also encode user preferences, rules for splitting lines when they appear too long, behaviors when data errors are found and other pieces of information useful in automatic rendering of addresses.

An important feature of PATDL is that it is opened for external dictionaries of elements. Although address templates provided in S42b are composed from elements defined in S42a, PATDL does not require it and templates can be built on the base of any set of address elements, including national elements, OASIS, INSPIRE etc.

Templates provided in Part B are based on national formatting guidelines from postal operators and are developed in cooperation with national address experts. S42b also describes generic design and mapping conventions. S42b is modified from time to time to reflect new countries added to the list. The rendering of addresses needs to be kept up to date with any changes in S42b in order to remain as effective as possible.

A.12.10.2 UPU S53:2009, *Exchange of Name and Address Data*

Address rendering is not within the scope of this standard.

A.12.11 *US FGDC Thoroughfare, Landmark and Postal Address Data Standards*

The standard is aligned with the USPS Publication 28, ‘Postal Addressing Standard’. that describes USPS address formats. It specifies the order of elements in the two last lines of address. Variations of ‘delivery address line’ are provided for USPS addresses (PO Box, General Delivery, Rural Route and Highway Contract) as well as addresses in Puerto Rico that contain an additional address line and elements for specifying the address area called urbanization. Significant consideration is given to dictionaries of standardized abbreviations.

A.13 Address assignment schemes

A.13.1 *Introduction*

An address assignment scheme identifies the components that make up and address and describes how values are assigned to these components.

An address assignment scheme establishes the framework of rules, both spatial and non-spatial, adopted by an address authority for assigning addresses within its area of jurisdiction. The address assignment scheme includes, as needed, rules governing address numbering, street naming, block definition, subaddresses (suites, offices, apartments, etc.), and place names. The address assignment scheme also may define address baselines (north-south or east-west lines used as a zero starting point for address numbers) and datum points (origin for numbering), polylines (streets, geometric lines, or other lines used to measure address number assignment intervals and ranges within an address system), breakpoints (points along a street denoting where an address range beginning and/or endpoint is located) and breaklines (lines that connect breakpoints to indicate where one scheme ends and another starts) to guide address numbering throughout the area.

Street Addressing and the Management of Cities by Farvacque-Vitkovic et al. (2005) reviews the role of addressing within the array of urban management tools an explores the links between addressing and civic identity, urban information systems, support for municipal services, tax systems, land management and tenure issues, slum upgrading, support for concessionary services, and economic development. It also outlines current and future applications, highlights practices in many African countries, and offers a methodological guide for implementing street addressing initiatives that can be used in any country.

In subsequent sections, the characteristics of an address assignment scheme are discussed and then a number of examples of address assignment schemes are described. For each example of an address assignment scheme, the components that make up an address are listed. For each component, a description of how values are assigned and maintained is provided. The latter description includes who assigns the values (e.g. which authority), what rules are followed in the assignment of these values (e.g. specific address numbering rules), whether values can change over time and how these changes are managed.

A.13.2 *Characteristics of address assignment schemes*

A.13.2.1 Thoroughfare-based address assignment schemes

A.13.2.1.1 Axial or grid type address assignment scheme

In axial address assignment schemes, address numbering is organized around axes. Address axes typically extend from a common point of origin (the local ‘zero’ point for address numbers), and all numbers increase with distance from the point of origin. The axes, in turn, define the zero point for numbering along streets that cross the axes. Typically, an axial system organizes the streets and address numbering into a grid.

A.13.2.1.2 Linear non-axial address assignment schemes

In a linear non-axial address assignment scheme, each thoroughfare is addressed independently of the other thoroughfares. There are no axes and there is no grid. Each thoroughfare has its own point of beginning for address numbering, and numbers proceed according to a numbering rule from that point to the end of the thoroughfare or the boundary of the address assignment scheme.

A.13.2.2 Area-Based address assignment scheme

In area-based address assignment schemes, complete address numbers are not assigned along a thoroughfare, but within an area denoted by a community name or a block number. Inside the area, address numbers might be assigned according to a spatial pattern (around the block, for example), or by parcel or lot numbers, or chronologically as the buildings are built.

A.13.3 *Example: AS/NZS 4819:2003 rural address assignment scheme*

Addresses in Australia and New Zealand are described by reference to the road on which each address site is located followed by the hierarchy of administrative areas in which the address site is situated (e.g. locality, state/territory, country). In both urban and rural areas, addresses are expressed as a sequence of address elements, being the address number (e.g. 167), road name (e.g. Macquarie Street), locality (e.g. Hobart), state or territory (e.g. Tasmania) and country (e.g. Australia). Sub-address elements are included prior to the address number to identify individual units in multi-unit sites (e.g. Apartment 1809). A building or descriptive name (e.g. Kooyong Tennis Centre) may optionally be included to aid location. (In the case of addresses for postal delivery, a four digit postcode issued by Australia Post and New Zealand Post is also included.)

There are rules governing the allocation of locality names, road names and address numbers. Locality names and road names are required to comply with relevant jurisdictional legislation and guidelines, and to be formally recognised and published by the appropriate jurisdiction. Similarly, address numbers must comply with relevant guidelines and can only be assigned by an authorised addressing authority.

In general, address numbering commences from a datum point at one end of a road. Odd and even numbers are allocated on opposite sides of the road (for example, odd numbers on the left side, even numbers on the right side). In urban areas, the address numbers are determined according to existing or planned lot frontage widths. In rural areas the address numbers are determined according to the measured distance from the datum point, i.e. the distance in metres from the datum point is divided by 10 and rounded to a whole number. Thus an address site 49.532 km from the datum point and situated on the right hand (even) side shall be numbered 4952, whereas an address site on the opposite side of the road would shall be numbered 4953.

Water address numbering can be applied to address sites that are only accessible by water. Water addresses adopt the name of the water body, in place of the road name. Address numbers are distance-based, the distance being measured along the shoreline of the water body. Numbering is in the upstream direction based on logical datum points similar to the principles of rural addressing (e.g. from the mouth or confluence point of the river or creek).

A.13.4 *Example: Canadian address assignment scheme*

The Canadian address assignment scheme is comprised of two different parts: civic address standards and mailing standards.

Civic addresses are created and maintained by the local government and later aggregated and observed by the provincial and federal authorities.

Local government, and municipalities usually have a person who is assigned a role of addressing coordinator. This person acts according to specific by-laws or other legislation created by the same authority.

At the same time, not all governments have such legislation in place and, therefore there are no static rules and regulations on how the addresses are assigned.

Every municipal government has their own rules on address assignment and usually they are governed by a higher authority, such as provincial government. In many cases addresses are created following mailing address format standards derived from Canada Post regulations.

Addresses are created as a result of new land development. After a new set of land parcels are created and registered, the municipality assigns a civic address to each parcel and from this point the address starts its lifecycle. Refer to Figure A.23.

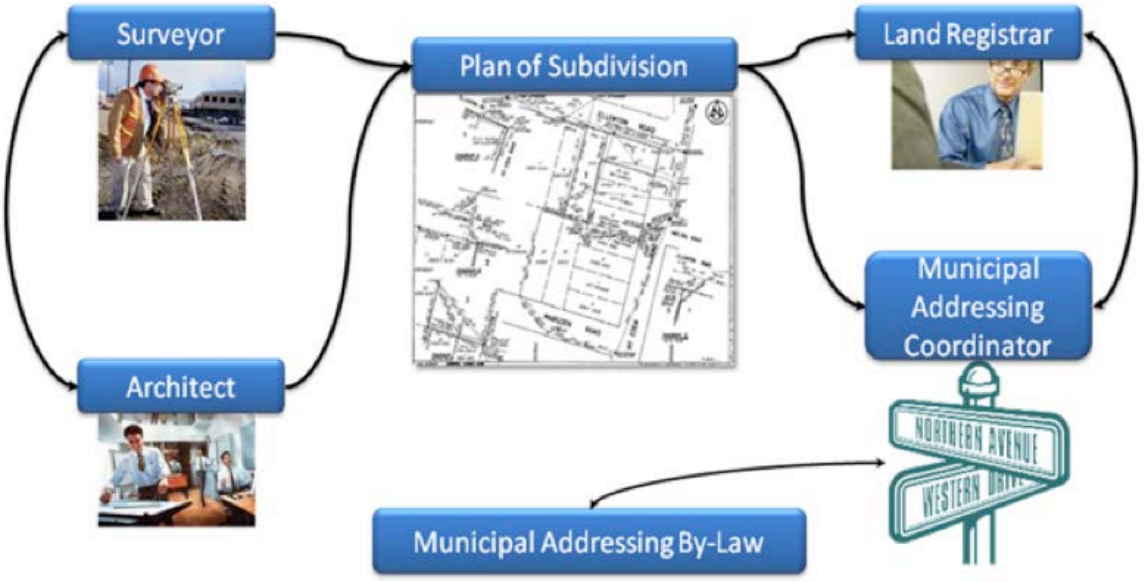


Figure A.25. Canadian address lifecycle

Municipal governments then share new addresses as well as changed ones with other authorities such as provincial and federal agencies and utilities and services suppliers.

One of the main users of these newly created addresses is Canada Post as the national postal authority. Canada Post then assigns postal codes as delivery indexes or creates specific delivery modes in order to provide fast sorting and quality delivery for mail. In some cases based on mail delivery logic, the civic address disappears, and is replaced with other mail delivery methods such as General Delivery, Rural Routes, Large Volume Receivers, etc.

This process creates another addressing subsystem: mailing address.

Visually mailing and Civic Addresses have some minor differences. At the same time, there is a major difference in definition and, therefore, in behaviour and the lifecycle of each. Refer to Table A.5 for examples of civic and mailing addresses,

- *Civic Address* describes a location where the address is physically located and in most cases is related to a track of land described by land title or to a building structure erected. This address is created and own by a government authority and can be retired and/or changed only by the same authority. The trigger to such change is future development or asset maintenance reasons.
- *Mailing Address* describes a point of mail delivery and includes special index (Postal Code) of such delivery. These addresses are created based on known Civic Addresses by the Postal authority. The trigger to address creation, change and retirement is successful and efficient mail delivery reasons. Municipal name changes happen as well based on historical mail delivery factors.

Table A.5 Canadian civic and mailing addresses

Civic Address	Mailing Address
257 CENTRE ST, ANGUS, ON	257 CENTRE ST, SS 2, ANGUS, ON, **L0M1B2**
8 DANDELION LANE, BRACEBRIDGE, ON	8 DANDELION LANE, RR 1, BRACEBRIDGE, ON, **P1L1W8**
1 KING ST W, TORONTO, ON	1 KING ST W, TORONTO, ON, **M5H1A1**
35 CANYON AVE, TORONTO, ON	35 CANYON AVE, NORTH YORK, ON, **M3H 4Y2**

Table A.6 shows the rules and formulas that govern Canadian civic addresses.

