

## Address data exchange in South Africa

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### Abstract

An address is one of the most common forms of describing a location with the purpose of providing directions for all kinds of ‘deliveries’, ranging from visitors, postal mail, utility services such as water, sewerage, electricity or telecommunication to household surveys and the opening of bank accounts. South Africa is often referred to as a ‘world in one country’ referring to the diversity in its natural environment, as well as its people and their cultures. This cultural diversity along with the multiple sources of address-related data and the absence of a single mandated addressing authority is similar to an international situation of individual countries, each the source of its own socio-cultural specific addresses and no single addressing authority. In this paper we present South African addresses and the address types that are defined in the South African Address Standard (SANS 1883) and that allow for address data exchange of structured addresses in traditionally formalized areas, as well as descriptive addresses in rural and informal settlements typical to a developing country. We believe that some aspects of the South African address standard are of interest to the development of an international address standard and conclude with a discussion of the benefits that an international address standard would bring to a developing country like South Africa that has a substantial addressing backlog.

### 1. Introduction

An address is one of the most common forms of describing a location. The purpose of describing the location is to provide directions for a ‘delivery’, ranging from the ‘delivery’ of visitors, postal mail, and utility services such as water, sewerage, electricity or telecommunication to emergency services, household surveys and the opening of bank accounts. Addresses are often structured into a spatial hierarchy that describes the location with increasing accuracy, for example, in the address ‘14 Richmond Road, Mowbray, Cape Town, South Africa’ the spatial hierarchy goes from country (South Africa) to city (Cape Town) to suburb (Mowbray) to street (Richmond Road) to street number (14). Addresses are unique if the names and boundaries of the components in the spatial hierarchy are assigned unambiguously *and used* accordingly. Addresses that are structured into a spatial hierarchy are common to many countries and examples of both national and international standards that prescribe and describe their contents can be found in the standards developed by the Universal Postal Union (UPU, 2006), OASIS (OASIS, 2007), the British Standards Institution (BS 7666-0:2006) and also the US address standard that is currently under development (Address Standard Working Group, 2008), Australian (AS/NZS: 4819:2003) and South African (SANS 1883) address standards.

However, we cannot deny that loosely structured addresses and even completely descriptive addresses are also commonly used. Examples are descriptive addresses in informal settlements on the urban edge, typical of developing countries, where formal addresses still have to be assigned, addresses in rural areas where a structured addressing system is not in place, and colloquial addresses that are commonly used by people but not necessarily recognized as the official address by authorities, for example, an address with a reference to a publicly known landmark. An address standard should enable interoperability of structured as well as these descriptive addresses.

An address, whether structured or descriptive, is used for all forms of service delivery, and not just for postal delivery. This is particularly important in a country where many people do not yet have access to basic services such as running water, electricity, sewerage and waste removal, and an address is critical

for the utilities and authorities rolling out and maintaining the delivery of services to them. As a result of apartheid, for many in South Africa, having an address also has a social status, providing a sense of identity and of being recognized as a proper citizen (Coetzee and Cooper, 2007a).

Recent presentations at the Urban and Regional Systems Association (URISA) annual conference describe the value of standardized addresses to the economy, society and governance in the individual countries of Denmark (Lind, 2007), South Africa (Coetzee and Cooper, 2007a) and the United Kingdom (Barr, 2007; Nicholson, 2007). In a paper delivered at the 10th International Global Spatial Data Infrastructure Conference (GSDI-10), researchers from South Africa and organizations in Denmark, the United States and the United Kingdom argue that the time is right for bringing together a number of past and current international initiatives to develop a common international address standard. The paper lists some of the benefits of a common international address standard that we also discuss in this paper. In addition, the research team points out that a standard would enable seamless access to address information across regional and national boundaries, which is vital in disaster management and emergency situations. In conclusion, the paper explores different options for developing such a standard and proposes a potential scope for the standard (Coetzee et. al., 2008).

South Africa is often referred to as a ‘world in one country’ referring to the diversity in its natural environment, as well as its people and their cultures. This cultural diversity along with the multiple sources of structured as well as descriptive address data that are not regulated by a central authority is similar to an international situation of individual countries, each being the source of its own socio-cultural specific address data that usually ranges somewhere between formally structured and completely descriptive. Thus, we believe that some aspects of the South African address standard are of interest to the development of an international address standard.

