MultiNet 3.5.1

User Guide v. 1.3.4

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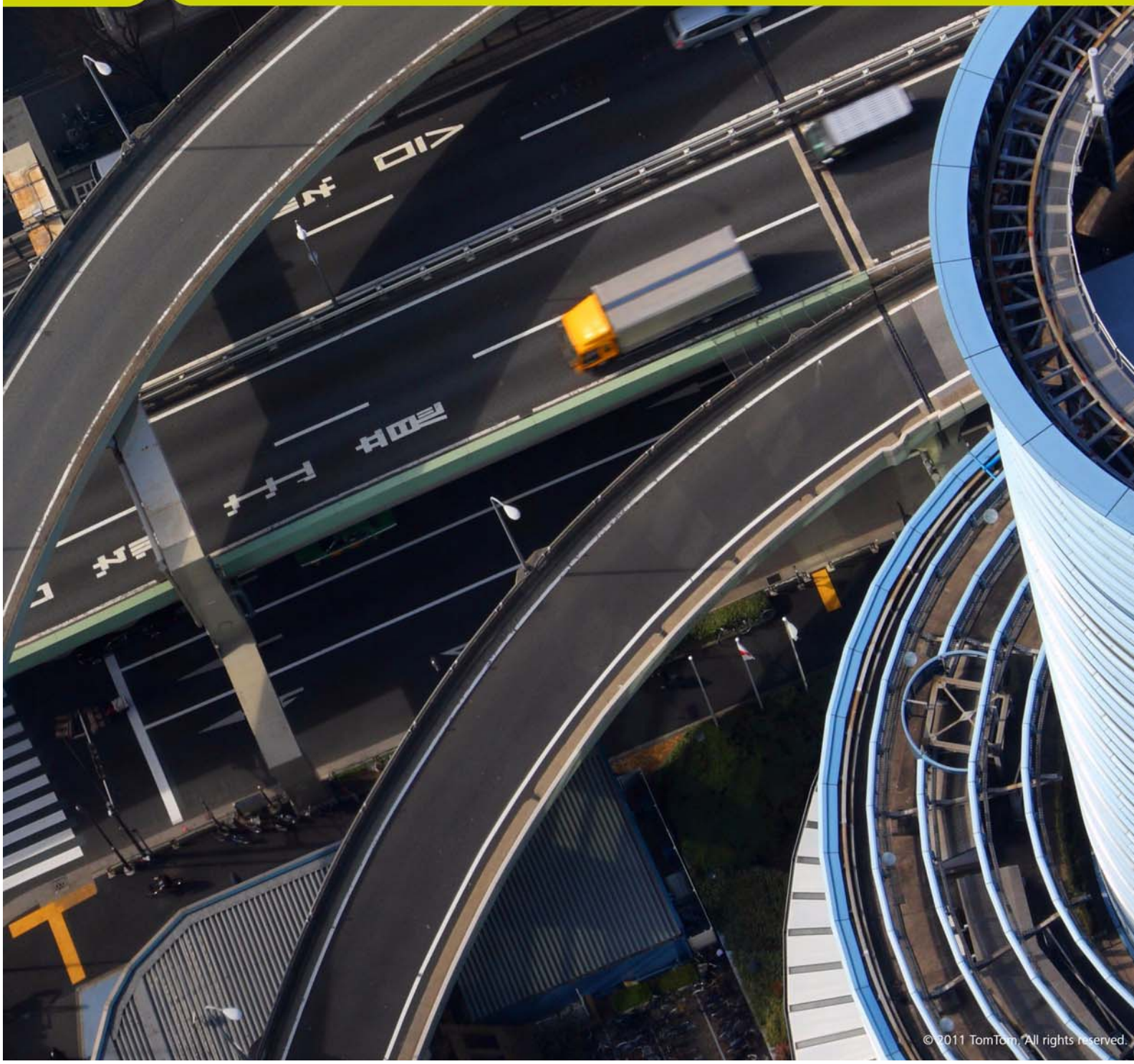

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User Guide Change Overview

VERSION	DATE	DESCRIPTION OF DOCUMENT CHANGES
2007.07	July 2007	Currency update; First release of MultiNet® user guide; MultiNet® product built to MultiNet® Data Specification 3.4.2; Detailed information in Release Notes for 2007.07.
2007.10	October 2007	Currency update; Detailed information in Release Notes for 2007.10; New content added to this MultiNet® user guide.
2008.01	January 2008	Currency update; MultiNet Shapefile Specification v. 4.3.2.2 applicable;Conversion Records for Shapefile format reintroduced; Other detailed information in Release Notes for 2008.01;
2008.04	April 2008	Currency update; Added bullet point to Postal Districts in U.S. in this user guide;
2008.07	July 2008	Currency update; Detailed information in MultiNet Release Notes for 2008.07;
2008.10	October 2008	Currency update; Global character set changed to UTF-8; Product built to MultiNet specification 3.5; Detailed information in MultiNet Release Notes for 2008.10
2009.02	February 2009	Currency update; Additions in the "How to Use..." sections of this user guide. No specification changes; See the MultiNet® Release Notes document included with this delivery.
1.0.0	June 2009	Currency update; Documentation versioning changed
1.1.0	September 2009	Currency update; in documentation added Administrative Boundaries and Shorelines subsection
1.2.0	Dec. 2009	User guide updated for MN GDF 3.5.1 and MN Shapefile 4.5
1.2.1	March 2010	Changed copyright date to 2010; Added mapping docs as reference docs; Updated Shapefile Relational Model; Added User Guide Metadata section
1.3.0	June 2010	Removed reference doc section and referenced Getting Started with MultiNet doc instead; added table of contents; changed heading “User Guide Metadata” to “User Guide Change Overview” and moved to front of doc; eliminated Quick Start Guide section; removed precision of 6 decimal places for North America and replaced with 7 decimal places. Expanded TMC information in Shapefile and GDF; added short section on Artificial Administrative Areas in How to Use GDF section.
1.3.1	September 2010	Added clarification about “closed in both directions” value in the NW.ONEWAY field; added a note that indicates shapefile area features are limited to <= 500 000 shape points per feature; updated Lane Information graphic to include PM table; added “how to use toll information.”
1.3.4	February 2011	Reformatting of document to TomTom style guide;added a note about using the NAME field in the Shapefile GC layer to obtain a full street name.