Table A.6 Canadian Civic Address rules and formulas

Civic Address Component	Example	Existence	Comments
Street Number	**24**A MAIN STREET WEST, UNIT 5, KITCHENER ON OR 5-**24**A MAIN STREET WEST KITCHENER ON	Must exist	
Street Number Suffix	24**A** MAIN STREET WEST, UNIT 5, KITCHENER ON OR 5-24**A** MAIN STREET WEST KITCHENER ON		
Street Name	24A **MAIN** STREET WEST, UNIT 5, KITCHENER ON OR 5-24A **MAIN** STREET WEST KITCHENER ON	Must exist	
Street Type	24A MAIN **STREET** WEST, UNIT 5, KITCHENER ON OR 5-24A MAIN **STREET** WEST KITCHENER ON		Can be located as Prefix in French
Street Direction	24A MAIN STREET **WEST**, UNIT 5, KITCHENER ON OR 5-24A MAIN STREET **WEST** KITCHENER ON		Can be located as Prefix in French

Civic Address Component	Example	Existence	Comments
Unit Type	24A MAIN STREET WEST, **UNIT** 5, KITCHENER ON		
Unit Number	24A MAIN STREET WEST, UNIT **5**, KITCHENER ON OR **5**-24A MAIN STREET WEST KITCHENER ON		
Municipality	24A MAIN STREET WEST, UNIT 5, **KITCHENER** ON OR 5-24A MAIN STREET WEST **KITCHENER** ON	Must exist	Name of the Census Subdivision as a legal name in Canada
Province	24A MAIN STREET WEST, UNIT 5, KITCHENER ON OR 5-24A MAIN STREET WEST KITCHENER ON	Must exist	

The following provides a formula of the Civic Address:

English version:

Street Number, [***Street Number Suffix***], **Street Name**, [***Street Type***], [***Street Direction***], [***Unit Type***], [***Unit Number***], **Municipality**, **Province**

French version:

Street Number, [***Street Number Suffix***], [***Pre-Street Direction***], [***Pre-Street Type***], **Street Name**, [***Unit Type***], [***Unit Number***], **Municipality**, **Province**

Civic Address is treated as an Addressable Object that has complex many-to-many relations to other Addressable Objects and their attributes. Other Addressable Objects are defined but not limited to a following list:

- Parcel of Land. This is usually defines a title to the land, has legal description and spatial extent.
- Building, defined as any structure used or intended for supporting or sheltering any use or occupancy
- Farms,
- Engineering Structures.

A.13.5 *Example: Costa Rica address assignment scheme in metropolitan areas*

The methodology for the assignment of street addresses in metropolitan areas of Costa Rica is specified in the technical standard (Norma Tecnica) published by Correos de Costa Rica (2002) and the description provided here is based on this standard. The specification standardizes the way of referencing location in cities by means of the block of buildings and the crossing streets concepts. This method is also used in other countries of Latin America.

A.13.5.1 Assignment of street names

Street names consist of two parts: *street type* and *street identifier*. Street type is assigned according to the direction of the street and the street identifier is assigned

according to its position among other streets of the same direction from the central point in the municipality area. The combination of street type and street identifier should be unique.

A.13.5.1.1 Street types

Five distinct street types: *Plaza, Avenida, Calle, Diagonal, Transversal* are allocated to streets according to their directions.

Type 'Plaza' is assigned to squares that have no direction and addresses are allocated around it in internal or external perimeter.

Four other types are allocated according to the angle between its direction and the West East direction as on the Figure A.26 and Table A.7 below:

Table A.7 Street types according to the angle

Street type	Orientation	Angle between street direction and E-W
Avenida	Este Oeste	0º - 29º, 150º - 179º
Calle	Noreste Suroeste	30º - 59º
Diagonal	Norte Sur	60º - 119º
Transversal	Noroeste Sureste	120º - 149º

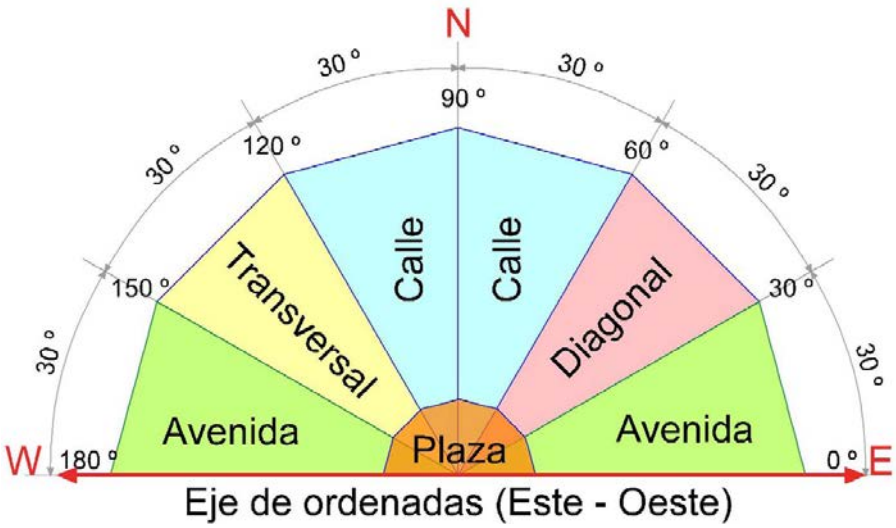


Figure A.26. Assignment of street types

A.13.5.1.2 Street identifier

Street identifiers are assigned in an axial system. The central point of a metropolitan is chosen to be 'the point zero'. Each street of the same direction is identified by a subsequent integer number of the same parity depending on the position in the sequence starting from the point zero (see Figure A.27). New streets created between existing streets will have numbers composed from the lesser number of the two streets and a letter from the Latin alphabet (A, B, C, …) (see Avenidas 2A and 2B created between Avenida 2 and Avenida 4 on Figure A.27).

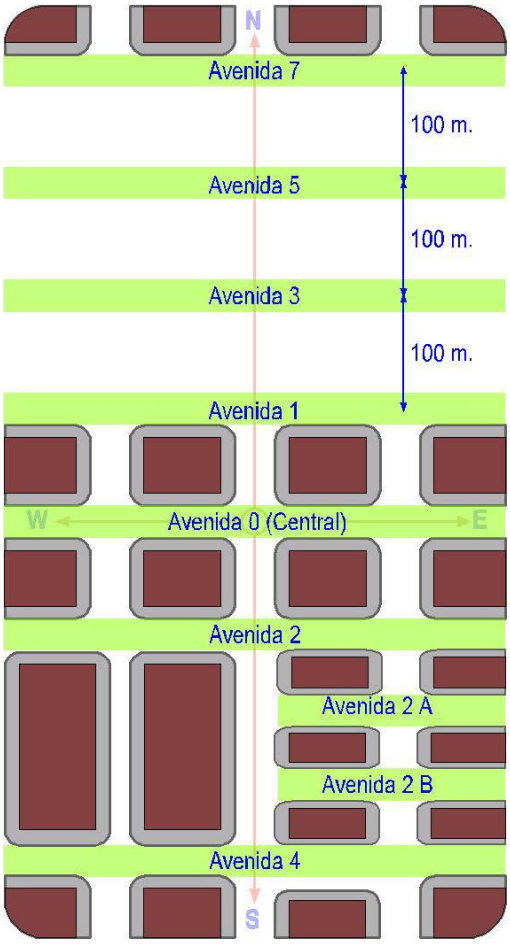


Figure A.27. Assignment of street identifiers from the point zero

Even or odd numbers are assigned to be street identifiers according to the position of the street in relation to the point 'zero' as explained in Table A.8 and Figure A.28.

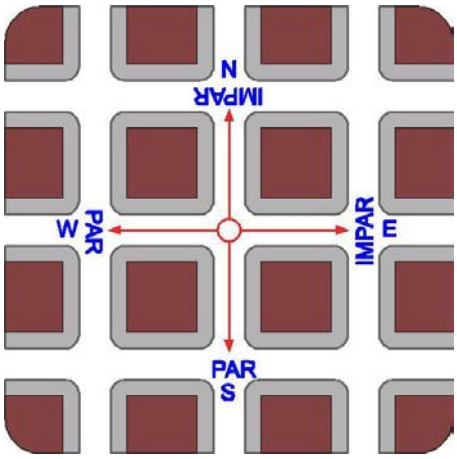


Figure A.28. Parity of street identifiers

Table A.8 Assignment of even and odd street numbers

Street direction/ type	Position from the zero point	Parity
West-East (Avenida)	North	Odd
West-East (Avenida)	South	Even
South-North (Calle)	West	Odd
South-North (Calle)	East	Even

Plazas have numbers assigned according to the numbering of Avenidas. It means that Plaza will have number that is between the numbers of Avenidas neighboring the Plaza from North and South.

Street identifiers are assigned to streets of Transversal and Diagonal types in similar way.

A.13.5.2 Premise numbers

Premise numbers are assigned according to the distance in meters between the address point and the point in which the corner of the block on which the address is located (the corner that is closer to the central point zero).

The distance in meters is rounded to the odd number for premises located on the left side (looking in the direction in which the distance values are growing) and is rounded to the even number for premises located on the right side. See Figure A.29. ('I' stands for odd (*impares*), and P stands for even (*pares*)).

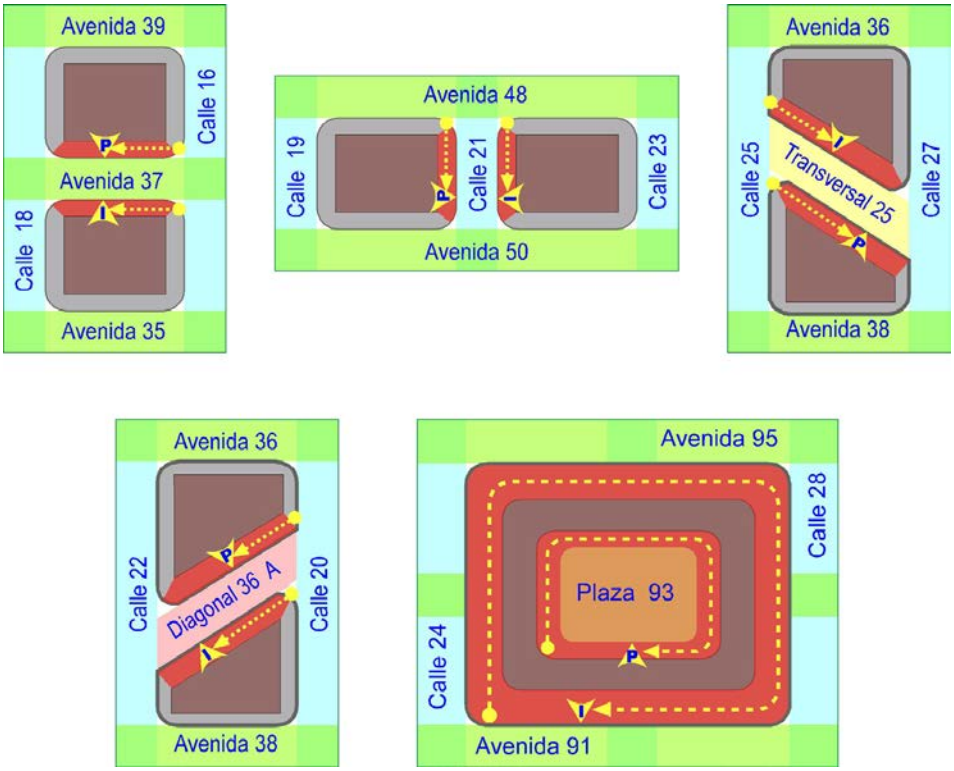


Figure A.29. Directions of premise numbers assignment

Premises located on squares (plaza type) are numbered by subsequent numbers in clockwise direction starting from the point closest to the point zero. Odd numbers are

assigned on the outer perimeter of the square whereas even numbers on the internal perimeter. Therefore any premise within a metropolitan area is identified by four components:

- type of the street on which premise is located
- identifier of the street on which premise is located
- minimal identifier of the street delimiting the block to which premise belongs
- premise number

A.13.6 *Example: Japanese address assignment scheme*

The Japanese addressing system is in most cases different from the street-based addressing system, typically found in Western countries. Basically, the Japanese jusho (address) consists of three elements (except building names, room numbers, etc.):

a) autonomous body names: *todofuken* (prefecture), *shichoson* (municipality), etc.;

b) geographical area names: name of an area typically surrounded by roads, rivers, etc.; and

c) codes and numbers that identify a specific addressable object:

(1) based on *chiban* (parcel number)

(2) based on *jyukyo hyoji* (indication of residential address)

A.13.6.1 Autonomous body names

The structure of autonomous bodies in Japanese addresses is shown in Figure A.30.

