DGIWG – 204

NATO Geospatial Real World Object Index (NGRWI)

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Abstract:	This standard provides information on the purpose and structure of data within the NATO Geospatial Real World Object Index (NGRWI) part of the NATO Geospatial Information Framework (NGIF)
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Table of Contents

List of Tables

List of Figures

i. Submitting organizations

Nation	Organisation
United Kingdom	Joint Forces Intelligence Group - Defence Geographic Centre (JFIG-DGC)
Germany	Bundeswehr Geoinformation Centre (BGIC)
France	Institut Géographique National (IGN)
Sweden	Swedish Armed Forces Geo SE
The Netherlands	Royal Netherlands Army Geographic Agency
United States	National Geospatial-Intelligence Agency (NGA)

ii. Document contributor contact points

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iii. Revision history

Date	Release	Editors	Primary clauses modified	Description
2013-10-18	1.0	GBR, DEU	All	Resolution of final review comments.

iv. Future work

As the NGIF programme of work continues and business and technical process mature, it is expected that the NGRWI specification and outputs will evolve. This specification will be reviewed and updated accordingly.

A process for proposing changes and new additions to NGRWI will be developed. New NGRWI content continues to be identified in order to enhance the current NGIF 1.0 NGRWI normative content. Updates to the normative content of this standard may be published.

Introduction

This Standard has been developed as part of the NATO Geospatial Information Framework (NGIF) suite of standards.

The NATO Geospatial Real World Object Index (NGRWI) provides a Real World Object Index for the NATO Geospatial Information Model (NGIM).

It is based on the Bundeswehr Geoinformation Centre (BGIC) Real World Object Register (GeoInfoROR) of the Bundeswehr Registry for Vector Data Modelling (GeoInfoVBDREx).

The NGIM is an NGIF-wide logical model for geospatial data that is technology neutral. This *Platform Independent Model* determines the syntactic structure. The NATO Geospatial Entity Catalogue (NGEC) is a simplified view on the content using a catalogue structure.

Within the NGIF, the NATO Geospatial Feature Concept Dictionary (NGFCD) is the authoritative source for valid concepts in the NGIM, which itself is a profile of the DGIWG Feature Data Dictionary (DFDD)

However, commonly used names for real world phenomena/real world objects may not be realised as explicit Feature Types in the NGIM. For example a Real World Object of *Quarry* is implemented as a Feature Type *Extraction Mine* with an attribute of *Extraction mine type = Quarry*. For a user/implementer non-conversant with the NGIM in may be wrongly assumed that Quarry is not a represented feature in the defined schema.

The NATO Geospatial Real World Object Index (NGRWI) 1.0 provides an entry point into the NGIM 1.0 by providing indexing from names of Real World Phenomena to their implementations in the NGIM.

1 Scope

The scope of this standard is to provide information on the purpose and structure of data within the NATO Geospatial Real World Object Index (NGRWI) part of the NATO Geospatial Information Framework (NGIF) suite of standards.

2 Conformance

All Real World Object terminology should conform to the Shorter Oxford English Dictionary (SOED), 5th Edition.

3 Normative references

The documents listed in Table 1 are indispensable to understanding and using this standard. For dated references, only the cited edition or version applies. For undated references, the latest edition or version of the referenced document (including any amendments) applies.

Table 1: Normative References

Standard or Specification
DGIWG STD-13-022-ed1.0.0 - *NATO Geospatial Real World Object Index (NGRWI) 1.0 - Normative Content https://portal.dgiwg.org/files/?artifact_id=8630*
DGIWG STD-13-014-ed1.0.0 - *NATO Geospatial Information Model (NGIM)*
DGIWG STD-13-016-ed1.0.0 - *NATO Geospatial Feature Concept Dictionary (NGCFD)*
DGIWG STD- 13-015-ed1.0.0 - *NATO Geospatial Entity Catalogue (NGEC)*

4 Terms, definitions, and abbreviations

4.1 Definitions

The terms and definitions specific to this standard are given in Table 2.