Section 1: Introduction

Introduction

Navigating within this Document

For optimal use of the electronic version of this document, please activate the Adobe® PDF bookmarks function.

Hypertext links appear in **bolded dark blue** text.

References to other documents outside this user guide appear in **grey bolded** text and are not linked.

Intended Audience

This document was created for a broad range of users, from generalists to specialists.

Related Documents

To fully understand MultiNet® and all its variations, several documents are necessary.

See the **Getting Started with MultiNet** document on this documentation DVD for an overview of these documents.

Product Description

The TomTom® MultiNet® database is a highly accurate and comprehensive digitized reproduction of today's road, street and transportation network that also includes land cover features. Database updates are released four times a year. The database covers a high percentage of the landmass of Europe, the United States and Canada and a rapidly growing portion of Africa, Asia, Australia, South America and Central America. TomTom® data is consistently formatted, enabling application developers to combine and expand their geographical coverage seamlessly.

Map Displaying a Partial U.S. GDF Dataset

Product Features

MultiNet® products contain an extensive list of features. These features are organized below by theme, as they appear in the **MultiNet® 3.5.1 Specification** document.

NOTE:
Features and their attributes are stored quite differently in the MultiNet® data formats. Please also see the Data Content and Format sections of this user guide for more details.

Theme 1: General

Topics grouped under this theme are general attributes used in MultiNet® data to help describe and identify real-world objects.

Theme 2: Roads and Ferries

Grouped under this theme are road network geometry, ferry geometry and stubble (incomplete) geometry and related topics represented in MultiNet® data including: network classification, direction of traffic flow, one-ways, restricted maneuvers, blocked passages, overpass and underpass (Z-level) information, toll roads, speed restrictions, signage, lane information and Traffic Message Channel (TMC) codes.

Theme 3: Road Furniture

The term "Road Furniture" relates to objects in the real world found along a road network that help drivers with guidance and information about the immediate and nearby areas such as traffic signs and signpost information.

Theme 4: Administrative Areas

Included in this theme are administrative hierarchial "Orders" 0-9, with Order 0=Country, and Order 9=smallest administrative division in a country. Also included are non-hierarchial Administrative Places.

Theme 5: Brunnels

The term "Brunnel" is derived from the words BRidges and tUNNELs and is a general term for all constructions that form a grade separation. Bridges and tunnels also are referred to as "Structures."

Theme 6: Railways

In this theme, railways and rail classes (railway, tram or monorail) are captured and identified.

Theme 7: Settlements and Named Areas

The Settlements and Named Areas theme contains postal districts, census districts and other areas not included in the Administratrive Areas theme.

Theme 8: Land Cover and Use

Land Cover and Use is the database representation of a number of entities relating to physical cover or functional usage of the earth's surface. Examples include artificial surfaces, parking garage footprints, forests and parks.

Theme 9: Waterways

Waterways include water line, point and area features. Waterways are not part of the Land Cover and Use theme.

Theme 10: Services

An extensive list of services and/or points of interest is available both through the standard MultiNet® product and in the TomTom® Premium Points of Interest side file product. Services include airports, amusement parks, cinemas, petrol stations, restaurants and many other categories. See the **MultiNet® 3.5.1 Specifications** document Theme 10 for a more complete list of Services provided in MultiNet® data.

Theme 11: Relationships

The Relationships theme refers to objects that are linked together to represent real-world entities. Examples of relationships include bifurcations and maneuvers.

Theme 12: Meta Information

Meta Information, also known as metadata, is defined as data about data. Examples of MultiNet® metadata include positional accuracy and geocoding accuracy.

NOTE:

MultiNet® does not necessarily contain all listed Features and Attributes in every region or data partition. For region-specific information on coverage and availability, please refer to the appropriate MultiNet® Release Notes for the region or release.

If a feature or attribute is not available or not yet captured for a particular geographic region, in Shapefile or Oslfile format there are blank fields in data files.

Product Design and Use

MultiNet®'s advanced capabilities are designed to support:

- Turn-by-turn navigation applications;
- Drive location-related GIS applications;
- Utility and telecommunication management;
- Online mapping; and
- Location-based services (LBS).

The MultiNet® database is a powerful tool to improve worldwide route planning and spatial queries, and quickly build powerful digital mapping and real-time navigation applications.

Other applications for MultiNet® include the following:

- Geocoding;
- Emergency response;
- Risk management/assessment;
- Presentation-quality maps; and
- Territory management.

Baseline Data Sources

The majority of data in the MultiNet® product is taken from the TomTom® core internal database. TomTom® continuously builds and updates this core streets and addresses database through a constant blending of geographic data from many verified sources.

Many of the data feeds are from official government sources (ministries, state governments, provincial authorities, local authorities, statistical offices and agencies).

TomTom® relies on relationships with thousands of resource providers, strategic development partnerships and data enhancement feedback loops for baseline data sources. These ongoing relationships have developed into an effective mechanism to gather local information such as a new subdivision or a change in a street name. TomTom® also partners with many customers, including delivery companies and utilities, to identify new neighborhoods and confirm addresses.

NOTE:
No confidential information about an individual, family, household, organization or business has been obtained from Statistics Canada.

How TomTom® Verifies the Quality of this Product

Data Resource Acquisition Standards—TomTom® maintains the integrity of its data attribution by relying on acquisition of data resources from authoritative sources.

- TomTom® Resource Acquisition Specialists acquire only those resources that conform to TomTom® documented resource specifications.
- Only after resources have passed inspection are they available to TomTom® Digital Mapping Technicians.

Field Data Sourcing—TomTom® also sends teams of field verification specialists to drive the roads of selected areas to verify and update the "ground truth" of our digitized data and attributes.