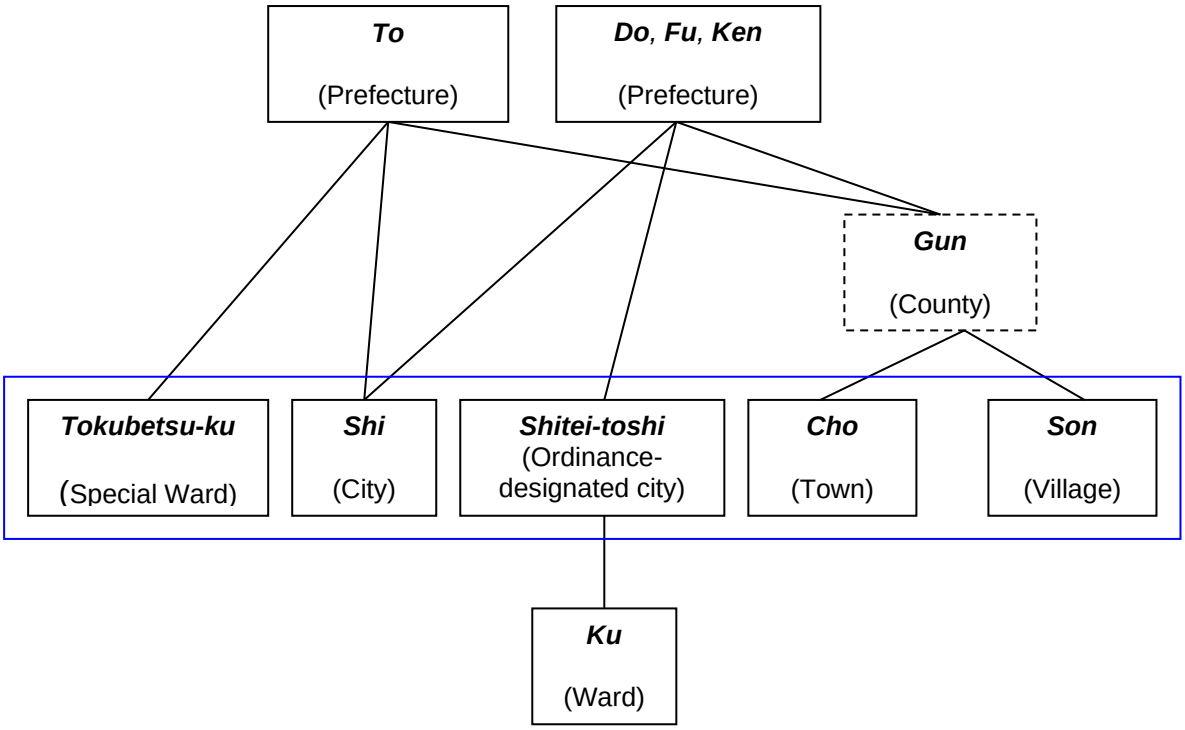


Figure A.30. Autonomous bodies in Japan

The top-level autonomous body is the *todofuken* (prefecture) (47 prefectures). The second-level is *shichoson* (municipality), such as *tokubetsuku* (special wards), *shi* (cities), *cho* (towns) or *son* (villages) (there were 23 special wards, 786 *shi* (cities), 757 *cho* (towns) and 184 *son* (villages) as of April 2010). Only the Tokyo metropolis has the special wards. *Seireishiteitoshi* (ordinance-designated cities) (19 including Osaka and Kyoto, as of April 2010) respectively have several wards (17 including Osaka and Kyoto, at present). In addition, each *cho* (town) and *son* (village) belong to one *gun* (county).The *gun* (counties) served as administrative units in the past, however, they are not used as administrative units today. The *gun* (county) name, however, is still used, in certain places, as a component of an address.

A.13.6.2 Geographical area names

Areas within an area of autonomous body are called *machi-or-aza* (districts). A *machi -or-aza* (district) is an area typically surrounded by roads, rivers, etc. A *machi-or-aza* (district) is based on the old community unit. Sometimes the name comes from local history dating back more than a hundred or even a thousand years.

Recently, urban development works such as land readjustment arranged a new *machi-or-aza* (district) area and its new name. Municipal mergers also sometimes modify the names of *machi-or-aza* (districts) and their areas.

Many *machi-or-aza* (districts) have few or no hierarchical structures. However, sometimes a *koaza* (lower-level district) may exist in a *machi-or-aza* (districts). Historically, *koaza* are primarily used for the management of unique parcel numbers related to agricultural land areas, and there are a number of minor specialized exceptions to their use In this case, the unique parcel numbers existing at the *machi-or-aza* (district) level are omitted from the official address description. Under normal procedures, *shichoson* (municipalities) manage the *machi-or-aza* (district) names used for address description based on the *chihojichiho* (local autonomy act).

A.13.6.3 Codes and numbers based on *chiban* (parcel number)

The Registry Office under the Ministry of Justice manages land properties assigning a number to each parcel in the Land Registry Record Book.

The Registry Office also manages building properties. Basically, a building registry number is the same as the registry number of the parcel at which the building is located, with the exception being a building on multiple parcels of land.

Generally, addresses are not sequential numbers even though the *chiban* (parcel numbers) are arranged along a series of numbers under each *machi-or-aza* (district) or more precisely under each *chiban kuiki* (unit area for numbering parcels), because only the *chiban* (parcel numbers) with buildings are used for addresses. The *chiban* (parcel number) used inside the address is called a *banchi* (place number.) The number sometimes has a branch number (for example: 10-1, 15-2) which is due to the subdivision of the parcel.

In Japan, the land registry has a 100+ year history, and over time, there have been changes of old *machi-or-aza* (districts) due to land development and other factors. This results in less systematic and inconsistent codes and numbers within the registry system.

A.13.6.4 Codes and numbers based on *jukyo hyoji* (indication of residential address)

Large-scale developments of land result in a less-systematic system of addressing based on *chiban* (parcel number), especially in urban areas. That is a reason for address ambiguity.

For this reason, an act for the development of a building numbering system, independent from the land registry system, was established in 1962. This act is referred to as *jukyo hyoji ni kansuru horitsu* (the act for indication of residential address). Initially, this address indication system was mainly applied to densely urbanized areas where there were confusing address numbers. After that, this address indication system has been often introduced where there have been wide-scale land development such as land readjustment. Generally, this action has been applied to the part of a *shichoson* (municipality), involved with the land development, not the entire municipal area.

Creation of new *jukyo hyoji* (indication of residential address) are announced to the public, along with their name, number, date of implementation, etc. The act also specifies that *machi-or-aza* (district) names shall be named based on the existing names to the maximum extent, in order to retain the historical significance of the geographic name. This article was amended to the act because in the past there were judicial trials (court cases) where the public sought to restore the geographic name.

The act permits that *shichoson* (municipalities) may choose whichever *gaiku* (block) based address system or street based address system they desire.

In the block-based address system, a *gaiku fugo* (block code) is assigned to the smallest block that is surrounded by roads, railroads, etc. in the district. The numbering of the block code begins at a significant ‘base place’ such as a municipal government office, designated as ‘1’ and continues in order. Each block usually has *kiso bango* (frontage numbers): ‘1,’ ‘2,’ ‘3’ and so on, positioned along the outer circumference, at regular (10m – 15m) intervals in a clockwise direction starting from the corner nearest to the ‘base place.’ Then beginning with the first corner, the closest frontage number to an entrance or major gate of the building is identified as a *jukyo bango* (residence number). (See Figure A.31: this figure is modified from Change Request for enhanced admin structure definition capabilities, 2008.)

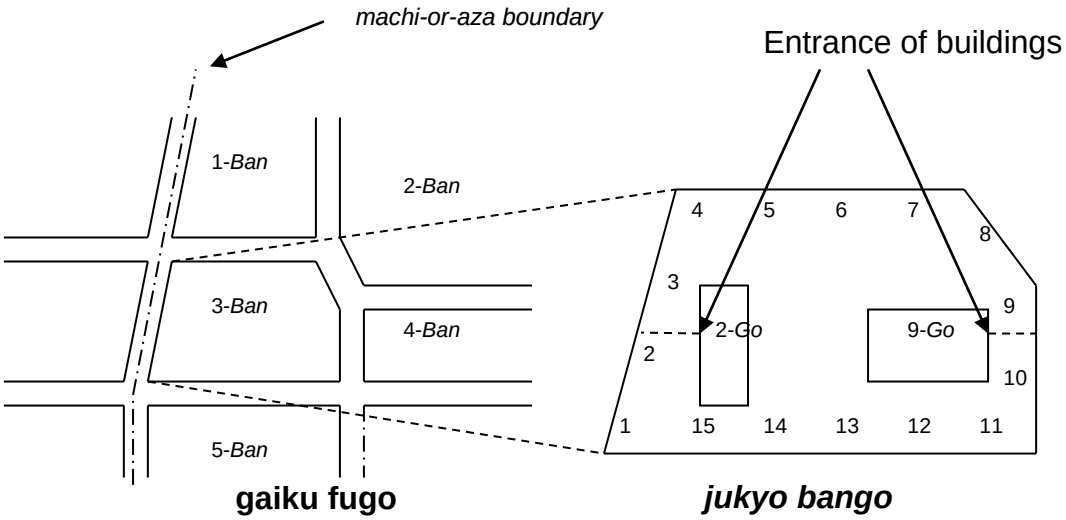


Figure A.31. gaiku fugo and jukyo bango and Jukyo-number

Jukyo bango (residence numbers) may not be sequential because the number is assigned at each regular interval of block frontage. While very infrequent, the possibility does exist that the same residence number may be assigned to the neighbouring buildings. The block-based address system can be thought of as a kind of linear reference system along the peripheral roads.

The act also permits the use of a street-based address system; however, thus far, only two municipalities have adopted a street-based address system.

The act also permits the street-based address system; however, only about two municipalities have adopted it.