Table 2: Definitions Applicable to this Standard

Term	Definition
NGIM	A structured collection of feature information (features, attributes, associations, and ancillary data) whose metamodel conforms to the general feature model as specified in ISO 19109.
Application Schema	Conceptual schema for data required by one or more applications [ISO 19101]
Conceptual Model	Model that defines concepts of a universe of discourse [ISO 19101]
Feature	Abstraction of real world phenomena [ISO 19101] NOTE A feature may occur as a type or an instance. Feature type or feature instance should be used when only one is meant.
Feature Attribute	characteristic of a feature [ISO 19101] NOTE 1 A feature attribute may occur as a type or an instance. Feature attribute type or feature attribute instance is used when only one is meant. NOTE 2 A feature attribute type has a name, a data type and a domain associated to it. A feature attribute instance has an attribute value taken from the domain of the feature attribute type.
Feature Concept / Data Dictionary	Dictionary that contains definitions of … concepts that may be specified in detail in a feature catalogue [ISO 19126]
Feature Catalogue	Catalogue containing definitions … of the feature types … occurring in one or more sets of geographic data [ISO 19110]
Geographic Data	Data with implicit or explicit reference to a location relative to the Earth NOTE Geographic information is also used as a term for information concerning phenomena implicitly or explicitly associated with a location relative to the Earth.
Platform Independent Model	A model that is independent of the specific technological platform used to implement it.
Real World Object	An existing geographic (or geospatial) occurrence whose characteristics can be described/identified e.g. A Wooden Bridge, A Mosque, A Divided Highway
Real World Object Tuple	A three element Feature Type-Attribute-Value combination used to describe a Real World Object
Universe of Discourse	View of the real or hypothetical world that includes everything of interest [ISO 19101]

4.2 Abbreviations

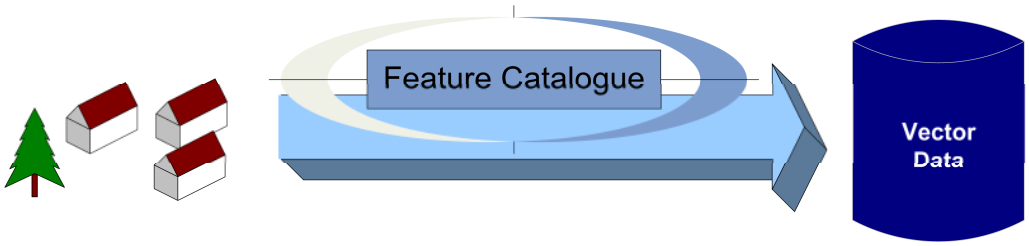
The acronyms and abbreviations that are used in this standard are specified in the following list.

- **BGIC** Bundeswehr Geoinformation Centre
- **DFDD** DGIWG Feature Data Dictionary
- **DGIWG** Defence Geospatial Information Working Group
- **NGEC** NATO Geospatial Entity Catalogue
- **NGFCD** NATO Geospatial Feature Concept Dictionary
- **NGIF** NATO Geospatial Information Framework
- **NGIM** NATO Geospatial Information Model
- **NGRWI** NATO Geospatial Real World Object Index
- **NMMT** NGIF Model Maintenance Team
- **NSG** National (USA) System for Geospatial Intelligence
- **STI** Special Technical Instruction

4.3 Purpose of the NGIF Real World Object Index

When real world phenomena or objects are modelled digitally, vector geometric entities consisting of points, curves and surfaces are used. To establish the relationships between these entities and the real world features/objects they represent, the concept of a Feature Catalogue is introduced.

Figure 1: Feature Catalogue as a Modelling Guide



Vector data is extracted, managed and provided within a defined schema and in a specified structure (in the form of a Feature Catalogue and/or a derived application schema). Within the NGIF, the NATO Geospatial Information Model (NGIM) contains the business rules and specifications used to describe the NATO geospatial vector data model.

The NATO Geospatial Feature Concept Dictionary (NGFCD), a profile of the DGIWG Feature Data Dictionary (DFDD), contains the concepts valid for the NGIM. The NGFCD presents an abstraction of reality as a defined classification of phenomena. The basic level of classification is the feature type.

Even though the NGIM contains standardised feature types and attribute concepts from the NATO Geospatial Feature Concept Dictionary (NGFCD), a real world object may not be directly (explicitly) referenced in the Feature Catalogue/Model but may be represented by another feature-attribute combination elsewhere in the NGIM.

For example, while a real world object **Bridge** can be easily found as a *Bridge* feature type in the NGIM, the real world object **Quarry** is modelled/defined as Feature Type *Extraction Mine* with an attribute of *Extraction mine type = Quarry*.

