National Railway Network (NRWN)

Data Product Specifications

Edition 1.0

2012-11-07

Natural Resources Canada
Mapping Information Branch
Centre for Topographic Information – Sherbrooke
2144, King Street West, Suite 010
Sherbrooke, Quebec Canada
J1J 2E8

Telephone: +01-819-564-4857 / 1-800-661-2638 (Canada and USA)
Fax: +01-819-564-5698
E-mail: supportGeobase@NRCan.gc.ca
URL: http://www.geobase.ca

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REVISION HISTORY

Date	Edition	Description
2012-11-07	1.0	Initial version.

FUTURE WORK

Key word	Description

These specifications are produced in accordance with *International Standard ISO/TC 211, 19131: 2007 Geographic Information / Geomatics – Data Product Specification*, which refers in particular to standard *ISO 19115: 2003 Geographic information – Metadata.*

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1 OVERVIEW

1.1 Title

National Railway Network

1.2 Reference date

Creation date of the data product specifications:

2012-11

1.3 Responsible party

GeoBase
Natural Resources Canada
Earth Sciences Sector
Centre for Topographic Information
2144, King Street West, Suite 010
Sherbrooke (Quebec) Canada
J1J 2E8

Telephone: +01-819-564-4857
1-800-661-2638 (Canada and USA)
Fax: +01-819-564-5698
E-mail: supportGeobase@NRCan.gc.ca
URL: www.geobase.ca

1.4 Language

Languages in which the data product specifications are available in accordance with the ISO 639-2 standard:

eng – English

fra – French

1.5 Terms and definitions

Attribute *(Attribut)*
Characteristic of a **feature**. For example, Number of tracks or Gauge.

Class *(Classe)*
Description of a set of **objects** that share the same attributes, operations, methods, relationships, and semantics. A class does not always have an associated geometry (e.g., Contact Information).

Crossing *(Croisement)*
Location along the rail network where a **track** crosses another network. It identifies the location and type of **crossing** that traverses either on, above, or below a **track** element. A **crossing** includes any **structure** supporting or protecting that part of the **track** or facilitating the **crossing**. **Crossings** are often equipped with public warning signs and audio/visual signalling safeguards to control and protect vehicular and pedestrian traffic.

Dataset *(Jeu de données)*

Data collection identifiable for a Canadian Province or Territory.

Feature *(Entité)*

Digital representation of a real world phenomenon. For example, the digital representation of the Prince Rupert train station is a feature.

Junction *(Jonction)*

Virtual connector point **feature** of the NRWN. A **junction** may be located: at the intersection of three or more sets of **tracks**; at the **track** end; at the transition of a national, provincial or territorial boundary; and at the beginning and end of a track **subdivision**.

Marker Post *(Panneau de point milliaire)*

Sign indicating the distance along the network. For example, signs are often posted at intervals along a railway **subdivision** indicating the distance from its point of origin in miles or kilometres.

Object *(Objet)*

An object is an instance of a **class**.

Station *(Gare)*

Location identified by a **station** name sign and designated by that name in a time table (schedule listing the times at which certain events, such as arrivals and departures at a station, are expected to take place).

Notes:

1) *A **station** or a stop does not necessarily have to be a building. Ref: FGDC-STD-014.7b-2008.*
2) *A **station** is associated with up to two separate track features sharing the same track classification and name for the same or a different subdivision.*
3) *A **station** may have up to four users (0-4).*

Structure *(Structure)*

Manmade structure built to support or protect a **track**. A **structure** may be represented by a line or a point feature. Linear **structures** may be built at, above, or below grade level.

Subdivision *(Subdivision)*

Unit of a national or regional network of **tracks** used to transport freight and/or passengers. A **subdivision** is identified by a name or a number, and/or a color and is delimited by a **junction** point at each extremity. For example, the Orange Line of Montreal's metro is a **subdivision**.

Track *(Voie)*

In the real world, a **track** provides a guide for the movement of trains and other equipment. In general, one linear feature represents the two rails of a **track**. A **track** is bounded by two **junction** points and is segmented at each change in attributes along its course.

Notes:

1) *A **track** has one main operator (for example, Canadian National) and up to four (0-4) users (for example, VIA).*
2) *A **track** may belong to a maximum of two **subdivisions**.*

Universal Unique Identifier (UUID) – *Identifiant universel unique (IDUU)*

Unique identifier within a universe defined in an application domain. UUIDs are those proposed by the ISO 19118 standard: *Geographic information – Encoding*. They are represented by a 32-character hexadecimal string.