On the other hand, South Africa, as a developing country with a huge addressing backlog and without a single national authority mandated to maintain a national address register, has a lot to gain from an international address standard that would encourage the development of re-usable addressing tools and enable address data interoperability. The objective of the rest of this paper is to 1) give some background information about addresses in South Africa; 2) give a brief overview of the South African address standard (SANS 1883); 3) show how SANS 1883 allows for address data exchange; and 4) discuss some benefits that South Africa would gain from an international address standard .

## **2. South African addresses**

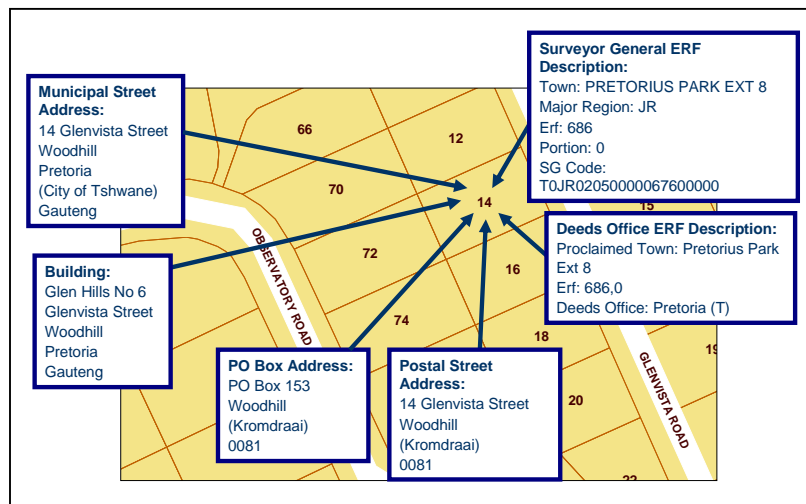
In South Africa, as in many other countries, there are many sources of address-related data. South Africa does not have an official address register that requires citizens to report their current residential address, as is the case in a country like Germany. Table 1 lists some sources of address-related data in South Africa. Some of this data is complementary, such as the cadastre from the Surveyor General and the address data from municipalities, while other datasets contain contradictory and/or ambiguous data, such as the address data from municipalities and the address data from the South African Post Office, as illustrated in Figure 1.

Apart from the multitude of address data sources, urbanization, the apartheid legacy and communal land in tribal areas are further complicating factors in the South African address landscape. Rapid urbanization, typical of a developing country like South Africa, causes people to flock to the cities faster than proper serviced dwellings on formal properties can be provided, illustrated in Figure 2. Formal address allocation does not exist in the informal settlements and dwelling demarcation of the informal settlements is dynamic and after, for example, a fire, dwellings can be rearranged completely. The ‘address’ of a particular dwelling is usually descriptive such as ‘*At the highway entrance, first street left, opposite the butcher shop, Mandelaville*’, but even descriptive directions to a dwelling or location might change over time due to the dynamic nature of the settlements.

**Table 1. Sources of address-related data in South Africa**

Owner	Description
Surveyor General	One integrated digital cadastre for the whole country.
Registrar of Deeds	Property ownership
Chief Directorate Surveys and Mapping	Topographical maps
Municipalities	Allocation of street addresses and data required for the collection of property taxes.
South African Post Offices (SAPO)	Delivery of postal mail.
South African Geographical Names Council	Standardizing geographical names, with a strong focus on redressing, correcting and transforming the geographical naming system.
Utilities	Data required for delivering services such as electricity and telecommunications. The focus is on actual service delivery points.