To simplify the identification and extraction of real world objects from the NGIM, an index has been developed.

The NATO Geospatial Real World Object Index (NGRWI) can be used as an entry point to the NATO Geospatial Information Model (NGIM) and provides traceability between a commonly used real world object name and it encoding in the NGIM.

The NGIF Real World Object Index provides a searchable reference **Quarry** and its associated NGIM encoding. The NGRWI allows the identification and retrieval of real world objects without having to have a detailed knowledge of the NGIM and NGFCD.

In addition common synonyms, when identified, are included to further simplify the extraction process and make the index more user-friendly.

For example searching for Real World Objects **Pit, Mining Plant, Quarry, Colliery** or **Mine** would all locate the feature type *ExtractionMine*

5 Applications of the NGIF Real World Object Index

The NGRWI may be used for the following applications:

5.1 Search and Find

Users can identify real world phenomena that are not directly (explicitly) reflected by the model (e.g., **Gold Mine** or **Desert Track**).

5.2 Maintain Consistency

Modellers may check if real phenomena are represented by more than one combination of model elements, thus avoiding inconsistencies. For example, the model must not define more than one representation of a **Church**. If a church is defined by the attribute *Feature Function code* on the feature type *Building* then it should not also be delineated by another modelling element, like a feature type *Church*.

5.3 Assist with Modelling User Requirements

Requirements are often not expressed in technical terms. For instance, a user may need to model a lake. By searching for "**Lake**" in the NGRWI, one is able to find the feature type *Inland Waterbody* associated to the attribute *Inland Water Type*.

5.4 Mapping and Transformations

If one is mapping features between two different models, both having their own real world object index, searching by their real world terms may help find the corresponding modelling constructs, without having to deeply analyse the data models.

5.5 Synonyms and Language Issues

The terminological definition of real world objects allows the use of synonyms and technical terminology, which in turn caters for the variation in the use of the English language, colloquialisms and ambiguities. This also makes translations easier.

5.6 From Requirements to Products

Usually, the contents of products are driven by the requirements of their users. With the help of the NGRWI, it is easy to define these requirements and store them in a Product Object Register. Linking of the Product Object Register, the model and the Real World Object Index allows verifying the consistency of the overall vector data workflow. For further details on the Product Object Register, see related documents.

6 Structure

The normative content of NGRWI 1.0 is published as an excel spreadsheet.

6.1 Information on real world objects

Along with the information that is necessary for the NGIF Register, e.g. on identification, etc., an element of the NGRWI consists of the following fields.

6.1.1 AlphaCode

Each real world object has a unique AlphaCode

6.1.2 OCL Constraint

To support UML implementation, each real world object has an Object Constraint Language (OCL) encoding that implements it.

6.1.3 English Term

A real world object has an English name. Any real world object from another language has been translated to the English equivalent. If the rare case an object cannot be translated into English, then consideration is given to using the name in the original language.

An English Term shall only appear once in the NGRWI. When applicable a single term with different meanings will be de-conflicted e.g. **Bank,** by using clarification in brackets**.** In the exceptional cases where a single unique English term has separate different meanings in different territories e.g. Pavement, Subway, the English term includes a clarification in brackets e.g. **Pavement (GBR)**

Listing of synonyms as separate English Term items is permissible.

Example:

In the current model, the real world objects "**Pit Mine**", "**Mine**" and "**Colliery**" are considered synonyms. Each has a unique entry in the index all referencing the same NGIM location. (Should the applications change, it may become necessary to model the above-mentioned real world object in different ways which would result in the real world objects no longer being treated as synonyms).

6.1.4 Real World Object Tuples

A Real World Object is identified in the NGIM model by a three element Feature Type-Attribute-Value combination. This is known as a real world tuple.

All Feature Type, Attribute and Values must all be conformant to NGFCD and a tuple must be implemented in the NGIM, and be valid in the NGEC

A tuple has the following mandatory information:

- Alpha code of the feature type
- Alpha code of the attribute

- Alpha code of the value

If the attribute and value are not required to define the object then the content is recorded as “0” (zero). Null values is not permitted.

Example 1

For the real world object “**Irrigation ditch**” the tuple designation is expressed as;

- *Ditch + DitchFunction + irrigation*

Example 2:

The real world object "**Canal**" is directly referred to the feature type "Canal“. Consequently, the tuple only consists of the feature type. The attribute and value are not valid.