The definition and method used for the generation of a UUID is defined in the *National Vector Data: Identification Rules and Change Management* document available on the GeoBase portal (http://www.geobase.ca).

1.6 Abbreviations and acronyms

CCOG	Canadian Council on Geomatics
CMAS	Circular Map Accuracy Standard
CRSID	Coordinate Reference System Identifier
EPSG	European Petroleum Survey Group
FGDC	United States Federal Geographic Data Committee
GDF	Geographic Data File
GML	Geography Markup Language
GPS	Global Positioning System
IACG	Inter-Agency Committee on Geomatics
ID	Identifier
ISO	International Organization for Standardization
KML	Keyhole Markup Language
NAD83CSRS	North American Datum 1983 (Canadian Spatial Reference System)
NID	National Identifier
NRCan	Natural Resources Canada
NRWN	National Railway Network
OGP	International Association of Oil and Gas Producers
TC	Technical Committee
UML	Unified Modeling Language
UUID	Universal Unique Identifier
XML	Extensible Markup Language

1.7 Informal description of the data product

The National Railway Network (NRWN) product contains quality geospatial data (current, accurate, consistent and maintained) of Canadian railway phenomena (including ferry connection for the purpose of railway network continuity).

The NRWN product is distributed in the form of eleven provincial or territorial datasets and consists of one linear feature (Track), four punctual features (Junction, Crossing, Marker Post, and Station), and one linear or punctual feature (Structure) with which is associated a series of descriptive attributes such as, among others: Track Classification, Track Name, Track Operator, Track User, Gauge, Number of Tracks, Electrification, Design Speeds, Subdivision Name; Junction Type; Level of Crossing, Crossing Type, Warning System, Transport Canada Identifier; Station Name, Station Type, Station User, Number of platforms; Structure Type.

The NRWN conceptual model was elaborated in collaboration with interested data providers and is adopted by the Canadian Council on Geomatics (CCOG). The ISO 14825 — *Intelligent transport systems — Geographic Data Files (GDF) — Overall data specification* standard served as a guide for the elaboration of the NRWN conceptual model and feature catalogue. The NRWN vocabulary used (class names, attribute names and definitions) largely conforms to the ISO 14825 and to the terminology used by Transport Canada.

The methodology that will be used to maintain the NRWN data has yet to be defined. However, it will likely be done within the framework of partnership agreements with closest to source bodies capable of offering adequate and current representations of the railway phenomena.

Data produced form a homogeneous and standardized view of the entire Canadian territory.

2 SPECIFICATION SCOPE

This section describes the scope referred to by information provided in subsequent sections which describe the product.

2.1 Scope identification

Global

Note: "Global" means that this scope refers to all parts of this data product specifications.

2.2 Level

This scope refers to the following level according to the ISO 19115 standard:

006 - series

2.3 Level name

NRWN

2.4 Extent

This section describes the spatial and temporal extent of the scope.

2.4.1 Description

Canadian landmass

NRWN data are seamless between datasets and form a continuous network over the Canadian landmass.

2.4.2 Vertical extent

The NRWN data are two-dimensional. There is no elevation (z) associated with the data.

2.4.2.1 Minimum value

Not applicable

2.4.2.2 Maximum value

Not applicable

2.4.2.3 Unit of measure

Not applicable

2.4.2.4 Vertical datum

Not applicable

2.4.3 Horizontal extent

The geographic extent is given by the following geographic bounding box:

2.4.3.1 West bound longitude

140° West (or -140°)

2.4.3.2 East bound longitude

60° West (or -60°)

2.4.3.3 South bound latitude

41° North (or 41°)

2.4.3.4 North bound latitude

63° North (or 63°)

2.4.4 Temporal extent

The temporal extent is given by the following period of time:

2.4.4.1 Beginning date

1979-07

2.4.4.2 Ending date

Today

Note: "Today" means the current date of publication of an instance of the NRWN. That is, an instance of the NRWN may include the railway network that is current at the time of publication.