**Figure 1. Different address-related data for the same service delivery point**



**Figure 2. An informal settlement on the urban edge**



The legacy of the apartheid system has resulted in a wide variety of unacceptable names for places and streets. The South African government has embarked on a process to redress, correct and transform the geographical naming system (South African Geographical Names Council, 2002) and as a result, many town and street names are changed, resulting in addresses also changing. Because it takes time for people to start using the new addresses (including deliberate resistance to using new names), and also because it takes time to modify all addresses that are currently held on record, any address standard in South Africa has to cater for the possibility of more than one address per location or service delivery point. Street names were not assigned in many apartheid era black townships on the outskirts of cities where people lived but travelled to work in the cities. A typical township address consists of a number and a locality (the name of the township, suburb or section) only. Municipalities are now starting to assign street names in these areas, but since it is a political process that involves the local community, progress is slow. Thus, a South African address standard has to cater for these township addresses,

In tribal areas communal land consisting of a single, relatively large, land parcel is owned by a chief on behalf of the tribe, and the chief allocates land to the members of the tribe. In many instances, there is no formal record stating who stays where, at least not at a centralized, publicly-available deeds registry, and an addressing system is typically not in place (refer to Figure 3). As another example, farm workers and dwellers live on the farms where they work and their “land parcels” are assigned to them by the owner of the farm without official address allocation. Descriptive addresses are therefore widely used.

**Figure 3. A village with loosely scattered dwellings and no addresses**



Because there is no single national address database with complete coverage of South Africa, it is difficult to estimate how many address locations South Africa has. Coetzee and Cooper (2007b) attempt a crude estimate, which we relate here. According to the mid-2007 estimate by Statistics South Africa, South Africa has a population of 47.9 million (Statistics South Africa, 2007). According to the most recent Census, conducted in 2001, there are around 11 million households in South Africa (Statistics South Africa, 2003). There is not necessarily a one-to-one relationship between a household and an address, as more than one household could be living at the same address (e.g. in a garden flat) and a household could have more than one address (e.g. parliamentarians living in Cape Town and their home towns). The digital cadastre holds around 7 million registered land parcels; however, there are many more “properties” in tribal areas and in informal settlements. The deeds registry records approximately 500,000 sectional title properties, i.e. more than one property on a land parcel (e.g. in a block of flats).

Based on these figures, there are between 7,500,000 and 11,000,000 addresses in South Africa (excluding PO Box addresses). Currently, the largest address databases in the country have between 3,500,000 and 5,000,000 addresses, implying that the backlog in addresses is somewhere between 4,000,000 and 7,000,000 addresses, i.e. around 50%. This is arguably a very crude estimate but it does illustrate that the back log is substantial.

The fact that South Africa has eleven official languages – Afrikaans, English, Ndebele, Northern Sotho, Setswana, SiSwati, Southern Sotho, Tsonga, Xhosa and Zulu – further illustrates its cultural diversity. In fact, South Africa is often referred to as a ‘Rainbow Nation’ or a ‘world in one country’, referring to the diversity in its natural environment, as well as its people and their cultures. This cultural diversity along with the multiple sources of address-related data that are not regulated by a central authority, are similar to an international situation of each country being the source of its own socio-cultural specific address data.

### 3. The South African address standard (SANS 1883)

The South African address standard is being developed in three parts:

1. SANS 1883-1, Geographic Information – Address Standard, Part 1: Data format of addresses
2. SANS 1883-2, Geographic Information – Address Standard, Part 2: Guidelines for addresses in databases, data transfer, exchange and interoperability
3. SANS 1883-3, Geographic Information – Address Standard, Part 3: Guidelines for address allocation and updates

The first part defines an address and the different address types that are in use in South Africa; the second part provides a data model for address data exchange; and the third part gives guidelines for the allocation of addresses.

Since the project started in June 2006, the SANS 1883 project meetings have enjoyed broad participation of more than thirty organizations across South Africa, including national departments, municipalities, para-statal organizations as well as the private sector. Others have provided inputs via correspondence and a recently awarded GSDI Small Grant allowed some of the corresponding project team members and delegates who were unable to participate due to a lack of transportation to attend and actively participate in the development of the address standard.

The draft South African address standard (SANS1883) has drawn from similar standards elsewhere and the widespread expertise of its project members to describe the plethora of address types used in South Africa. The current draft standard includes eleven types of addresses: a street address, a building address, an intersection address, a site address, four types of SA Post Office addresses, a landmark address, a farm address, and an informal address. It must be emphasized that SANS 1883-1 aims at describing all forms of addresses used in South Africa, rather than prescribing a narrow set of addresses to be used.