Database Enhancement Verification—All database enhancements are verified by trained TomTom® professional data analysts who follow a rigorous Quality Assurance control process:

- Street data is crosschecked and verified using several independent mapping sources.
- More than 500 algorithmic QC checks are applied against the database to ensure that changes to geography and attribution conform to Database Feature Modeling Specifications.

Product Delivery Testing—Quality Assurance specialists follow strict testing guidelines prior to releasing this product to the market. Data testing is initiated following:

- Each change in the database where a potential impact on the product is anticipated.
- Each change in the production system where potential impact on the product is anticipated.
- Each new release of product extract code.
- Planned changes to the product and any resolved issues from prior production runs.

Map Feedback

End users can report road changes not currently in MultiNet® data or data discrepencies by using the TomTom® **Map Insight™** reporting system.

Product Limitations

- Demographic Data — This product does not contain census demographic information. Demographic data that can be used in conjunction with this product is available from several different providers (e.g., in the U.S., the U.S. Census Bureau).

- The capturing of all earth's features in a covered geographic area with accompanying attribution is not a realistic assumption. However, TomTom® is customer directed and responds to the most sought-after features and attributes that markets demand.

Product Versions and Currentness

PRODUCT SPECIFICATION	VERSION
MultiNet® Data Specification	3.5.1
MultiNet® ASCII Sequential (AS) Specification	3.5.1
MultiNet® ASCII Relational (AR) Specification	3.5.1
MultiNet® Shapefile Specification	4.5
MultiNet® Oracle Specification	4.5

Format Availability

MultiNet® is available in the following formats:

FORMAT	DESCRIPTION	PRINCIPAL USERS
GDF-ASCII Sequential (GDF-AS)	A standard international exchange format and data model for navigable databases.	In-car navigation system builder.
GDF-ASCII Relational (GDF-AR)	The same data as GDF-AS, but presented as relational tables.	In-car navigation system builder.
Shapefile	ESRI® Shapefile format, structured as a layered data model.	Portable navigation developers; Spatial application developer managing data on GIS-based platform.
Oslfile	Oracle® Spatial loader files with SQL scripts and batch software for easy upload and spatial index creation.	Location Based Systems (LBS) application developer; Spatial application developer managing data in the Oracle® environment.

Geographic Coverage

The MulitNet® database is constantly being updated and improved. The geographic coverage of the database also is expanding.

Please refer to the **MultiNet® Release Notes** for this release or contact a TomTom® Sales and Marketing representative through the **TomTom website** for details of current and planned coverage.

Road Networks

TomTom® is continually improving road network coverage throughout the world. There are three levels of MultiNet® road networks available for represented countries:

- Major Road Network (MRNW)
  - The Major Road Network covers freeways, motorways and limited-access highways. Connector Roads are a subset of the MRNW.
- Interconnecting Network (ICNW)
  - The Interconnecting Network covers all geometry included in the MRNW and also includes local connecting roads and local roads of high importance.
- Street Network (STNW)
  - The Street Network represents the entire road network, including local roads.

Please contact a TomTom® Sales and Marketing representative through the **TomTom website** for the current level of network coverage for your geographic area.

Data Partitioning

MultiNet® data is delivered by nation. For most countries, each nation database is partitioned with a hierarchy of Administrative Areas. Country is the highest level—Order 0—and sub-municipality (Hamlet) is the lowest possible level—Order 9.

For data partitioning structure, see the **MultiNet Global Directory Structure** document included in the specs folder of this documentation DVD.

Depending on the country, only some of the intermediate orders may be present.

Data Delivery

Delivery methods from TomTom® may vary depending on how your data is partitioned and packaged. In order for certain GIS format applications to open and display data files correctly on your computer, copy all data from the DVD or DVD(s) to your hard drive following the same directory structure as it appears on the DVDs.

The directory structure and file naming are detailed in the **MultiNet Global Directory Structure** document.

Character Set

This product employs the UTF-8 character set. See **UTF-8** later in this user guide for more details.

Projection / Datum / Units / Precision

- Projection: Geographic.
- Datum: WGS84.
- Units: Decimal degrees.
- Precision: Seven decimal places.
- See The Coordinate System in Section 3 for details.

Section 2: Getting Started

What's In This Package?

With your shipment of this product you should have received:

- Product files on the correct media and in the correct format;
- Packing Slip (paper or electronic listing of package contents);
- Documentation DVD.

Check now to be sure that you have received the correct order.

Installation

For loading Oslfile (Oracle® Spatial) data, see **Loading Oslfile into a Database** in the Oslfile Format section of this user guide.

Replacement and Return Policy

Please read the data on the enclosed media as soon as possible. TomTom® strongly recommends that back-ups of all data be made once the media is read successfully.

TomTom® will replace defective or unreadable media at no charge provided we are notified within 30 days of the original invoice date. TomTom® shall provide you with a replacement copy of this product within a commercially reasonable time after notification.

Section 3: Understanding MultiNet®

General Product Rules

The following section of this user guide is intended to cover general MultiNet® concepts that apply to all data formats. However, any format-specific information is noted when applicable.

There are several concepts governing incorporation of features, attributes and relationships into this product. Understanding these rules will help you make better use of the product.

The Coordinate System

A coordinate system is a reference system used to measure horizontal and vertical distances on a map. A coordinate system usually is defined by projection, spheroid of reference, datum, one or more standard parallels and a central meridian.

The data in this product uses a "geographic" coordinate system.

Projection

Although not a true map projection, feature location in the "geographic projection" is based on a flat grid of latitude and longitude coordinates.

Datum

A datum is the 3-dimensional reference frame that is the basis for the coordinate systems upon which feature locations are measured on the earth's surface. A datum is defined both by an ellipsoid that approximates the size and shape of the Earth, and by parameters that specify the ellipsoid's orientation.

This product references the World Geodetic System 1984 (WGS84) datum, a global datum that is the reference frame used by Global Positioning System (GPS) satellites.