- *Canal + 0 + 0*

6.1.5 Tuple combinations

Every real world object can be defined by a maximum of three combinations[1] of feature type-attribute-values (real world tuples).

Example 1

The real world object “**Historic Palace**” can be identified by

- *Building + featureFunction + palace*
- *Building + historicSignificance + historic*

Example 2

The real world object “**Fresh Water Well**” can be identified by

- *WaterWell + 0 + 0*
- *WaterResourceInformation + waterType + fresh*

Example 3

The real world object “**Buddhist Monastery Facility**” (and its synonym “**Lamasery“)** can be identified by

- *Facility + featureFunction + religiousActivities*
- *ReligiousInformation + religiousDesignation + buddhism*
- *ReligiousInformation + religiousFacilityType + monastery*

[1] Theoretically, this number can be increased arbitrarily.

6.1.6 Combined Codes

In view of better integration into the other model specifications, a mandatory Combined Code is also created for each real world object tuple.

The combined codes are created by amalgamating the tuple elements feature type, attribute and value NGFCD AlphaCodes, separated by an underscore into a single value.

Example 1
The real world object "**Irrigation Ditch**" can be identified by

- *Ditch_ ditch Function_ irrigation*

Example 2:
The real world object "**Canal**" is directly referred to the feature type "Canal". Consequently, the combined code only consists of the feature type:

- *Canal__ (*and optionally as

Example 3:
The combined Codes for the real world object "**Historic Palace**" can be identified by

- *Building_featureFunction_palace*
- *Building_historicSignificance_historic*

6.1.7 5-3-1 Codes

NGRWI 1.0 also contains Real World Object Tuples and Combined Codes expressed in legacy 5-3-1 encoding. These will not be maintained in future versions.

The Feature Type, Attribute and Value are all conformant to the 5-3-1 code in NGFCD 1.0 and correspond to the repetitive Alphacodes.

Example 1

For the real world object "**Irrigation Ditch**" the 5-3-1 tuple designation is expressed as;

- *BH030 + DIT + 1*

And the Combined code will be

- *BH030_DIT_ 1*

Example 2:

The real world object "**Canal**" is directly referred to the feature type "Canal". Consequently, the tuple only consists of the feature type

- *AH020 + 0 + 0*

And the Combined code will be

- *AH020_0_0*

As with alphaCodes, every real world object can refer to a maximum of three combinations of feature type-attribute-value (real world tuples).

6.2 Data Types

The following information pertains to a real world object

Table 3: NGRWI Properties

Name	Description	Data Type	Mult.	Constraint
NewAlphaCode	Unique NGRWI AlphaCode for the real world object Name based on the English Term.	CharacterString	1	Mandatory
English Term	Unique common name for a real world object in English.	CharacterString	1	Mandatory.
OCL Constraint	Object Constraint Language (OCL) encoding that implements the real world object	CharacterString	1	Mandatory
CCodeAlpha_1	The Combined Code of the first Feature Type, Attribute and Value tuple that implements the real world object in the NGIM (expressed by the unique alphaCode used to denote the concepts in NGFCD separated by underscores)	CharacterString	1	Mandatory
Entity 1 AlphaCode	First Feature type that implements the real world object in the NGIM (expressed by the unique alphanumeric value (alphaCode) used to denote the concept in NGFCD)	CharacterString	1	Mandatory. NGCFD 1.0 and NGIM 1.0 Compliant.
Entity Attribute 1 AlphaCode	The attribute that – in combination with the first feature type – implements the real world object in the NGIM. (expressed by the unique alphanumeric value (alphaCode) used to denote the concept in NGFCD)	CharacterString	1	Mandatory (Value=0 if not valid). NGCFD 1.0 and NGIM 1.0 Compliant.
Attribute Value 1 AlphaCode	The value (numeral, text or from a value list) the attribute has to assume in order to implement the real world object in the NGIM. (expressed by the unique alphanumeric value (alphaCode) used to denote the concept in NGFCD)	CharacterString	1	Mandatory (Value=0 if not valid). NGCFD 1.0 and NGIM 1.0 Compliant.
CCodeAlpha_2	The Combined Code of the second Feature Type, Attribute and Value tuple that implements the real world object in the NGIM (expressed by the unique alphaCode used to denote the concepts in NGFCD separated by underscores)	CharacterString	0..1	Optional
Entity 2 AlphaCode	Second Feature type that implements the real world object in the NGIM (expressed by the unique alphanumeric value (alphaCode) used to denote the concept in NGFCD)	CharacterString	0..1	Optional (Mandatory if CCodeAlpha_2 is populated Value=0 if not valid). NGCFD 1.0 and NGIM 1.0 Compliant.
Entity Attribute 2 AlphaCode	The attribute that – in combination with the second feature type – implements the real world object in the NGIM (expressed by the unique alphanumeric value (alphaCode) used to denote the concept in NGFCD)	CharacterString	0..1	Optional (Mandatory if CCodeAlpha_2 is populated Value=0 if not valid). NGCFD 1.0 and NGIM 1.0 Compliant.
Attribute Value 2 AlphaCode	The value (numeral, text or from a value list) the attribute has to assume in order to implement the real world object in the NGIM (expressed by the unique alphanumeric value (alphaCode) used to denote the concept in NGFCD)	CharacterString	0..1	Optional (Mandatory if CCodeAlpha_2 is populated Value=0 if not valid). NGCFD 1.0 and NGIM 1.0 Compliant.
CCodeAlpha_3	The Combined Code of the third Feature Type, Attribute and Value tuple that implements the	CharacterString	0..1	Optional. Not valid if CCodeAlpha_2 is not