The South African address standard states that an address *unambiguously specifies a point of service delivery*, which is the *actual location where a service could be provided* (SANS/WD 1883-1, 2007). This definition highlights the importance of recognizing that an address is used for all forms of service delivery, and not just for postal delivery. In South Africa we have to accept that we have a less than perfect situation (in terms of addressing completeness and stability) with an addressing backlog and place name transformation, and that we will have to live with it for a few years to come. Therefore, it is of utmost importance that the addressing standard accommodates this less than perfect situation so that as many as possible addresses are included to plan, roll out and maintain services until such time as the situation improves.

The SANS 1883-1 address types has four groups of address types, illustrated in Table 3. In its most basic form the street address consists of a street name and a locality. An indication of street numbering is optional, i.e. the 1736 in 1736 Pretorius Street is optional or the 938B in 938B Nelson Mandela Drive is optional. The locality can include suburb, town, municipal, provincial and/or country names. The inclusion of a postcode is optional. The intersection address type describes a location at the corner of two intersecting streets without any street number information. Site addresses occur primarily in townships established during the apartheid years when house numbers were allocated per block or section in a township, but no street names were assigned.

The composite address types include landmark and building names and either add more information to

one of the traditional formalized address types (street, intersection and site address types), or the name of a landmark together with a locality, and without any reference to a street, is enough to be an unambiguous description of the location.

**Table 3. SANS 1883 address types**

<b>Traditional formalized address types</b>	
Street Address	Dr Lategan Road, Groenkloof 1736 Pretorius Street, Arcadia, 0083 70 Park Street West, Hatfield, City of Tshwane, Gauteng 938B Nelson Mandela Drive, Rustenburg, South Africa 18-20 Settlers Avenue, Rhodes
Intersection Address	Corner of Kings and Richmond Roads, Mowbray Corners Festival and Schoeman Streets, Hatfield Festival Avenue and Schoeman Street, Hatfield
Site Address	25436 Soshanguve CC Portion 938 Mooikloof
<b>Composite address types</b>	
Landmark Address	Parliament, Cape Town Voortrekker Monument, Pretoria Room 4-66, IT Building, University of Pretoria, Pretoria Church Square, Pretoria, City of Tshwane
Building Address	Election House, 260 Walker Street, Sunnyside 2nd Floor, Celtis Plaza, Schoeman Street, Hatfield Commission House, corner of Church and Hill Streets, Pretoria
<b>SA Post Office (SAPO) address types</b>	
SAPO Box Address	PO Box 2947, Hatfield, 0028, ZA Private Bag X2438, Glenstantia, 0010 Postnet Suite 29487, Private Bag 10, Menlo Park, 0102
SAPO Street Address	477 Chopin Street, Glenstantia, 0181 74 Observatory Road, Woodhill, 0081
SAPO Poste Restante Address	Mr Peter Smith, Poste Restante, Hazyview, 3928 Mr Kgagiso Molefe, Poste Restante, Winterveld, 0198
SAPO-type Rural Village Address	012151 Ngxingxolo, Mooiplaas, 5228 110101 Corana, Umtata, 5100
<b>Descriptive address types</b>	
Farm Address	Blommeplaas, Koue Bokkeveld Tabakskuur, My Plaas, Kimberley Road, Bloemfontein My Geluk, Road S935, opposite farm dam, Koffiefontein
Informal Address	Opposite the butcher shop, Tsamaya Street, Mamelodi 1 <sup>st</sup> house on right after Vodacom booth, Olievenhoutbosch



The SA Post Office specifies four address types for postal mail delivery: the PO Box address, street address, 'poste restante' address, and the SAPO-type rural village address. Of these, the SA Post Office-type village address is interesting because it has been implemented by the SA Post Office in rural areas to decrease the addressing backlog in South Africa. It consists of a house number together with an optional village name, and a mandatory place name and postcode. The house number consists of three pairs of digits, identifying (from left to right) the village, section and dwelling. The place name and postcode refer to the post office closest to the village. The rural addressing system is described in detail by Rossouw and Kgope (2007).