3 DATA PRODUCT IDENTIFICATION

3.1 Title

National Railway Network

3.2 Alternate title

NRWN

3.3 Abstract

The NRWN product is distributed in the form of eleven provincial or territorial datasets and consists of one linear feature (Track), four punctual features (Junction, Crossing, Marker Post, and Station), and one linear or punctual feature (Structure) with which is associated a series of descriptive attributes such as, among others: Track Classification, Track Name, Track Operator, Track User, Gauge, Number of Tracks, Electrification, Design Speeds, Subdivision Name; Junction Type; Level of Crossing, Crossing Type, Warning System, Transport Canada Identifier; Station Name, Station Type, Station User, Number of platforms; Structure Type.

The development of the NRWN was realized by means of individual meetings and national workshops with interested data providers from the federal, provincial, and territorial governments as well as the main railway companies in Canada.

In 2011, the NRWN Edition 1.0 was alternately adopted by members from the Inter-Agency Committee on Geomatics (IACG) and the Canadian Council on Geomatics (CCOG). The NRWN content largely conforms to the ISO 14825 from ISO/TC 204.

3.4 Purpose

The National Railway Network (NRWN) provides quality geospatial and attributive data (current, accurate, consistent), homogeneous and normalized of the entire Canadian railway network.

The NRWN data serve as a foundation for several applications. This common geometric base is acquired and will be maintained on a regular basis by closest to the source organizations selected for their specific interests or for their ease in offering adequate, up-to-date representations of railway phenomena, in accordance with the GeoBase initiative (www.geobase.ca). This common infrastructure facilitates data integration of NRWN data with supplementary data.

3.5 Topic category

Main topics for the product, as defined by the ISO 19115 standard, are:

013 – location

018 – transportation

3.6 Spatial representation type

Type of spatial representation for the product, as defined by the ISO 19115 standard, is:

001 - vector

3.7 Spatial resolution

Spatial resolution denominator of the data:

10 000

Note: The nominal spatial resolution is only a general estimate since the data originate from multiple sources (GPS, existing federal or provincial data; existing data from railway operators) but is approximately 1:10 000.

3.8 Geographic description

3.8.1 Authority

International Organization for Standardization (ISO)

3.8.1.1 Title

Standard for codes of geographical regions:

ISO 3166-1:1997 Codes for the representation of names of countries and their subdivisions – Part 1: Country codes

3.8.1.2 Date

Reference date of the ISO 3166-1 standard:

1997-10-01

3.8.1.3 Date type code

Type of date according to ISO 19115 standard:

002 - publication

3.8.2 Code

Code of the geographical region covered by the product according to the ISO 3166-1 standard:

CA – Canada

3.8.3 Extent type code

Extent type code of the delimitation polygon according to the ISO 19115 standard:

1 - inclusive (the delimitation polygon is inclusive)

3.9 Reference to specification scope

Global (See 2.1)

4 DATA CONTENT AND STRUCTURE

4.1 Description

The NRWN product is distributed in the form of eleven provincial or territorial datasets (there is no railway network in Prince Edward Island or in Nunavut). Each dataset consists of one linear feature (Track), four punctual features (Junction, Crossing, Marker Post, and Station) and one linear or punctual feature (Structure) with which is associated a series of descriptive attributes such as, among others: Track Classification, Track Name, Track Operator, Track User, Gauge, Number of Tracks, Electrification, Design Speeds, Subdivision Name; Junction Type; Level of Crossing, Crossing Type, Warning System, Transport Canada Identifier; Station Name, Station Type, Station User, Number of platforms; Structure Type.

4.2 Data modelling schema used

4.2.1 Application schema

The conceptual model of the NRWN data is presented in the document *National Railway Network, Conceptual Data Model, Edition 1.0* accessible on the GeoBase portal (www.geobase.ca).

The physical implementation of the NRWN product differs from the conceptual model in what concerned the management of object metadata.

For the Object Metadata, the conceptual model foresees two distinct series of metadata attributes describing the respective sources used for the creation and the revision of the data. Only the creation and revision dates were distinctly specified. When a revision date is indicated and a geometric modification was applied on the object (with regard to the previous dataset edition), the series of metadata attributes describes the sources used for revision. Otherwise, Object Metadata attributes describe the sources used for creation.

The document *National Railway Network, Product Distribution Formats, Edition 1.0* also demonstrates the implementation of the conceptual model into the physical model of the NRWN data product according to the distribution formats GML, KML, and Shape (www.geobase.ca).