Name	Description	Data Type	Mult.	Constraint
	real world object in the NGIM (expressed by the unique alphaCode used to denote the concepts in NGFCD separated by underscores)			populated. NGCFD 1.0 and NGIM 1.0 Compliant.
Entity 3 AlphaCode	Third Feature type that implements the real world object in the NGIM (expressed by the unique alphanumeric value (alphaCode) used to denote the concept in NGFCD)	CharacterString	0..1	Optional (Mandatory if CCodeAlpha_3 is populated Value=0 if not valid). NGCFD 1.0 and NGIM 1.0 Compliant.
Entity Attribute 3 AlphaCode	The attribute that – in combination with the third feature type – implements the real world object in the NGIM (expressed by the unique alphanumeric value (alphaCode) used to denote the concept in NGFCD)	CharacterString	0..1	Optional (Mandatory if CCodeAlpha_3 is populated Value=0 if not valid). NGCFD 1.0 and NGIM 1.0 Compliant.
Attribute Value 3 AlphaCode	The value (numeral, text or from a value list) the attribute has to assume in order to implement the real world object in the NGIM (expressed by the unique alphanumeric value (alphaCode) used to denote the concept in NGFCD)	CharacterString	0..1	Optional (Mandatory if CCodeAlpha_3 is populated Value=0 if not valid). NGCFD 1.0 and NGIM 1.0 Compliant.
CCode531_1	The Combined Code of the first Feature Type, Attribute and Value that implements the real world object in the NGIM (expressed by the unique 531 code used to denote the concept in NGFCD separated by underscores)	CharacterString	0..1	Optional
Entity 1 5-3-1 Code	Feature type that implements the real world object in the NGIM (expressed by the unique 531 code used to denote the concept in NGFCD)	CharacterString	0..1	Optional. Mandatory if CCode531_1 is populated. NGCFD 1.0 and NGIM 1.0 Compliant.
Entity Attribute 1 5-3-1 Code	The attribute that – in combination with the feature type – implements the real world object in the NGIM (expressed by the unique 531 code used to denote the concept in NGFCD)	CharacterString	0..1	Optional. Mandatory if CCode531_1 is populated (Value=0 if not valid). NGCFD 1.0 and NGIM 1.0 Compliant.
Attribute Value 1 5-3-1 Code	The value (numeral, text or from a value list) an attribute has to assume in order to implement the real world object in the NGIM (expressed by the unique 531 code used to denote the concept in NGFCD)	CharacterString	0..1	Optional. Mandatory if CCode531_1 is populated (Value=0 if not valid). NGCFD 1.0 and NGIM 1.0 Compliant.
CCode531_2	The Combined Code of the second Feature Type, Attribute and Value that implements the real world object in the NGIM (expressed by the unique 531 code used to denote the concept in NGFCD separated by underscores)	CharacterString	0..1	Optional. Not valid if CCode531_1 is not populated.
Entity 2 5-3-1 Code	Second Feature type that implements the real world object in the NGIM (expressed by the unique 531 code used to denote the concept in NGFCD)	CharacterString	0..1	Optional. Mandatory if CCode531_2 is populated. NGCFD 1.0 and NGIM 1.0 Compliant.
Entity Attribute 2 5-3-1 Code	The attribute that – in combination with the second feature type – implements the real world object in the NGIM (expressed by the unique 531 code used to denote the concept in NGFCD)	CharacterString	0..1	Optional. Mandatory if CCode531_2 is populated (Value=0 if not valid). NGCFD 1.0 and NGIM 1.0 Compliant.
Attribute Value 2 5-3-1 Code	The value (numeral, text or from a value list) an attribute has to assume in order to implement	CharacterString	0..1	Optional. Mandatory if CCode531_2 is