A.13.7 *Example: Korean address assignment scheme*

Korea has two types of address systems: the ‘road name address' and the 'parcel based address'. Currently, parcel based addresses (‘Resident Registration Act’, ‘Survey, Waterway investigation and Cadastre Act’) are being converted into road name addresses ('Road Name Address Act'). Parcel based addresses were introduced in Korea in 1918 and the new road name addresses in 2007. From 29 July 2011 onwards, road name addresses will be in use throughout the country. Parcel based addresses will be allowed until 2013 when they will have been replaced by road name addresses.

Detailed addresses (*sangsejuso*) are managed by the Korean Land Information System (KLIS) and detailed addresses of apartment houses are managed on a digital map and attributes by the Architect Administration System.

Most roads already have a road name and basic number so that, if a new house is built, the road name can be assigned immediately. The authorities (city mayor, county governor and head of borough) assign the new building number when a new house is built. When the building is demolished, the building number is discarded.

Parcel numbers for parcel based address have already been assigned in the whole country. When an applicant applies for the division of land, the authorities update the map and attributes on the KLIS (after the new parcel number is assigned, the data is

available to use as a new address). Parcel numbers can thus change or be discarded as a result of consolidation of land parcels.

The Korean address standard (2011) is established by the Korea Address Forum (KAF), comprising business partners, universities, research centres and others. The document defines the standard of the address system of Korea. It includes a conceptual model, metadata and rendering and aims to achieve interoperability. The following terminology is defined in the standard:

road name address, *Si/Do* (metropolitan province), *Si/Gun/Gu* (basic local government province), *Gu/Eup/Myeon* (local district), road name, road section, basic number, building number, *Jiha* (basement), *Sangsejuso* (building number, floor, room number), parcel based address, *Dong/Ri* (area based on parcel numbers), San (separator of registration parcel numbers), *Jibeon* (parcel number).

Figure A.32 shows the conceptual model for the new road name address, while Figure A.33 shows the conceptual model for the old parcel based address of Korea.

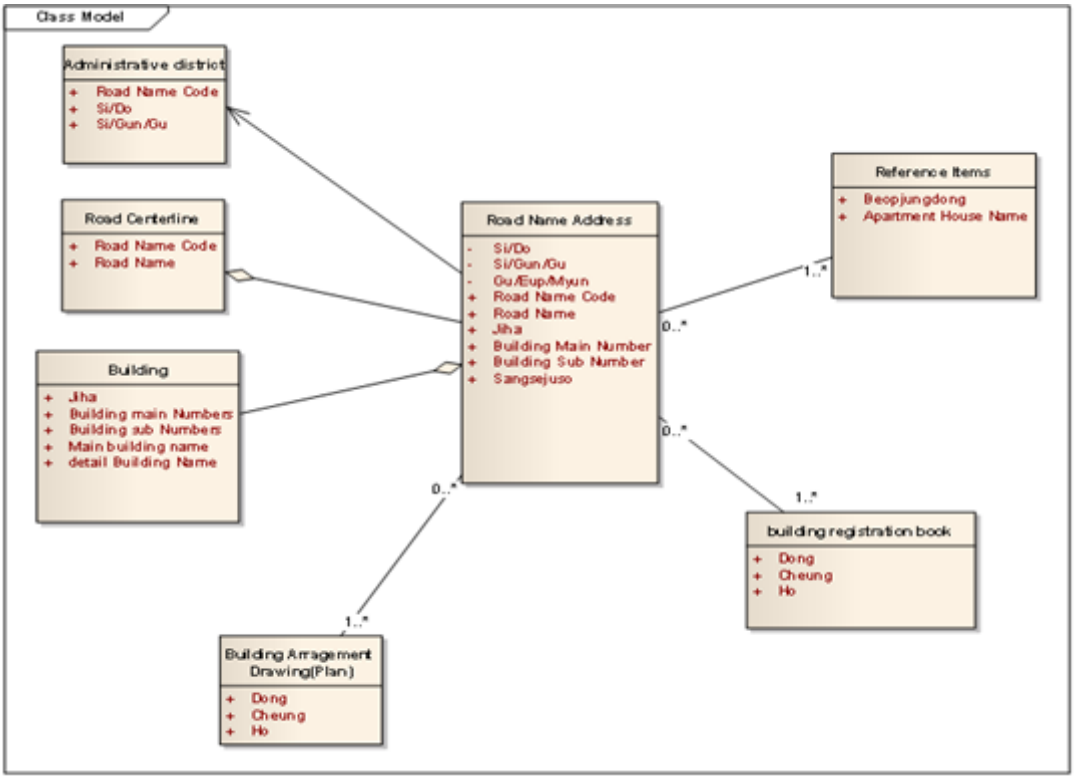


Figure A.32. Road name address (new address)

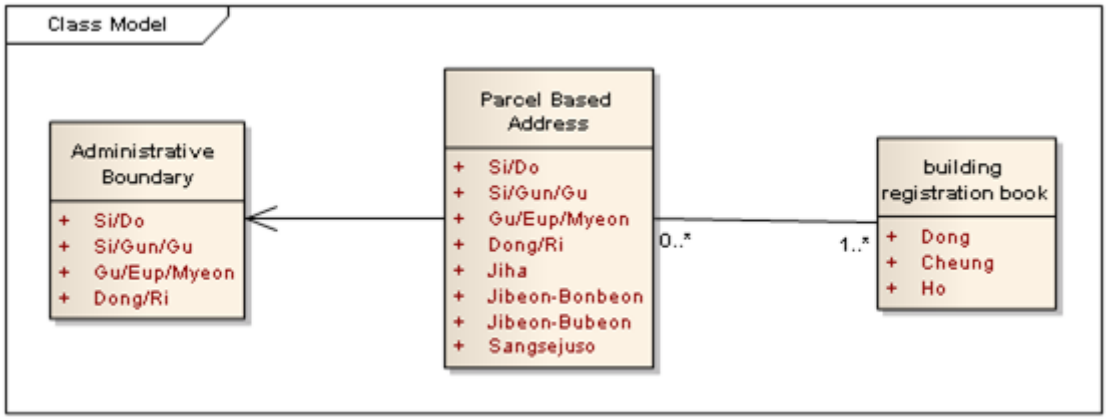


Figure A.33. Parcel based address (old address)

The list below provides some explanation for the address components:

1. Address components that represent an identifier for the address, addressable object or delivery point: *sangsejuso, jijeombeonho, jibeon*.

2. Address components that reference a real world object: *jiha, san, -daero, -ro, -gil*.

3. Address components that reference a geographical area: *-do, -si, -gun, -gu, -eup, -myeon, -dong, -ri*.

4. Address components that specify a distribution office: *guyeokbeonho*.

5. Address components for the person or organization at the address: *organization name, department, title name, full name*.

The KAF address defines ten metadata elements:

unique number (identification code of building unit assigned by related authorities), paper number (road name registration), territory of building, road name, *jiha* (basement or not), building number, reason of naming, notification date (notification date or abolition of building numbers), assign maker (decision-maker of road name), *jijeombeonho*.

A.13.7.1 Road name address assignment

Road name address assignment follows the steps shown below. Refer to Figure A.34 for sample addresses.

Base research

⇓

Road section assignment

⇓

Basic number assignment

⇓

Road naming

⇓

Building numbering

⇓

Sangsejuso assignment

Base research

- The base research and field survey are represented in drawings and various public documents which show the status on-site.
- To assign and change road sections: research on the terrain, which blocks the traffic flow (e.g. various width road and rivers, streams and oceans), and also survey of one-way roads.
- To assign and change building numbers: research on the building status, main entrance, status of building clusters, the adjacent road signs and status of building, storeys and rooms.

Road section assignment

- Road sections are divided based on the landscape, such as a river, sea and administrative boundary, namely *Si, Gun, Gu*, but sustainability, uniqueness, continuity and linearity, should be considered.
- The road section should be arranged and changed in the direction of west to east and south to north.

Basic number assignment

- The basic number begins with an odd number on the left side of the road, while even numbers are arranged on the right side. Symmetry should be maintained.
- Most basic intervals are set to 20 meters, regardless of the number of buildings located on the street.

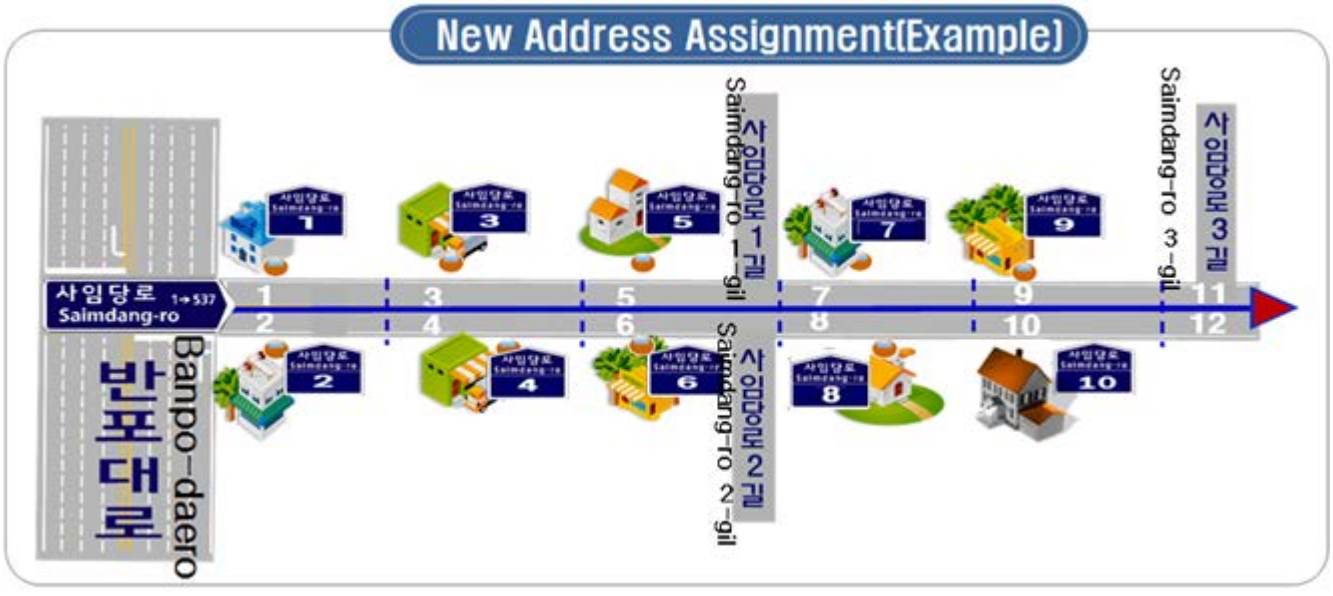


Figure A.34. Road name address assignment example

Road naming

- The road address may include *Daero, Ro, Gil,* depending on the size of the road (*Daero* has more than eight lanes, *Ro* has two to seven lanes, *Gil* has less than two lanes).

- The road name includes basic numbers, serial numbers and bearing in order to predict the location.

Building numbering

- If there are more than two buildings in one basic number, the main number and sub-number should be indicated from the second building onwards.