Units

The units of measurement in this product are degrees of longitude and latitude.

Precision

Precision refers to the number of decimal points used when representing longitude and latitude in degree units. The precision of the longitude and latitude degrees in this product is seven decimal places (EXAMPLE: 9,5044797 47,1561687).

UTF-8

UTF-8 is the abbreviation for **U**nicode **T**ransformation **F**ormat-**8**. UTF-8 is a variable-length character encoding for Unicode.

UTF-8 encodes each Unicode character as a variable number of 1 to 4 bytes, where the number of bytes depends on the integer value assigned to the Unicode character. One byte is needed to encode the 128 US-ASCII characters. Two bytes are needed for characters from Greek, Cyrillic, Armenian, Hebrew, Arabic, Syriac and Thaana alphabets. Three or four bytes are needed for Chinese and virtually all characters in common use.

The first byte of a multi-byte character sequence indicates the number of bytes in the sequence.

UTF-8 and GDF-AS

In MultiNet® GDF-AS, a record is 80 characters long (81 with a Line Feed).

For more detailed information on UTF-8, see either the **MultiNet® Shapefile, Oslfile (Oracle), ASCII Sequential (GDF-AS)** or **ASCII Relational (GDF-AR) Specification** documents on this user documentation DVD.

Positional Accuracy

GDF attribution name abbreviation in data = AP

Shapefile and Oslfile field name = POSACCUR

Absolute positional accuracy refers to how closely a given feature's mapped position matches that feature's position on the earth's surface.

Positional Accuracy Codes

In MultiNet® data, the following positional accuracy code values apply:

POSITIONAL ACCURACY CODE VALUE	DESCRIPTION
0	Normal: A very accurate source. Accuracy is between 5 and 25 meters.
1	Highly inaccurate: Accuracy is off by up to 100 meters.
2	Moderately inaccurate: Accuracy is off by up to several tens of meters.

Records = Rows; Fields = Columns

As a general note, data files contain rows and columns of information. Rows (records) appear horizontally and columns (fields) appear vertically in your data. The Table Records that define the data in the MultiNet® Format Specification documents describe the information contained in each horizontal record in the data. Portions of each record (row) of information are divided into record fields (columns).

In MultiNet® specification documents, the presentation of record fields is vertical and their description is horizontal.

EXAMPLE:

Shapefile

Portion of Shapefile data (NW) in dbf format:

ID	FEATTYP	FT	F_JNCTID	F_JNCTTYP
13720000131081	4110	0	13720200063911	0
13720000131082	4110	0	13720200033340	0
13720000131085	4110	0	13720200052231	0

Table Record of the above data in the **MultiNet® Shapefile Format Specification** document describing the above data record fields:

ABBR.	FULL NAME AND ATTRIBUTE VALUES	W	T	D
ID	Feature Identification	15	N	0
FEATTYP	Feature Type: • 4110: Road Element • 4130: Ferry Connection Element • 4165: Address Area Boundary Element	4	N	0
FT	Ferry Type: • 0: No Ferry (default) • 1: Ferry Operated by Ship or Hovercraft • 2: Ferry Operated by Train	1	N	0
F_JNCTID	From (Start) Junction Identification:	15	N	0
F_JNCTTYP	From (Start) Junction Type: • 0: Junction (default) • 2: Bifurcation • 3: Railway Crossing • 4: Country Border Crossing • 5: Ferry Operated by Train Crossing • 6: Internal Data Set Border Crossing	1	N	0

GDF-AS

Although the appearance of data in ASCII files is not always as uniform as that of dbf files and the field names are not identified in the data, the same guidelines apply: records are rows and portions of records (fields) are columns:

Portion of GDF data in GDF-AS format:

```
03FEAT_ID    10N       <S>
03FEAT_NAME  20G       <S>
03FEAT_SYN   20G       <S>
03FIELD_SIZE 2N        OBL
```

Record type 03 in the MultiNet® ASCII Sequential (GDF-AS) Format specification document describing the above data record fields is below. Field names are matched by color to data fields in this example:

FIELD NAME	SIZE	TYPE	NO DATA	MIN	MAX	DESCRIPTION
REC_DESCR	2	N	Obl			Record Type Code (03)
FLD_NAME	10	G	Obl			Attribute Type Code of attribute type in this record
FIELD_SIZE	2	N	Obl			Attribute Value Field Size
DATA_TYPE	2	A	<S>			Data Type – the type of data in this record G = any printable characters A = alphabetic characters N = number (unsigned) I = number (signed) AN = alphanumeric characters
DATA_UNIT	3	A	<S>			Data Unit (ALWAYS BLANK)
UNIT_EXP	2	I	<S>			Unit Exponent (ALWAYS BLANK)
NO_DATA	6	G	Obl			No Data – Value if no data is being sent Obl = Obligatory <S> = Space characters

Features

A Feature is the GDF representation of a real-world object. All represented objects are related to the road environment. The road environment, however, covers a large field of topics.

A Feature Theme is a compilation of Features that share a common property.

Feature Class Name: A Feature or Feature Theme has a name that is derived from a term commonly used in everyday life.

Feature Class Code: GDF refers to a Feature or Feature Theme by a numeric code rather than by name. See the Appendix section of the **MultiNet® 3.5.1 Specification** for a list of Feature Names and Codes.

Feature Representation - Level 0

At level 0, real-world features are represented by a set of geometric primitives:

- Nodes: zero-dimensional geometry that is represented by only one coordinate pair;
- Edges: one-dimensional geometry, a linear sequence of at least two coordinate pairs;
- Faces: two-dimensional geometry represented by a polygon.

In level 0, geometry is built according to a planar graph model: edges are split when crossing each other or when crossing faces. This is the geometric foundation on which topology is built and features are constructed.

In MultiNet® Shapefile format, Level 0 is not present explicitly, but is part of the internal (invisible) structure of the Shapefile format.