Name	Description	Data Type	Mult.	Constraint
	the real world object in the NGIM (expressed by the unique 531 code used to denote the concept in NGFCD)			populated (Value=0 if not valid). NGCFD 1.0 and NGIM 1.0 Compliant.
CCode531_3	The Combined Code of the third Feature Type, Attribute and Value that implements the real world object in the NGIM (expressed by the unique 531 code used to denote the concept in NGFCD separated by underscores)	CharacterString	0..1	Optional. Not valid if CCode531_2 is not populated.
Entity 3 5-3-1 Code	Third Feature type that implements the real world object in the NGIM (expressed by the unique 531 code used to denote the concept in NGFCD)	CharacterString	0..1	Optional. Mandatory if CCode531_3 is populated. NGCFD 1.0 and NGIM 1.0 Compliant.
Entity Attribute 3 5-3-1 Code	The attribute that – in combination with the third feature type – implements the real world object in the NGIM (expressed by the unique 531 code used to denote the concept in NGFCD)	CharacterString	0..1	Optional. Mandatory if CCode531_3 is populated (Value=0 if not valid). NGCFD 1.0 and NGIM 1.0 Compliant.
Attribute Value 3 5-3-1 Code	The value (numeral, text or from a value list) an attribute has to assume in order to implement the real world object in the NGIM (expressed by the unique 531 code used to denote the concept in NGFCD)	CharacterString	0..1	Optional. Mandatory if CCode531_3 is populated (Value=0 if not valid). NGCFD 1.0 and NGIM 1.0 Compliant.

6.3 Example Data

Table 4: NGRWI Data Examples

Field	Example 1	Example 2	Example 3
AlphaCode	Helipad	Lake	FreshWaterWell
English Term	Helipad	Lake	Fresh Water Well
OCL Constraint	"/* Helipad has attribute 0 with value 0 */ inv: Helipad.0.valueOrReason .value=Helipad0::0"	/* InlandWaterbody has attribute inlandWaterType with value lake */ inv: InlandWaterbody.inlandWaterType.valueOrReason.value=InlandWaterbodyinlandWaterType::lake	/*WaterWell has attribute 0 with value 0 and WaterResourceInformation has attribute waterType with value fresh */ inv: WaterWell.0.valueOrReason.value =WaterWell0::0
CCodeAlpha_1	Helipad__	InlandWaterbody_inlandWaterType_lake	WaterWell_0 _0
Entity 1 AlphaCode	Helipad	InlandWaterbody	WaterWell
Entity Attribute 1 AlphaCode	0	inlandWaterType	0
Attribute Value 1 AlphaCode	0	lake	0
CCodeAlpha_2			WaterResourceInformation_waterType_fresh
Entity 2 AlphaCode			WaterResourceInformation
Entity Attribute 2 AlphaCode			waterType
Attribute Value 2 AlphaCode			fresh
CCodeAlpha_3			
Entity 3 AlphaCode			
Entity Attribute 3 AlphaCode			
Attribute Value 3 AlphaCode			
CCode531_1	GB030_0_0	BH082_IWT_1	BH230_0_0
Entity 1 5-3-1 Code	GB030	BH082	BH230
Entity Attribute 1 5-3-1 Code	0	IWT	0
Attribute Value 1 5-3-1 Code	0	1	0
CCode531_2			ZI024_SCC_11
Entity 2 5-3-1 Code			ZI024
Entity Attribute 2 5-3-1 Code			SCC
Attribute Value 2 5-3-1 Code			11
CCode531_3			
Entity 3 5-3-1 Code			
Entity Attribute 3 5-3-1 Code			
Attribute Value 3 5-3-1 Code			