Sangsejuso assignment

- *Sangsejuso* follows the principles of numbering (ISO 4157). The diversity of characters should be considered, but the number of digits is regulated to prevent indiscriminate use.
- The building identifier can be represented with a combination of arabic numbers and characters; storeys and rooms are identified by an arabic number.

A.13.7.2 Parcel based address assignment

The bulleted list below describes the parcel based address assignment.

Cadastral survey

- Execute cadastral survey for trading of ownership transfer and land readjustment that comes with alteration under permission.
- Secure the boundaries of land parcel by on-field survey and research on land extent and the purpose of the land use.

Jibeon assignment

- The north-west to south-east direction is used for the sequence of assigning a new parcel(lot) numbers.
- If there is land division, the new parcel number has a sub-number of its own (e.g. 5 -> 5-1)
- If there is land consolidation, the sub-number should preferably be discarded.

Sangsejuso assignment

- Sangsejuso follows the principles of numbering (ISO 4157). The diversity of characters should be considered, but the number of digits is regulated to prevent indiscriminate use.
- The building identifier can be represented with a combination of arabic numbers and characters; storyes and rooms can be identified by an arabic number.

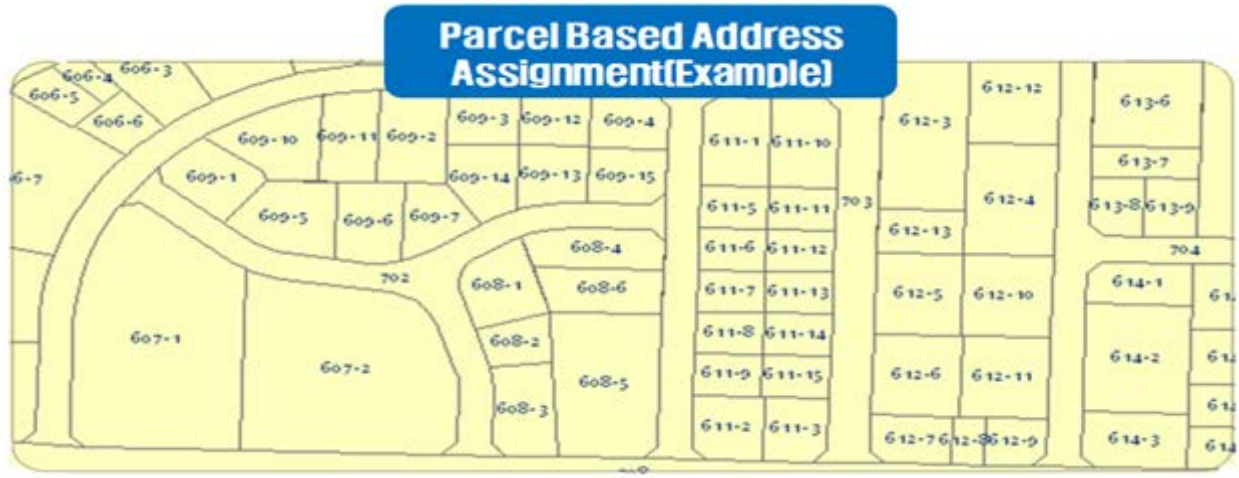


Figure A.35. Parcel based address assignment example

Managing a cadastral map and land book

- Authorities register and manage the *jibeon*, a cadastral map and land book.

Registering detailed address of building registration book

- The owner of a building applies for a building construction permit with building blueprints to relevant authorities.
- Registration and management details of a building include *'Dong', 'Cheung', 'Ho'* in the building registration book once building construction completed.

Figure A.35 shows an example of parcel based addressing.

A.13.8 *Example: Non-residential postal address assignment scheme*

A.13.8.1 Introduction

Postal non-residential addresses are assigned in relation to the organizational unit of the postal operator responsible for providing a specific delivery service (this is usually the delivery post office). The unit may be identified by name and/or by postcode. The delivery point is identified by specifying both the delivery service (PO Box, Private Bag, Rural Route poste restante, etc.) and the identifier (PO Box number, Private Bag or name of the box on the rural route). The delivery service identifiers are assigned by the postal operators. Table A.9 shows examples of non-residential postal addresses.

Table A.9 Examples of non-residential postal addresses

Country	Delivery Type	Delivery point ID	Postal Delivery Unit	Postcode	Other components
South Africa	PO BOX	789991	SANDTON	2146	
South Africa	PRIVATE BAG	X101	RIVONIA	2128	
Canada	Rural Route	Fred Winston Sr	RR 1 Stn Delivery Centre	K9J 6X2	Calgary ON
United States	Rural Route	BOX 36	RR 1	61571-9602	WASHINGTON IL
Italy	CASELLA POSTALE	456	UFFICIO FERRARA CENTRO	44100	FERRARA FE
New Zealand	CMB	A53	RD 1	3771	Huntly

A.13.8.2 Example: South African Post Office Box and Private Bag address assignment scheme

A.13.8.2.1 Background

In terms of the statutory Postal Act, Post Office Box (PO Box) and Private Bag (P Bag) addresses, also known as Postal Delivery Service (PDS) addresses, in South Africa are issued by the South African Post Office. Thus the originator and official custodian of these addresses in South Africa is the SA Post Office. In terms of this Act, delivery to these addresses includes legal obligations and performance standards not required of non-official address boxes and other service delivery, such as time to delivery, performance standards and conformance, integrity of the mail stream and security of mail items.

Approximately 30% of all official addresses in South Africa are of PDS type. PDS addresses are by definition served by a Post Office. Thus PDS address types include some lesser used types, for example, Poste Restante and foreign military service Field Post Office (FPO) addresses.

A.13.8.2.2 Structure

The structure of PDS addresses is formal and consistent. This is as follows:

Level 1:	Country
Level 2:	Post Office (identified by Postcode)
Level 3:	Delivery Point (PO Box number or Private Bag number)
Level 4:	Sub delivery point address identifier (for complex address type variant)

A.13.8.2.3 Rendering

Formal rendering of rural addresses for service delivery purposes is as follows:

First line:	Mailee /addressee name
Third last line:	Delivery Point identifier
Second last line:	Post office name
Last line:	Post code

Additional information, which may be free text, is permissible after the first line and before the third last line to support routing and location and for complex addresses (multiple addresses within one delivery point). Service distribution points functioning as complex addresses are commonly private or independent of unofficial service delivery providers. An example in South Africa is Postnet, a company each of whose branches offices rent a private bag from the SA Post Office. They have no logistics, sorting or delivery infrastructure of theirs own.

In such case, the complex address rendering is as follows:

First line:	Mailee /addressee name
Fourth last line:	Postnet box number
Third last line:	Delivery Point identifier

Second last line:	Post office name
Last line:	Post code

A.13.8.2.4 Location ID

The address location ID is as for the location ID of the post office or lobby or unmanned mail collection point where boxes are located. This is not associated with the location of the mailee or addressee as a natural or legal persona.

A.13.8.2.5 Compliance

The PDS addressing system is fully compliant with and described in SANS 1883 and UPU S42:2006 addressing standards. The latter includes mailee and addressee information. Data exchange and interoperability is compliant with UPU S53:2009.

PDS addresses do not satisfy certain statutory requirements such as proof of physical (residential and business) address, for example *domicilium executandi* (address at which legal proceedings may be instituted), even if a PDS address is associated with or linked to a physical address.

A.13.8.2.6 Implementation and Operation

Planning is done by the SA Post Office, as address originator and official address custodian. Planning is as per the levels of the address structure. First, research is done to determine demand and capacity requirements per area, from which address quantities are determined.

Development and implementation starts with the postcode, determined with consideration of postal regions and neighbouring codes. The postal point (office or lobby or MCP or agency) is named. Box ranges are determined by computer to ensure no duplication or possible confusion with other numbers in the area or nearby. This includes range availability for possible expansion in the future.

Once officially launched, these are rented out through a retail post office branch or online.

A.13.8.2.7 Other PDS address types

Private bags are used for large mail volumes. Private bag numbers are associated with boxes by number. For example a Private Bag uses the same number as the PO Box rented by the same renter.

Military serving in foreign countries use a Field Post Office (FPO) identifier, which does not identify a post office or location. The FPO is identified by number, on the second last line. Address rendering is as follows:

First line:	Addressee name
Third last line:	Military unit information
Second last line:	FPO + number
Last line:	Post code

Poste Restante addresses are uncommon but are used. Arrangements must be made with the branch manager of the specific post office. Address rendering is as follows.

First line:	Addressee name
Third last line:	Poste Restante
Second last line:	Post office name
Last line:	Post code

A.13.9 *Example: Saudi Arabian address assignment scheme*

A.13.9.1 Why Saudi Post needed to develop a GIS – based addressing system

Before the new addressing system was created, there was no home delivery in Saudi Arabia. To receive mail, citizens had to subscribe to a post box in the post office and collect their mail from there. Saudi Post recognized that there was a strong requirement for providing a universal home delivery postal service. This however required the creation of an addressing system, posing some serious challenges.

The first challenge concerned the requirement for addresses in Arabic and Latin. In Saudi Arabia, English is nearly as common as Arabic and transcription rules from Arabic to English are difficult to standardize. One Arabic name can be written in several different ways in English. For example, the popular Arabic name (محمد) can be transliterated to English in at least five different ways: Mohamed, Mohammed, Muhammad, Muhammed, Mohammad. It would therefore be difficult to standardize spellings of address components. Moreover, not all premises had street addresses allocated to them and not all buildings had been numbered systematically. Under these circumstances, the creation of a robust, traditional street addressing system would pose problems related to transliteration of address components, street naming and property numbering. A Unified Postal Addressing System was developed to address these challenges. It uses GIS-based numbers to identify addresses, while at the same time recognizing traditional thoroughfare, district and city names in both Arabic and English.

Table A.10 Example of an address in the new unified Saudi Arabian postal addressing system

English	Arabic
2345 Salem Street - Olaya District	2345 شارع سالم - حي العليا
Riyadh 12345-6789	الرياض 12345-6789

The address in the Table A.10 consists of the components shown in **Feil! Fant ikke referansekilden.**.

Table A.11 Saudi Arabia address elements

English	Arabic	Local name of component	Required
2345	2345	building number	Mandatory
Salem Street	شارعسالم	thoroughfare name	Optional
Olaya District	حيالعليا	district name	Optional
Riyadh	الرياض	city name	Optional
12345	12345	zipcode	Mandatory
6789	6789	additional number	Mandatory

The traditional components used in the addresses in **Feil! Fant ikke referansekilden.**, such as city, district and thoroughfare names, assist humans in identifying the addressable object. However, these components exist in a variety of valid versions and they are optional for the postal address. On the other hand, each addressable object is uniquely identified by means of three or four numbers that are mandatory.

What makes the Saudi Post addressing system unique is the method of allocation of the building and additional numbers**.** They are both defined by the local coordinate system within the *zipcode* area and are linked to names of streets, localities and districts in a database. Access to this database is provided to the public via web portal.

A.13.9.2 Allocation of building and additional address numbers

The allocation of building and additional address numbers has to be preceded by the following steps:

1. allocation of zipcode areas,
2. allocation of parcel coordinates
3. classification of thoroughfares by dominant direction
4. allocation of the building and additional numbers based on the coordinates of the parcel, the class of the thoroughfare, and the side of the thoroughfare on which building is located.