Important Note:

An exception exists for the North American MultiNet® Shapefile database: the Roads layer is a geometrical representation of the planar graph Level 0 geometry. A Road Edge is bounded by a Junction on every crossing with another Feature.

Feature Representation - Level 1

Level 1 objects (also called simple features) form integrated systems, such as a road network or a postal district area. Topologically related nodes and edges form higher objects in a mathematical or logical network, with information about the connectivity between them.

For example, edges can build up Road Elements that are connected when sharing a "Junction" Point Feature at the same level.

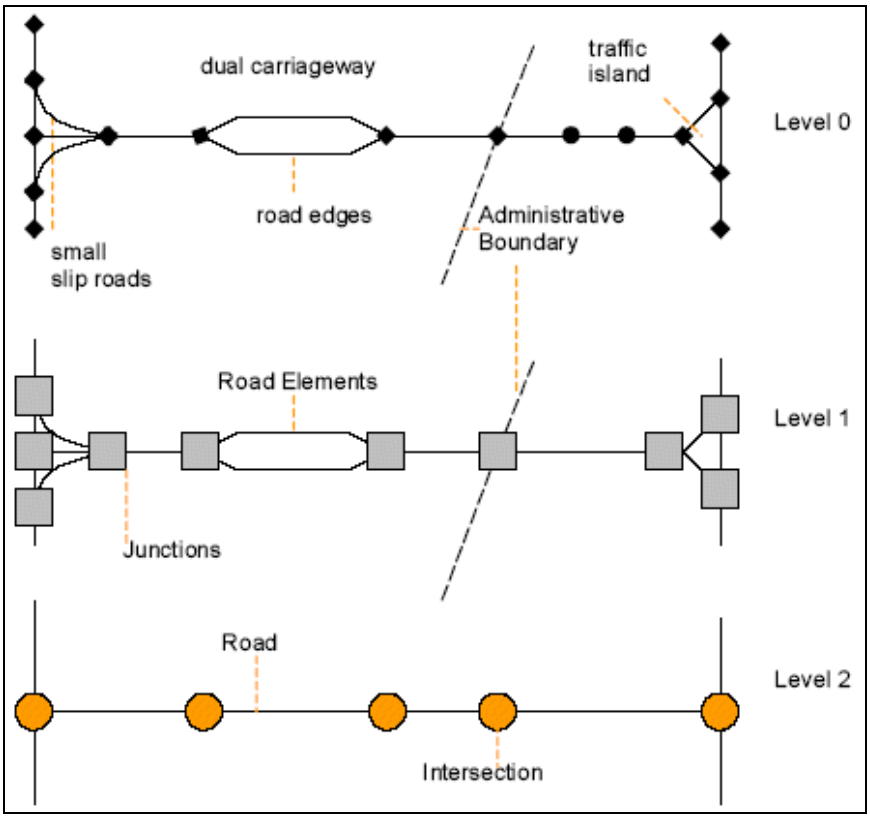
- Point features (e.g., City Centers) are constructed from nodes.
- Line features (e.g., Transportation elements) are constructed from edges.
- Area features (e.g., Administrative Areas) are constructed from faces.

Features are collected into feature classes by assigning a Feature Class Code to them. For example, a Transportation element can be a Road Element (Feature Class Code 4110), a Ferry element (4130) or an Address Area Boundary element (4165).

Feature Representation - Level 2

Level 2 objects (also called Complex Features) do not directly contain any geographic topology. Complex Features are present whenever a feature is built of several lower-level features.

Level 2 is often a simplification of Level 1 because functionality is more important:



Administrative Areas

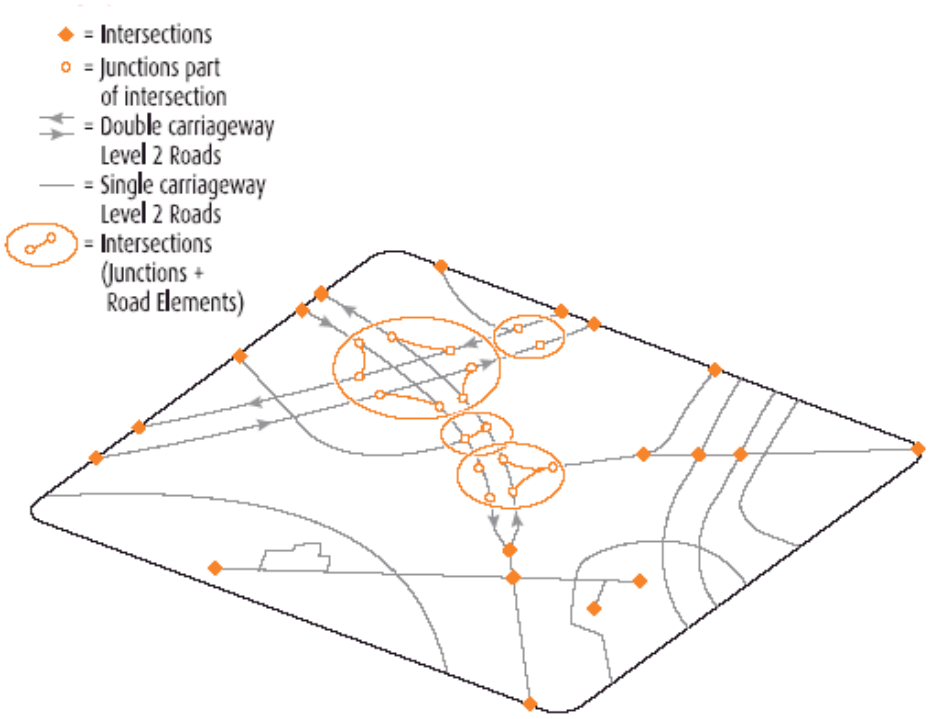
All higher-level Administrative features (i.e., lower Administrative Order number) are complex (Level 2) features because they consist of various lower-level features. Sub-municipality settlements (Order 9) or municipalities (Order 8) are Area features that are grouped into higher-level Administrative features.