4.2.2 Feature catalogue

The feature catalogue entitled *National Railway Network, Feature Catalogue, Edition 1.0* can be found on the GeoBase portal (www.geobase.ca).

4.3 Reference to specification scope

Global (See 2.1)

5 REFERENCE SYSTEM

5.1 Spatial reference system

Spatial data are expressed in latitude (φ) and longitude (λ) geographic coordinates in reference to the North American Datum 1983 Canadian Spatial Reference System (NAD83CSRS). The longitude is stored as a negative number to represent a position west of the prime meridian (0°). Coordinates measuring unit is the degree expressed as a 7-decimal real value.

5.1.1 Authority

5.1.1.1 Title

Coordinate reference system registry:

EPSG Geodetic Parameter Dataset

5.1.1.2 Date

Reference date:

2007-08-27

5.1.1.3 Date type code

Date type according to ISO 19115 standard:

002 - publication

5.1.1.4 Responsible party

OGP – International Association of Oil and Gas Producers
URL: http://www.ogp.org.uk

5.1.2 Code

Coordinate reference system identifier (CRSID):

4617

5.1.3 Code space

EPSG – European Petroleum Survey Group

5.1.4 Version

8.0

5.2 Reference to specification scope

Global (See 2.1)

6 DATA QUALITY

6.1 Completeness

NRWN product contains a quality geometric and attributive description (current, accurate, consistent), homogeneous and standardised of the entire Canadian railway network.

NRWN railway representation corresponds to centerline of the two rails (for all railway tracks with two rails) or to the unique rail on which monorails circulate, and this, regardless of the status (under construction, operational, discontinued) of the track, as long as the track exists and is connected to the network.

Note: Ferry connection segments are included in the NRWN for the purpose of railway network continuity.

6.1.1 Commission

Evaluation methods used for the detection of data in excess is determined by each data provider.

6.1.2 Omission

Evaluation methods used for the detection of missing data is determined by each data provider.

6.2 Logical consistency

6.2.1 Conceptual consistency

The conceptual model of the NRWN data can be found in the document *National Railway Network, Conceptual Data Model, Edition 1.0* accessible on the GeoBase portal (www.geobase.ca).

The physical implementation of the NRWN product has been made as conform as possible to the NRWN conceptual model. The implementation however differs from the conceptual model in respect to management of object metadata.

For the Object Metadata, the conceptual model provides two distinct series of metadata attributes describing the respective sources used for the creation and the revision of the data. Only the creation and revision dates were distinctly specified. When a revision date is indicated and a geometric modification was applied on the object (in comparison with the previous dataset edition/version), the series of metadata attributes describes the sources used for revision. Otherwise, Object Metadata attributes describe the sources used for data creation.

6.2.2 Domain consistency

The attributive values are validated by means of an XML schema containing the definition of the authorized domain values defined in the feature catalogue.

6.2.3 Format consistency

The NRWN data formats conform to the distribution formats described in the document *National Railway Network, Product Distribution Formats, Edition 1.0* accessible on the GeoBase portal (www.geobase.ca).

6.2.4 Topological consistency

The spatial relations of the entities of NRWN datasets are systematically validated by means of in-house software.

The validation performed consists in detecting and correcting whenever possible: duplication of features, connection between the linear and punctual features of the railway network, cardinality between segments and junctions, assignment of identifiers (NID), geometrical inconsistency (spikes) and network continuity of subdivisions and operators.

6.3 Positional accuracy

6.3.1 Absolute external positional accuracy

The geometric accuracy of objects is given as the difference between objects position in the dataset and their real ground positions measured in reference to the geodetic network. The accuracy may vary from one object to another. It is thus provided in attribute with each feature occurrence and is expressed according to the Circular Map Accuracy Standard (CMAS).

Standard Circular Error: $\sigma_c = 0.7071 (\sigma_x^2 + \sigma_y^2)^{½}$

σ_x : standard deviation in the X-axis

σ_y : standard deviation in the Y-axis

Circular Map Accuracy Standard: $CMAS = 2.1460 \sigma_c$

The planimetric accuracy aimed for the product is 10 meters or better. Under the data maintenance phase, no systematic validation of geometric nor attributive accuracies is performed on all NRWN datasets.