Now, these four steps are explained in more detail.

A.13.9.2.1 Allocation of five digit zipcode areas

Saudi zipcode is just another name for a postcode. Similar to most postcode systems, Saudi zipcodes create a hierarchy of areas in which each subsequent level is associated with a subsequent digit of the code. As this is typical for postcode systems in general, we will not go into further details here.

The area identified by the 5-digit zipcode (postcode) is called a ‘postal quarter’. All postal quarters are squares of a size up to 4,000m x 4,000m. This characteristic is of significant importance for the system of identifying buildings and parcels.

A.13.9.2.2 Allocation of parcel coordinates

For creating a Unified Postal Addressing System, Saudi Post has developed a local coordinate system based on the Universal Transverse Mercator projection with a datum of WGS-1984 (UTM WGS-84). Saudi Arabia spans four UTM zones: 36N, 37N, 38N and 39N, and therefore, the appropriate UTM zone is used for the local coordinates of the parcels for each city.

The distance in meters between the center point (Centroid) of the parcel and the base point of the zipcode (defined by the minimum co-ordinates of the zipcode area) provides two integer numbers: *x1* for the distance in longitude and *y2* for the distance in the latitude. Figure A.36 shows an example.

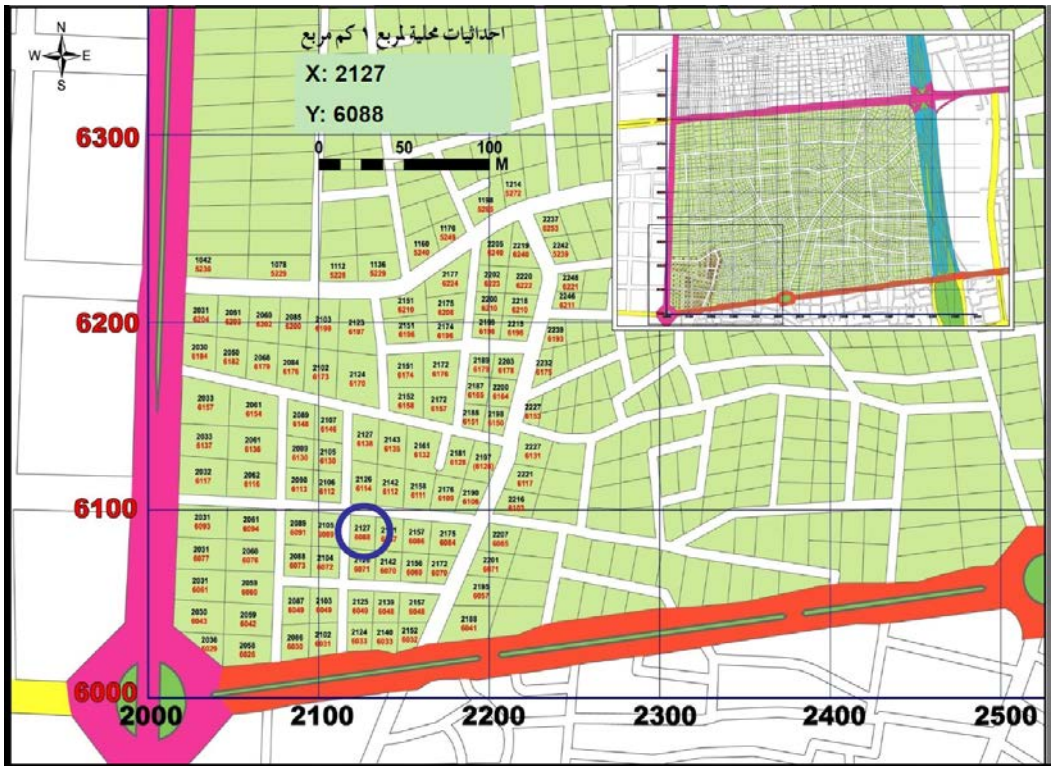


Figure A.36. Numbering of parcels in a zipcode area using a local coordinate system

Two coordinates *x0, y0* of the parcel are created by adding 2000 to *x1* and 6000 to *y1*.

x0=*x1*+2000, *y0* =*y1* + 6000.

Note that *x0* will always be in the range (2000, 5999) and *y0* in the range (6000, 9999). The zipcode area is not larger than a square of 4,000m x 4,000m.

These two coordinates of the parcel are used to allocate the values of *the building* and *additional numbers* used in the addresses of buildings.

A.13.9.2.3 Classification of thoroughfares

All streets are classified in one of the two classes South/North or West/East according to the dominant direction of the street. In case of diagonal streets the dominant direction is used for classification as on Figure A.37.

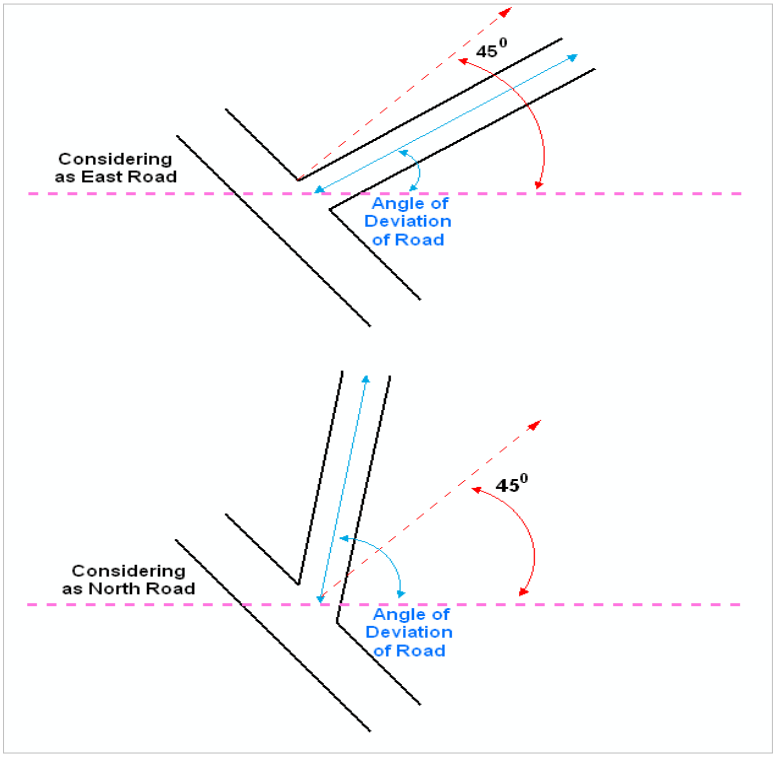


Figure A.37. Saudi Arabian thoroughfare classification

Rare cases (if any) of roads with an exact angle of 45º or 135º will be classified by the choice of system administrator.

A.13.9.2.4 Building and additional numbers

Those buildings that are accessed from the thoroughfare of West/East type and are located on the right hand side of the thoroughfare (facing East) take as the building number the *odd* number closest to the *X0* coordinate of the parcel (by adding or subtracting 1 if X0 is not an ODD number). The building on the left hand side of such a thoroughfare takes as the building number the *even* number closest to *X0.* The additional number for a building facing the West/East thoroughfare is the *Y0* coordinate of the parcel. Refer to Figure A.38.

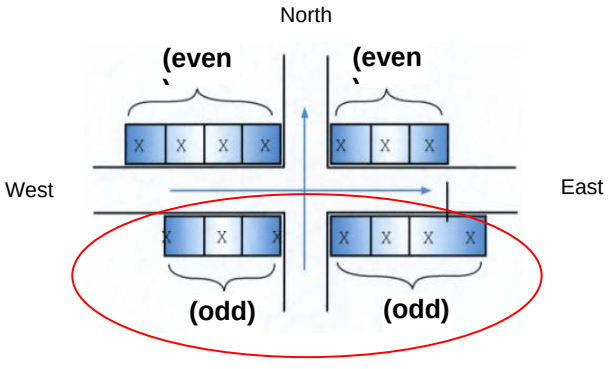


Figure A.38. Saudi Arabian building and additional street numbers (West-East)

Similarly, a building accessed from the thoroughfare of the North/South type and located on the right hand side (facing North) will take the *odd* number closest to Y0 (by adding or subtracting 1 if X0 is not an ODD number) and the building on the left hand side of such a thoroughfare takes the *even* number closest to *Y0*. The additional number for such a building is the *X0* coordinate. Refer to Figure A.39.

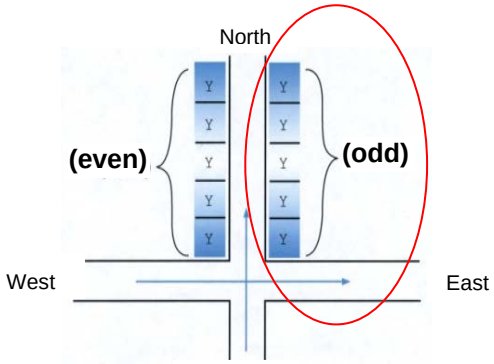


Figure A.39. Saudi Arabian building and additional street numbers (North-South)

In consequence, the building number identifies not only the location of the building but also the dominant direction of the thoroughfare on which it is located, i.e. a building number in the range (2000,5999) indicates a West/East thoroughfare and a building number in the range (6000,9999) indicates a South/North thoroughfare. Moreover the parity of the building number identifies on which side of the thoroughfare the building is located.

This shows that the building and additional numbers are related to the thoroughfare that the building faces. For buildings that face two different streets (e.g. on a corner) , the following rules apply:

1. The building is assigned to the bigger thoroughfare (main), according to the classification of the road network.
2. A building that is located on the corner of two roads of the same class, is assigned to the thoroughfare on which the building parcel covers more length.
3. A building located in the corner of two roads of the same class and with an equal length covered by the parcels, is assigned to the road on which the main door of the building is located.

A.13.10 *Example: South African rural address assignment scheme*

A.13.10.1 Background

The SA Post Office was appointed by the Inter Government Departmental Task Team to enable all service delivery to all physical addresses throughout the country and also to develop a National Address Database. Accordingly in 2003 it was mandated by Parliamentary Act to implement this.

Thus the originator and official custodian of the SA Rural Addressing System is the SA Post Office. This is executed under the name ‘Addressing the Unaddressed’, part of a broader initiative ‘Service Delivery by Addressing the Nation’. More than six

million rural addresses (of a target of seven million) are operational by 2010, more than half of all physical and postal addresses in the country.

A.13.10.2 Structure

Due to the lack of formal thoroughfares, named, numbered or neither, rural addresses are not thoroughfare-based and the rural addressing system is an area- and point-based structure.

The Inter Government Departmental Task Team agreed to the following formal hierarchical structure:

Level 1:	Country
Level 2:	Postal area
Level 3:	Village
Level 4:	Dwelling

The postal area is identified by post office name and post code; the village within the postal area by name and by place name ID code; the dwelling within the village by numerical ID. The dwelling can be sub-divided.

These data are public domain and freely availability. The formal data structure is designed for use by the stakeholders, as well as by other public and private parties. It is designed to be suitable for rural people that do not have access to any technology such as location devices or mobile phones and for those who may have no local knowledge.