Level 2 Roads

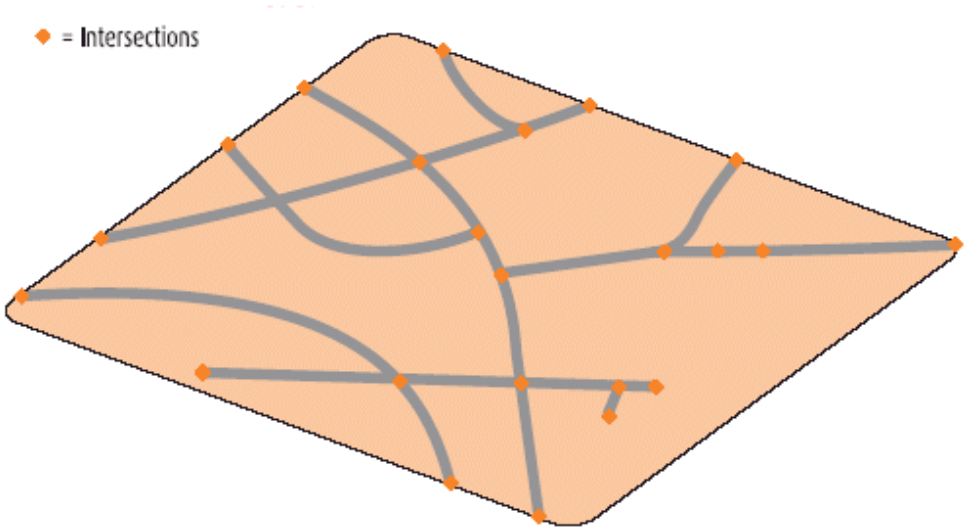
As with Administrative Area Complex Features, Level 2 Roads consist of various lower-level features. In addition to objects associated with lower-level geometry, an Intersection is also an example of a Level 2 object. The topology associated with an intersection is contained in the Level 1 geometry of the roads and junctions that make up the intersection. Level 2 roads form a more generalized representation of the Road Network.

On the following page are two figures: The first represents the lower-level components necessary to form Level 2 roads and intersections, and the second is a conceptual view of a Level 2 Road network.

See also **How to Use Level 2 Roads** in the How to Use MultiNet® Shapefile section of this user guide.



Junctions and Road Element Components To Form Level 2 Intersections



Conceptual Generalized Representation of Intersections and Level 2 Roads

Feature Categories (GDF only)

GDF-AS field name (in documentation) **= Feat_Cat**

GDF-AR field name (in documentation) **= FeatCat**

Feature Categories are employed in GDF formats to identify the basic category that a feature belongs to. Below are the categories and codes:

FEATURE CATEGORY	CODE	NOTES
Absent Part	0	GDF-AR only
Point Feature	1	
Line Feature	2	
Area Feature	3	
Complex Feature	4	
Relationship	5	Used in Relationship Records

Some General Feature Descriptions

As an introduction to some of MultiNet®'s features, some general descriptions applicable to all formats are listed below in alphabetical order. This is not a complete list.

Administrative Areas

Administrative units are constructed topologically and hierarchically in the MultiNet® database, according to the GDF model. Complex Administrative Features consist of lower-level complex Features or simple Area Features (also see **Level 2** earlier in this user guide). There are no overlaps or gaps between neighboring polygons, regardless of the administrative level.

At least 10 levels of Administrative Orders are defined for each country. The highest level, Order 0, is always the Country, which is made up of all lower-level units. Order 8 is also always present. The name of this level and the extension of its units are country-dependent. Order 8 is the lowest level that covers the whole territory of the country. It is especially important because many Relations between Features and the Order 8 Administrative Areas are made in the TomTom® database.

The intermediate orders from 1 to 7 and the lowest level, Order 9, may or may not be used, depending on a country's political hierarchy.

U.S. Administrative Areas:

- Order 0: Country
- Order 1: State
- Order 8: County
- Order 9: Minor Civil Division (MCD)

U.S. Census Places are Administrative Places (see below).

Administrative Places

An Administrative Place is an administrative area that does not fit into a hierarchical structure. This subdivision may lie in more than one Administrative Area.

Administrative Places may have their own hierarchy, as one Administrative Place can be entirely within, yet belong to, another Administrative Place. This Relation is expressed as a "Place within Place" relation. The Relationship relates an Administrative Place with another one that it belongs to, similar to the Relationship of an Entry Point and the POI that it belongs to.

NOTE:
In GDF formats the Place Within Place Relationship only remains between Administrative Places and Administrative Areas (U.S. only) because Index Areas are now an independent Complex Feature.

In Shapefile format, the Place Within Place Relationship is present between Administrative Places and Administrative Areas, and between Index Areas of different hierachy levels. Relationships between Index Areas and Administrative Areas no longer exist.

In Ireland, Administrative Place T is captured for each Townland and Administrative Place P is captured for each Postal Town as defined in the Geodirectory source of the Republic of Ireland.

In the U.S., Administrative Places are captured for each city represented in the latest Census Bureau TIGER® data.

Built-up Areas

A Built-up Area is an Area Feature independent from the Administrative Area structure. An Administrative Area can contain more than one Built-Up Area. A Built-Up Area corresponds to an area inside an Order 8 Area. An exception to this case is when an adjacent Order 8 Area does not contain a Center of Settlement. Then, the Built-up Area may cross an Order 8 Area.

Built-up Areas are determined geographically as a concentration of homes and buildings, mainly with a residential function. They improve map display and map readability. They also can play an important role in geocoding.

The lack of an administrative value of a Built-up Area has implications for routing. The point where an urban speed limit applies does not always coincide with a Built-up Area boundary. If a Built-up Area is used for assigning travel-time weight factors to the Road Elements running through it, the assignment may produce only an estimation of the travel time.