Data accuracy is evaluated according to the methods used to control acquisition sources (GPS, imagery, photogrammetry, etc.) and the positioning errors inherent to data extraction. The method for evaluating data accuracy is determined by the data provider.

6.3.2 Relative internal positional accuracy

Unknown

6.4 Temporal accuracy

6.4.1 Accuracy of a time measurement

Not applicable

6.4.2 Temporal consistency

Not applicable

6.4.3 Temporal validity

Not applicable

6.5 Thematic accuracy

6.5.1 Thematic classification correctness

Unknown

6.5.2 Non quantitative attribute accuracy

The method used for evaluating the accuracy of the non quantitative attribute values with respect to reality is determined by each data provider.

6.5.3 Quantitative attribute accuracy

The method used for evaluating the accuracy of the quantitative attribute values with respect to reality is determined by each data provider.

6.6 Reference to specification scope

Global (See 2.1)

7 DATA CAPTURE

7.1 Description

The method used for data acquisition is determined by each data provider. The selected method must allow for the acquisition of quality geospatial data (current, accurate, consistent) for the entire dataset. Many acquisition sources are used: GPS, orthoimages, orthophotos, photogrammetry.

Acquisition technique [both for original acquisition and data revision] used by the provider is indicated in the object metadata associated with each feature occurrence.

7.2 Reference to specification scope

Global (See 2.1)

8 DATA MAINTENANCE

8.1 Description

The methodology that will be used to maintain the NRWN data has yet to be defined. However, it will likely be done within the framework of partnership agreements with closest to source bodies capable of offering adequate and current representations of the railway phenomena.

In order to help NRWN data users in their management of the various update releases, updates will be packaged and distributed by change effects (addition, retirement, modification, confirmation). By proceeding in this fashion, identification rules as well as methods for classifying the modifications are established.

Identification rules on how to unequivocally identify feature occurrences and methods for classifying updates by change effects (addition, retirement, modification and confirmation) are defined in the document entitled *National Vector Data – Identification Rules and Change Management* available on the GeoBase portal (www.geobase.ca).

8.2 Reference to specification scope

Global (See 2.1)

9 DATA PRODUCT DELIVERY

Output file formats available for the product are: GML (*Geography Markup Language*), KML (*Keyhole Markup Language*) and SHAPE (ESRI™).

9.1 Information on the GML delivery format

9.1.1 Format name

GML – Geography Markup Language

9.1.2 Version

2.1.2

9.1.3 Specification

Geography Markup Language – GML – 2.1.2, OpenGIS® Implementation Specifications,
17 September 2002, OGC Document Number 02-069
(http://portal.opengeospatial.org/files/?artifact_id=11339)

9.1.4 Language

Languages used in the dataset according to ISO 639-2 standard:

eng – English

fra – French

9.2 Information on the KML delivery format

9.2.1 Format name

KML – Keyhole Markup Language

9.2.2 Version

2.2.0

9.2.3 Specification

Open Geospatial Consortium Inc., OpenGIS® KML Encoding Standard, Version 2.2.0, 2008-04-14,
Reference number of this OGC® project document: OGC 07-147r2
(http://www.opengeospatial.org/standards/bp)

KML specifications available on Google™ Earth Web site
(http://code.google.com/apis/kml/documentation).

9.2.4 Language

Languages used in the dataset according to ISO 639-2 standard:

eng – English

fra – French

9.3 Information on the SHAPE delivery format

9.3.1 Format name

Shape – ESRI™

9.3.2 Version

01

9.3.3 Specification

ESRI Shapefile Technical Description, an ESRI White Paper, July 1998 (http://www.esri.com/library/whitepapers/pdfs/shapefile.pdf)

9.3.4 Language

Languages used in the dataset according to ISO 639-2 standard:

eng – English

fra – French

9.4 Delivery medium information

9.4.1 Units of delivery

Canadian Province/Territory (with the exception of Prince Edward Island and Nunavut)

9.4.2 Medium name

Data are available on the GeoBase portal (www.geobase.ca).

9.4.3 Other delivery information

The name of the files, features, and attributes are described in the document *National Railway Network, Product Distribution Formats, Edition 1.0* (www.geobase.ca).

Data are subject to the GeoBase Unrestricted Use Licence Agreement (www.geobase.ca).

9.5 Reference to specification scope

Global (See 2.1)

10 METADATA

Not applicable

10.1 Reference to specification scope

Global (See 2.1)