**Figure 4. House 11509 in a rural village near Umtata in the Eastern Cape**



The farm and informal address types include descriptive free text. A farm address consists of a farm name, which is assigned by the occupant or owner of the farm, together with a town or colloquial area name and optional free text with directions to the farm entrance. Other descriptive addresses, such as a 'Under the tree at the entrance to the village of Feni' are commonly used by, for example, cell phone service provider delivering a pre-paid voucher. The minimum requirements for an informal address are a free format text reference together with a locality. Farm and informal addresses, like all others, have to be stored in a database, and have to be exchanged. For obvious reasons, the official allocation of such addresses is not encouraged.

#### 4. Address data exchange

SANS 1883-1 defines data elements, such as the street number, street name, place name, etc., and makes use of Extended Backus-Naur Form (EBNF) to define how address data elements can be combined to form valid addresses of an address type. As an example, refer to Figures 5 and 6 for the EBNF of the street address type and the informal address type respectively. We chose these two address types, as they represent the spectrum between the two extremes of structured and descriptive (free format) address types.

**Figure 5. EBNF of the street address type**

```
StreetAddress = StreetIdentifier, Locality

StreetIdentifier = [CompleteAddressNumber | StreetNumberRange],
                  CompleteStreetName

CompleteStreetName
= StreetName
| [[StreetNameModifier], StreetNameDirectional], StreetName,
  StreetNameType
| [StreetNameModifier], StreetName, StreetNameType,
```





```
</Locality>
</InformalAddress>
<StreetAddress>
  <StreetIdentifier>
    <CompleteAddressNumber>1736</CompleteAddressNumber>
    <StreetName>Pretorius</StreetName>
    <StreetType>Street</StreetType>
  </StreetIdentifier>
  <Locality>
    <RegisteredName>Arcadia</RegisteredName>
    <SAPOPostcode>0083</SAPOPostcode>
  </Locality>
</StreetAddress>
<IntersectionAddress>
  ...
</IntersectionAddress>
<LandmarkAddress>
  ...
</LandmarkAddress>
<SiteAddress>
  ...
</SiteAddress>
<FarmAddress>
  ...
</FarmAddress>
<SAPOVillageAddress>
  ...
</SAPOVillageAddress>
```

Another important aspect of data exchange is metadata which helps understand and interpret the content of the data that is being exchanged. Among others SANS 1883-1 provides for a unique address identifier, metadata about the source and distributors of the address data, the point of observation (e.g. center of the property or street front), the address life cycle stage (future, active, retired) and the official status. This metadata has comply with *SANS 1878 – South African spatial metadata standard*, the local profile of *ISO 19115 – Geographic Information – Metadata*.

SANS 1883 has been tested against a sample dataset from City of Joburg Metropolitan Municipality, one of the largest municipalities in South Africa. Figure 10 shows a map and associated attributes of address data (point features), as it appears in their municipal GIS database for 17 Mirwani Road in Sunninghill. By assigning the name of the suburb (RegisteredName) from the surrounding suburb boundary, and by adding appropriate metadata, in Figure 11 the sample data has been converted to the exchangeable SANS 1883 format. These two figures illustrate that SANS 1883 describes existing address data which is readily exchangeable in the SANS 1883 data model. This and other sample datasets, as well as other SANS 1883 supporting material, are available on the SANS 1883 website at [www.cs.up.ac.za/~scoetzee/sans1883](http://www.cs.up.ac.za/~scoetzee/sans1883).