Index Areas

Index Areas occur where administrative divisions of a country do not provide clear address selection or do not allow address selection at all. The following are examples of when Index Areas occur:

- Where different Administrative Areas have the same name;
- Where Administrative Areas at a different level are considered for addressing on the same level;
- Where the names of Administrative Areas are not suitable for addressing because they are not known by the public;
- Where the surface of an Administrative Area does not correspond with the area that is experienced as one unit for addressing;
- Where Centers of Settlements are used for addressing;
- Where street names are not unique within the Administrative Area.

Important: As evidenced by the conditions above and the examples below, how an Index Area is built is directly related to how Administrative Areas, Postal Districts and other addressing and naming components are defined by individual countries and how that information is captured and stored in MultiNet® data.

EXAMPLE: La Défense in Paris is an added value for address selection to the Administrative Order 8 Areas.

EXAMPLE: The Index Area Order 8 of Brussels replaces the Administrative Area Order 8 of Brussels as this larger Area corresponds to the public perception of Brussels.

EXAMPLE: The Great Britain Index Areas are based on postal information. They form a complete Index that replaces the existing Administrative hierarchy on Orders 7, 8 and 9.

Note
Northern Ireland, part of the United Kingdom, has no Index Areas. The normal Administrative Areas are sufficient for unambiguous address selection.

In short, there is no single solution or model to index building using the Index Areas that is suitable for all countries. More in-depth Index Area building examples can be found in **Index Areas in Shapefile / Oslfile** and **Index Areas in MultiNet® GDF** later in this user guide.

TomTom also provides an alternative to Index Area building with the Locality Index product. See **Locality Index** for a brief description.

Land Cover and Land Use

In the real world, the transportation network travels through land areas of various types and uses. In a digital map, the land areas can be modeled as a continuum of adjacent areas that have a certain cover or use.

Land Cover and Land Use are each a representation of the real world.

- Land Cover represents the physical status, or natural cover, of a feature.
- Land Use represents the human use of a feature.

The following table summarizes the differences between Land Cover and Land Use:

LAND COVER	LAND USE
In the real world, a Land Cover area does not necessarily have a clear extent or a definite boundary. In the digital map, therefore, the boundary may be arbitrary.	A Land Use area has a definite boundary.
Land Cover areas are exclusive. A face cannot belong to more than one Land Cover Feature. For example, a Woodland cannot simultaneously also be Heathland.	Land Use areas are not exclusive. A unit of Land Use can coincide with another unit of Land Use or with a unit of Land Cover. EXAMPLE: • An Industrial Harbor can be part of an Industrial Area.
Land Cover Features are not section-crossing.	Land Use Features may be section-crossing.
Exclaves (disconnected parts) are not allowed. Each Feature of Land Cover is composed of adjacent polygons within one section.	Exclaves are allowed. One single Feature of this category may be composed of several exclaves.

Land Use and Land Cover Features

FEATURE	FEATURE CODE AND / OR SUB-FEATURE AND CODE
Building	• (7110)
Forest and Semi-Natural Area	• Beach, Dune and Plain Sand (9710) • Forest (Woodland) (7120) • Moors and Heathland (9725)
Island	• (7180)
Park/Garden	• (7170)
Artificial Surface	• Airport Ground (9732) • Airport Runway (9776) • Amusement Park Ground (9733) • Cemetery Ground (9788) • Company Ground (9353) • Golf Course Ground (9744) • Hospital Ground (9748)

	• Industrial Area (9715) • Industrial Harbour Area (9720) • Institution (9780) • Military Territory (9789) • Other Land Use (9787) • Shopping Center Ground (9790) • Stadium Ground (9768) • University or College Ground (9771)

Of the features above, Display Type attributes are subdivided and coded as follows:

Land Use and Land Cover Display Types

FEATURE	DISPLAY ATTRIBUTE TYPE	DESCRIPTION	DISPLAY TYPE VALUE
Beach/Dune/Sand Area (9710)	7S (Sand Area Type)	Beach/Dune	1
		Others	99
Park/Garden (7170)	PT (Park Type)	City Park	1
		Regional or National Park	2
		County Park	3
		State or Province Park	4
		National Park	5
Forest (7120)	5F (Forest Type)	City Forest	1
		Regional Forest	2
		County Forest	3
		State/Provincial Forest	4
		National Forest	5
Company Ground (9353)	8G	Company Ground Type: • 1: Phillips • 2: BMW • 3: Volkswagen • 4: DaimlerChrysler • 5: Audi • 6: Ford • 7: Porsche • 8: SEAT • 9: Siemens • 10: Skoda • 11: Rover • 12: Opel • 13: Fiat • 14: Blaupunkt • 15: Continental • 16: Acura • 17: Alpine • 18: ATX Technologies • 19: Delphi • 20: GM • 21: Honda • 22: Johnson Controls • 23: Lexus • 24: Microsoft • 25: Nissan • 26: Toyota • 27: Mercedes-Benz • 28: EvoBus	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29

		• 29: Smart • 30: Bosch	30

For suggestions on the order of displaying Land Cover and Land Use features when programming for map display, see **Displaying Land Cover and Land Use Areas** later in this user guide.

Locality Index

The TomTom Locality Index prioritizes localities from administrative, postal, and other locality sources for each map feature to enable application developers to utilize one set of tools when building FIND applications that cover multiple countries.

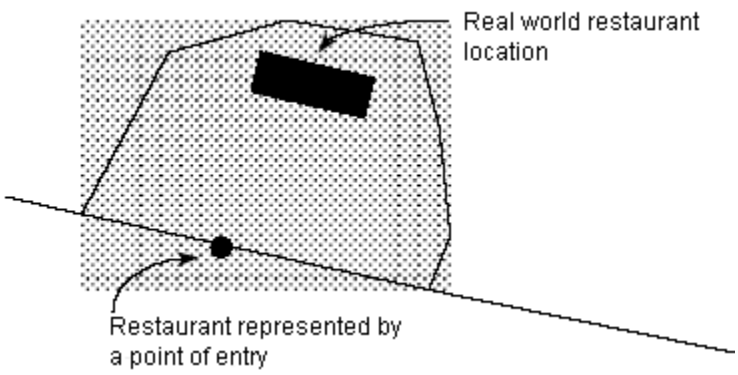
In addition, the TomTom Locality Index identifies major localities to differentiate between multiple localities that may share the same name.