For non-postal purposes, as alternative to Postal Area in level 2, the Municipal Area name or Traditional Authority name may be used. This alternative must enable unique identification of the village, as some village names are not unique within level 1 (country).

A.13.10.3 Delivery Point Identifier

The DPID or dwelling identifier uses six-digits, and is hierarchically structured as follows:

First two digits:	Village identifier
Next two digits:	Section identifier
Last two digits:	Household identifier

For implementation, provisions are made for future expansion, for possible increase of sections within the village and for possible increases of dwellings within the section.

Subdivision of dwellings is achieved through suffixing alpha characters.

A.13.10.4 Rendering

Formal rendering of rural addresses for service delivery purposes is as follows:

First line:	Mailee /addressee
Third last line:	Unique dwelling identifier and village name
Second last line:	Post office name
Last line:	Post code

Additional information, which may be free text, is permissible after the first line and before the third last line to support routing and location and for complex addresses (multiple addresses within one delivery point). Service distribution points functioning as complex addresses are commonly schools, churches, public services centres, community centres and local businesses.

A.13.10.5 Database

The address database includes other data: post code, administrative ward, geographic area location of village (or village section) by placename identifier, geographic position reference of the dwelling by GPS coordinates, postal agent in the village and various other metadata. Addressee personal data are also included: name and personal identification of head of household, mobile phone number.

A.13.10.6 Compliance

The SA Rural Addressing System is fully compliant with SANS1883-1:2009 and, including mailee and addressee information, is fully compliant with UPU S42:2006 addressing standards. Data exchange and interoperability is compliant with UPU S53:2009 and is also intended to be compliant with SANS1883-2. The purpose of compliance is to enable and promote free access to knowledge of standard data structuring and rendering requirements.

Residents' names are included in the data and associated with dwellings, thus enabling SA Rural Addresses compliant with S42 to be also fully compliant with financial and legal statutory requirements, including for purposes of *domicilium executandi* (address at which legal proceedings may be instituted).

A.13.10.7 Implementation and Operation

Planning is done by the SA Post Office. A comprehensive communication plan is designed and instituted. Implementation is done with the cooperation of the villagers through village leaders to align with village administration and structures. Local people and companies are contracted to undertake physical numbering. The address data are captured, verified and mapped.

A resident of the village is trained and formally appointed as the responsible agent in the village to facilitate service delivery, to provide local information and for data maintenance. The services of the agent are available to all public and private parties.

After implementation, testing of routing and deliverability is done for each address by sending a welcome-pack with confirmation of correct structuring and rendering according to the standard. The verified address is then available to service providers.

Delivery execution is effective in practise due to the standard and well-understood simplicity of the data structure and the system.

One feature of note is that villagers are extremely possessive of these rural addresses. Consequently, whenever there is a change to a dwelling, for example a household may move or be rebuilt elsewhere, the address is usually moved with it. Thus the geographical location of the address may change. Such changes are maintained through the agent.

A.13.11*Example: UK address assignment scheme*

Address allocation and compilation into addressing products are well-established fields within the United Kingdom. Multiple agencies are involved, organised along government administrative divisions. Although the agencies responsible for certain functions are separate between the constituent countries there is consistency in functions and approaches. The main agencies in question are shown in Table A.12 .

Table A.12 Address-related agencies in the UK

Function	Country	Agency
Addressable object and thoroughfare address component allocation	England and Wales	Local Government
	Northern Ireland	
	Scotland	
Non-definitive address component allocation	England and Wales	Local Government – Local Government Information House
		Ordnance Survey
		Royal Mail
	Northern Ireland	Land and Property Services
	Scotland	Local Government – Improvement Service
		Ordnance Survey
		Royal Mail
Postal address component allocation	England and Wales	Royal Mail
	Northern Ireland	
	Scotland	
	Northern Ireland	
	Scotland	

The allocation scheme in use in the UK can be described as a linear non-axial address assignment scheme.

A.13.11.1 Addressable object and thoroughfare address component allocation

A number of arrangements are in place within the UK to govern the allocation of address components.

Local government is responsible for the definitive allocation of Street Naming and Numbering (SNN) information including official street names, property numbers and property names. This is governed by a set of national and local statutory legislation. Each local authority with SNN obligations designates a Street Naming and Numbering Officer who is responsible for discharging the duties imposed by the legislation for the purposes of:

- Enabling effective responses to emergencies by ambulance, police, and fire services.
- Delivery of post by the Royal Mail and courier services.
- Record keeping, for example, for legal transactions and billing.

This typically involves consultation with the local community (including councillors, the public and key agencies such as emergency services, postal agencies and utilities) to ensure that the address components are acceptable and avoid ambiguity and resultant problems in service delivery. Records of the definitive address components are formally recorded and notification of interested parties. Whilst the legislation does not impose formal rules for the creation and maintenance of these address components, local authorities often create policies to direct allocation and there is an established body of national best practice published in the 'LLPG and SN&N Data Entry Conventions and Best Practice for the NLPG Version 2.0' (Information House), (which is written by representatives of local government in England and Wales). These aim to ensure that allocated values are meaningful, rich and unique within the local area. Values may change over time and the same documentation provides best practice information on how to manage this. An example of a local authority approach to maintenance is:

> *"The renaming/renumbering of existing streets and buildings will normally only be considered if they pose a risk to the ability of the emergency services to locate a property. Also, any changes will resolve any problems with postal services and deliveries. We aim to make any changes in harmony with the parish/ward/town council and the residents. This means that occasionally the numbering schemes will need to be reviewed or introduced. We are reminded by the Department of Transport the need to review and maintain logical numbering schemes.*
>
> *Street Naming and Numbering in England and Wales is not an exact science and the real world provides a rich and varied range of addresses. Where they exist street names and property names and numbers are required to be displayed on signs at the location and are regularly used for service delivery, routing and location both commercially and by the public." (Borough Council of King's Lynn & West Norfolk 2011)*

A.13.11.2 Postal address component allocation

The definitive allocation of postal address components is the responsibility of Royal Mail, the national postal service of the United Kingdom. Formerly a government department, Royal Mail is currently a government owned public limited company and a regulatory framework is in place to monitor their activities. The address components for which Royal Mail has the definitive responsibility for allocating are Post Town (which relates to the routing of mail rather than a geographic location) and Postcodes. Post Towns and Postcodes are primarily allocated for the purpose of delivering mail (by a number range of mail carriers, not just Royal Mail) and have been adopted as a reference system for many other services and are widely used by the public who often derive a strong sense of identity/community from these references. The Postcode Address File (PAF®) Code of Practice (Royal Mail 2010) (which was agreed between Royal Mail and the postal regulator) explains why and how postal addresses may change and how the changed addresses will be introduced. A postcode is made up of a combination of letters and numbers in one of the following ways:

- A1 2BC
- D34 5EF

- GH6 7IJ
- KL8M 9NO

The same code is usually used for a small group of addresses so it is not unique to every address but helps to pin-point exactly where the item of mail needs to go to.

Each part of the postcode provides step-by-step information about where the item of mail is heading. From left to right the postcode narrows down its destination. Refer to Table A.13 for an explanation of the different parts of a postcode.

Table A.13 Breakdown of the UK postcode

EC	1V	9	HQ
The first one or two letters is the postcode area and it identifies the main Royal Mail sorting office, which will process the mail. In this case EC would go to the Mount Pleasant sorting office in London.	The second part is usually just one or two numbers but for some parts of London it can be a number and a letter. This is the postcode district and tells the sorting office which delivery office the mail should go to.	This third part is the sector and is usually just one number. This tells the delivery office which local area or neighbourhood the mail should go to.	The final part of the postcode is the unit code, which is always two letters. This identifies a group of up to 80 addresses and tells the delivery office which postal route (or walk) will deliver the item .

Post towns are usually based upon the location of delivery offices. Currently their main function is to distinguish between locality or street names in addresses not including a postcode. There are approximately 1,500 post towns, which are organised at the convenience of the Royal Mail. Each post town can cover an area including many individual towns and villages. Post towns rarely correspond to political boundaries and often group places that for all other purposes are quite separate (Wikipedia 2011b).

It is of note that whilst a number of definitive administrative geographies exist there is no provision for the definitive allocation of geographic place names.

A.13.11.3 Non-definitive address component allocation

Non-definitive address elements may be created when:

- Objects which are not subject to street naming and numbering or postal delivery require an address, or
- Objects which have a definitive address are also referred to by a non-definitive address (sometimes described as ‘alternative’, ‘colloquial’ or ‘vanity’ address), or
- It is useful to expand the definitive address components of an existing address with further, non-definitive address components. These include address components that reference a geographical area or the person or organisation at the address. These agencies will also allocate metadata including classifications, lifecycle, temporal and quality information at the address instance level. In particular the allocation of unique reference numbers for

addresses and addressable object is well established and of great value to the nation.

A number of agencies in the UK create address data products and will, as part of the creation and maintenance process allocate non-definitive address components.

Royal Mail creates the Postcode Address File (PAF®) and a number of related products, which are the most widely used address products in the UK.

As part of its remit as the national mapping agency of Great Britain, Ordnance Survey creates a range of address data products including ADDRESS-POINT®, Address Layer and Address Layer 2 which are used widely across the public and private sectors. Ordnance Survey uses the Royal Mail PAF product and allocates additional address elements and metadata based on their own geographic data products and field surveys as described in the *OS MasterMap Address Layer 2 Technical specification* (Ordnance Survey 2011) and *ADDRESS-POINT User guide and technical specification* (Ordnance Survey 2010).

Local government in England and Wales compiles addresses into a master reference dataset known as the National Land and Property Gazetteer (NLPG); Scotland has a similar initiative called the OneScotland Gazetteer. These are maintained separately but to common standards and are the *de facto* standard for addressing across local government (including local authorities, emergency services and national parks). These values are allocated based on intelligence resulting from the wide range of interactions local authorities have in pursuit of their service delivery to citizens according to the rules and best practice described in *LLPG and SN&N Data Entry Conventions and Best Practice for the NLPG Version 2.0* (Information House), and *Scottish Gazetteer Conventions* (OneScotland Gazetteer Custodian and Gazetteer Working Groups 2009). Local government enters into contracts with itself to ensure effective provision of these services. Under these agreements each local authority with SNN responsibilities is required to designate named individuals to discharge these responsibilities.

Further agencies and users across the public and private sector maintain their own address datasets and allocate non-definitive address components based on address change intelligence resulting from their own activities. On a national scale the work done by the Valuation Office Agency (responsible along with local authorities for the collection of domestic and commercial taxation revenues) is well recognised. Further agencies including The Office for National Statistics Census project and TV Licencing derive address datasets by compiling the products listed above.

In Northern Ireland the agencies involved in address product creation have combined to form a single unit – Land and Property Services leading to a rationalization of the address maintenance process. Discussions are underway to move to a similar approach in other parts of the United Kingdom.

A.13.12 *Example: US mile post marker address assignment scheme*

In the United States, rural addressing is sometimes accomplished by using a system of mile markers set along highways and/or mile indicators along county roads. First, a point of origin is identified. Starting at the point of origin, each mile along the public

road is marked. Houses are addressed at the point where the private drive intersects with the public road.