Figure 10. City of Joburg Metropolitan Municipality sample data, as is

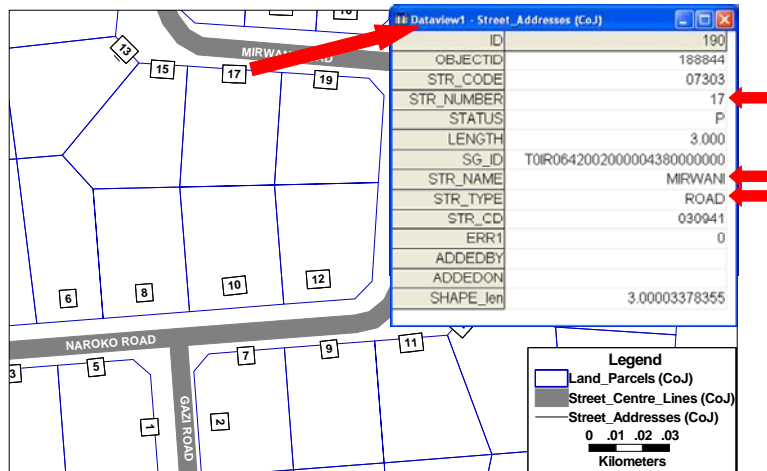
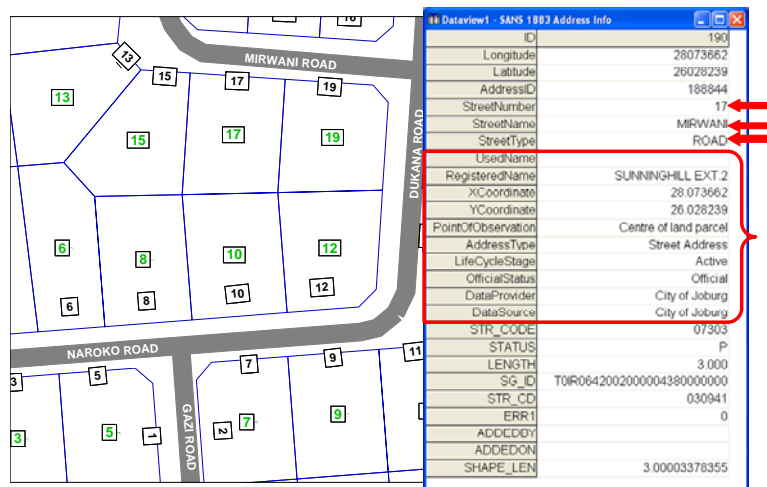


Figure 11. City of Joburg Metropolitan Municipality sample data, exchangeable as SANS 1883 address data



## 5. Benefits of an international address standard for South Africa

South Africa would benefit from an international address standard in more than one way. An international address standard would promote the development of addressing tools by both commercial vendors, as well as the open source community. Consultants of local authorities could reuse these tools at more than one local authority thereby establishing an address-related skills base. The tools would assist a country like South Africa to fast-track the assignment of addresses in previously unaddressed areas such as rural villages, allowing the establishment of required infrastructure for the much needed basic services and thereby integrating the rural population into modern civil society.

One example of such an addressing tool is a geocoding tool. The first step in the geocoding process involves the structuring of the address into its individual address components so that it can be matched against a reference dataset. The address standard provides the information for a geocoding tool to know how to structure the address, thus developers of geocoding tools would be able to develop a tool that works in more than one country for more than one address type.

An international address standard would establish a common vocabulary for addresses that eliminates ambiguities and misunderstandings both in address data maintenance as well as in day-to-day

communication, e.g. when giving directions. Such a standard would promote address data interoperability thus enabling the exchange of address data and facilitating the collation of address data into larger databases such as a provincial, national or an international address database. These larger databases are required, for example, for governance in a country: to prepare and run elections, to conduct household surveys, or to compare service infrastructure at different levels of government.

In the absence of a single national authority mandated to prescribe address assignment and address data exchange models an international address standard provides descriptive guidance to the address community in a region, country or a number of countries. The data grid, a recent trend in distributed software architectures, is an example of a service-oriented architecture (SOA) that is based on web services and that is not subject to centralized control (Foster, 2002). As such the data grid allows data from multiple organizations and their administrative domains to be presented as a single virtual dataset. Thus, the data grid is an ideal architecture to present address data from multiple sources that is not subject to centralized control as a single virtual address dataset to its users, and thereby sidestepping the need for a single authority to exercise control, provided a standard for address data interoperability exists (Coetzee and Bishop, 2008).

## **6. Conclusion**

An address is one of the most common forms of describing a location with the purpose of providing directions for all kinds of ‘deliveries’. The South African address standard is of interest to the development of an international address standard because of the variety of address types that are used in the country. These address types provide an all-encompassing description for addresses that are used in South Africa, ranging from structured addresses in traditionally formalized areas to descriptive (free text) addresses in informal settlements. SANS 1883 describes how address data can be exchanged in (and despite) a wide variety of address types. South Africa, as a developing country with a substantial addressing backlog and in the absence of a mandated authority to maintain a national address register, also has a lot to gain from an international address standard that would encourage the development of reusable addressing tools and enable address data interoperability.

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