Municipalities may choose to assign house numbers such that addresses are referenced based on their distance from the point of origin. Figure A.40 shows house numbers that represent the actual location of the house to the hundredth of a mile.

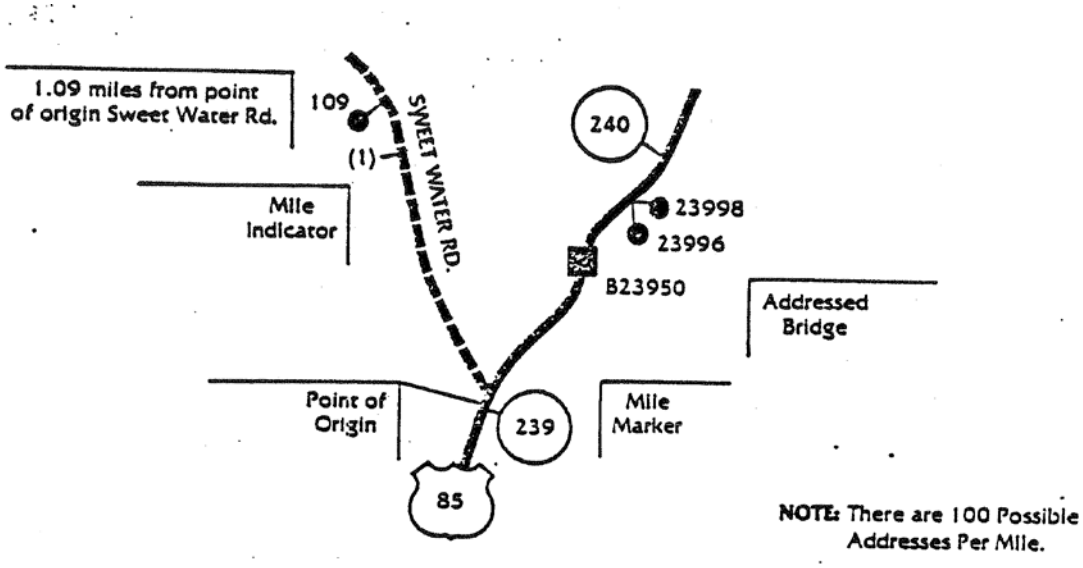


Figure A.40. Address numbers as a hundredth of a mile

In the example above, Sweet Water Road has a point of origin at the intersection of Highway 85. The dot on Sweet Water Road (indicating the location of the house) is about 0.09 miles from the indicated '1 mile' marker. Since the house is 1.09 miles from the point of origin, the assigned address is *109 Sweet Water Road*.

In some areas, municipalities may choose to reference the addresses based on the nearest integer mile. Figure A.41 shows an example of addresses referenced in this form. The example scheme also allows for the maintenance of parity for houses on the same side of the road.

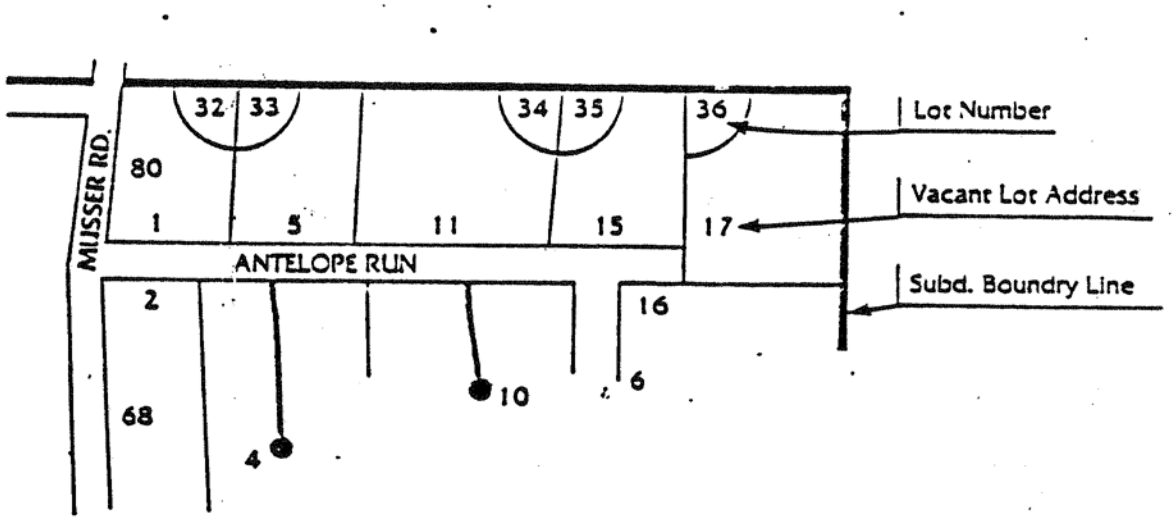


Figure A.41. Address number based on the nearest integer mile

In some very rural areas, an official addressing scheme based on mile markers is not assigned by the municipalities, but is often referenced by locals to indicate the location of their house. In those cases, the 'house number' may be prefixed by 'Mi.' to indicate the reference to mile markers. That is, the address described in the Figure A.40 example above would be referenced as '*Mi. 1.09 Sweet Water Road*'.

A.13.13*Example: US axial address assignment scheme*

In an axial address schema, there is generally a known or important point of origin from which address numbering begins. Address numbering begins at the origin point and numbers increase along the axes moving away from the defined point of origin. All other streets are addressed to conform with the numbering pattern as set by the baseline and meridian (north-south, east-west 'dividing lines' respectively) intersection that forms the point of origin. The baseline or meridian can be a street, a river, or some other visible or non-visible feature. East-west/north-south street directionals also are designated from the point of origin where the baseline and meridian form the dividing

Odd and even numbers are assigned to the right or left side of the street from the point of origin. The point of origin above is the intersection of Main Street and Elm Street, using the 100-range system. As one moves away from the point of origin, the numbering scheme depicts the right side as odd numbered, left side even numbered. Refer to Figure A.42.

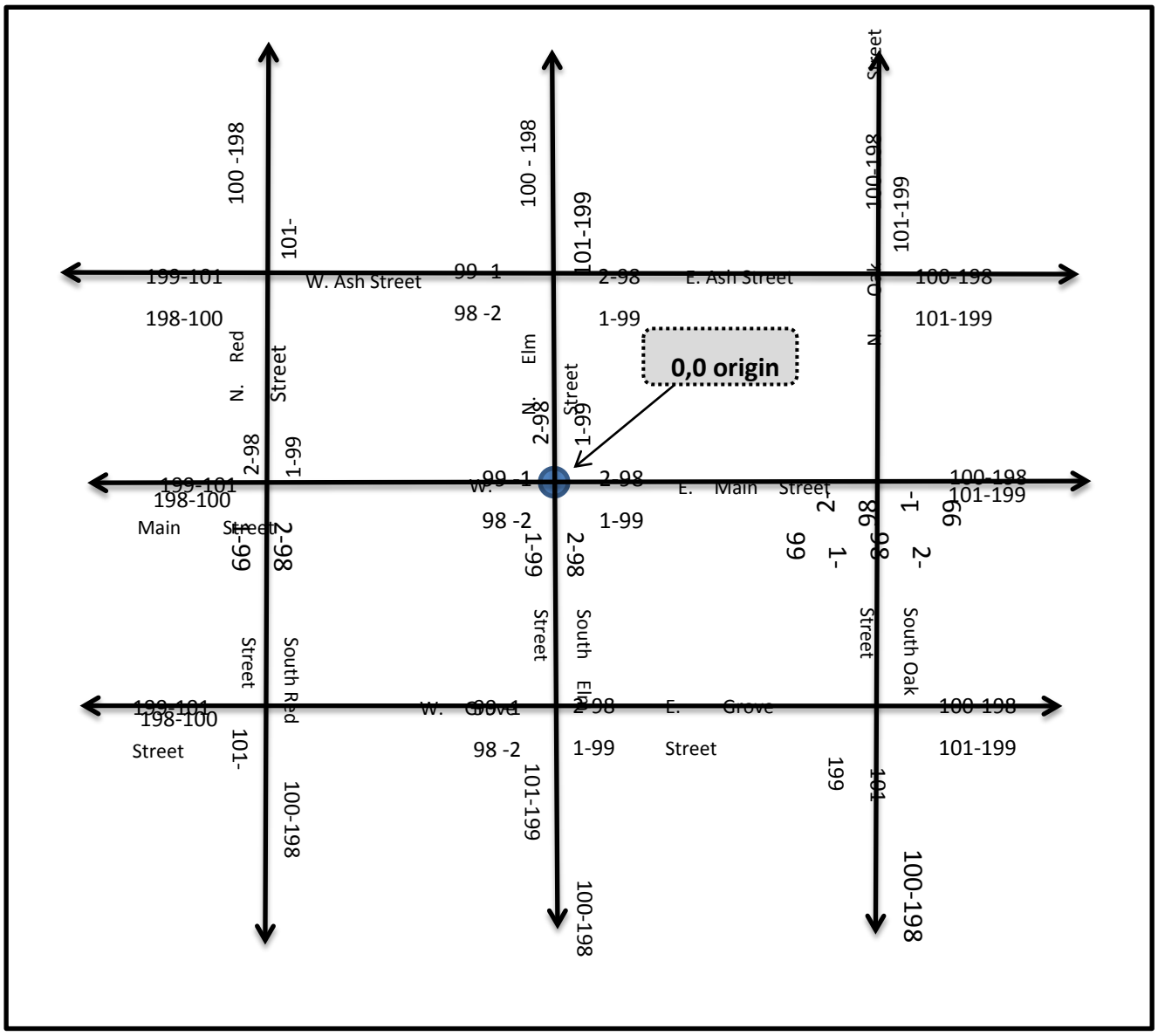


Figure A.42. Example of a US axial address schema

Annex B Member body and liaison representation

B.1 Member body representation

Member body	Nominated expert
Australia	Mr. Andrew Jones
Canada	Dr. Boris Gutkin
China	Ms. Li Li
Denmark	Mr. Morten Lind
France	Mr. Patrick Dousseaud
France	Mr. Emmanuel Mondon
Japan	Mr. Kazuhiko Akeno
Japan	Mr. Hidenori Fujimura
Japan	Mr. Koichi Hirata
Japan	Mr. Yo Iida
Japan	Mr Go Sato
Japan	Prof. Teruko Usui
Japan	Mr. Ishizeki Takayuki
South Africa	Dr. Serena Coetzee (project leader)
South Africa	Mr. Antony Cooper
South Africa	Mr. Pierre Rossouw
South Africa	Mr. Marius van der Merwe
South Africa	Mr. Arjen van Zwieten
Spain	Ms. Maria Cabello
Thailand	Ms. Siripon Kamontum
UK	Mr. Carsten Roensdorf
UK	Dr. Rob Walker
USA	Ms. Randy Fusaro
USA	Ms. Karen Owens

B.2 Liaison representation

Member body	Nominated expert
UNGEGN	Mr. Brian Goodchild
UPU	Mr. Ali Bakheet
UPU	Mr. Joe Lubenow
UPU	Mr. Piotr Piotrowski

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