The TomTom Locality Index is a set of files that are not part of the standard MultiNet® data specification. Please see the separate Locality Index specification located on this documentation DVD for more information.

Points of Interest

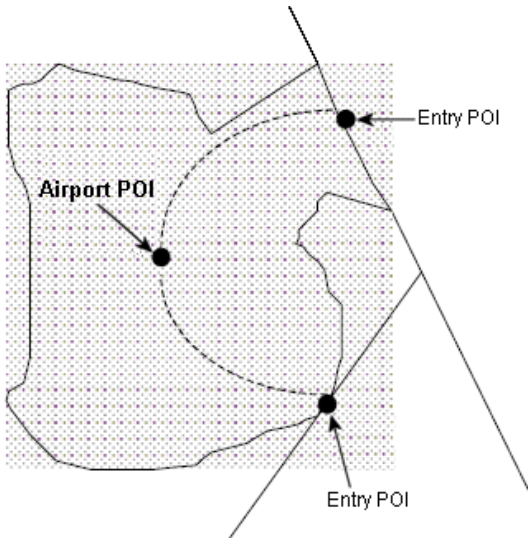
A Point of Interest (POI), also called a "Service," is a point representation of an activity at a specific location. "Service" represents the activity and not necessarily the building in which the activity takes place. Although the point also may serve as a destination landmark, the point does not necessarily represent an entire physical object.

A POI can be located off of the road network. In this case, the nearest transportation element or a place of entry is identified.



POI as Point of Entry

A POI also can be a central point of an area. An airport is an example of a Land Use Area also represented as a POI. For routing purposes, a Service Belonging to Service relationship is made between an entry point POI and the airport POI.



Entry Points as Service Belonging to Service Relationship

Geocoding Points of Interest and Accuracy Levels

Geocoding involves a reference database, tabular data to be geocoded and resulting geocoded features. Besides capturing POIs in the field, TomTom® uses the geocoding process to extend the number of POIs in the database, resulting in Geocoding Accuracy Level Attributes on the product level. This process is independent from the reference (geometrical) data that is provided, enabling any user to geocode (see **Geocoding** later in this user guide).

POIs in the TomTom® mother database are captured using three different methods:

- **Field capturing**: When a TomTom® Regional Data Collector collects needed information in the real world. Accuracy: Best.
- Manual capturing: When a TomTom® employee uses e-mail or a telephone communication as a means to verify the location of a service. Accuracy: Varies depending on source.
- Address matching: This method uses automatic geocoding of tabular POI data. Extensive POI lists, internal or external, are incorporated into the TomTom® database. Accuracy: Dependent upon geocoding parameters and content of information.

The TomTom® database has 11 geocoding accuracy levels. The levels range from geocoding to Settlements or Area Features (e.g., Postal Codes, Census Districts) to streets with house numbers.

See table on the following page.

In the table below are the values and descriptions for Geocoding Accuracy Level attribute 6A. Note that the 6A attribute and values appear in the Shapefile PIEA table (not available in North America data):

- The lower the level number, the higher the geocoding accuracy.
- POI Type LS = Location of the activity itself; LE = Location of the entrance related to an activity; PP = The activity is represented by a point located on a predefined place on the transportation network.

ACCURACY LEVEL	ACCURACY LEVEL VALUES IN DATA	DESCRIPTION	POI TYPE	RELATIVE POSITION	ADDITIONAL REM
L0.1	1 and 11 - 16*	Location of POI with Entry Point(s)	LS	YES	The exact location of is known, and it is al stored with its Entry Both are linked by m a "Service Belonging Service" Relationship
L0.2	2	Location of POI without Entry Point(s)	LS	-	The POI's location is but it does not have Entry Point. An algor used to establish a li the closest street. Th Relative Position is n stored.
L0.3	3	Location on a predefined place on the Transportation Network	PP	YES	Not applicable when concerns Entry Point
L1	11	Exact location of the entrance of the POI	LE/PP	YES	The Relative Position 100 when the Entry located on a Junction
L2	12	Nearest by location on the Transportation Network with the correct address	LE/PP	YES	This POI's address information and locat known, but the locat Entry Point is unknow Entry Point is arbitra located on the closes Transportation Eleme which the address information is correct
L3	13	Interpolated location on the correct side of the road part along which the POI is located	LE/PP	YES	
L4	14	Location on the correct side of the correct road part along which the POI is located	LE/PP	-	
L5	15	Location on the correct road part	LE/PP	-	

		along which the POI is located			
L6	16	Location on the correct street along which the POI is located	LE/PP	-	
L7	17	Location on the corresponding Center of Settlement	LE/PP (2)	-	
L8	18	Location on other corresponding Service	LE/PP (2)	-	

* L0.1 accuracy level has value 1 for the POI itself, and the Entry Point has a value between 11 and 16.

TomTom® also offers an add-on product, MultiNet® Points of Interest, applicable to some countries.

TMCs

The Traffic Message Channel (TMC) is a system of collecting, coding and broadcasting traffic-related information. Traffic announcements are broadcast as a coded message by a Radio Data System (RDS). The coding of the information is assembled according to a uniform global standard and is independent of language. The message is always in the same format: "there is an incident caused by something on a specific road, in a specific direction, and between two locations."

The TMC system identifies the incident location by identifying pre-determined TMC points. A Point Location is connected by means of Line Locations (roads connected as paths) within an Area Location.

See also **TMCs** for Shapefile usage in the How to Use MultiNet® Shapefile section of this user guide.

Attributes

Attributes represent properties of Features. EXAMPLE: Attributes of the Feature "Road Element" include the street name and number of lanes.

Attribution abbreviations can be GDF abbreviations (two-alphabet characters), GDF user-defined (one non-alphabet character, one alphabet character) or purely TomTom®-defined.

Attribution codes in MultiNet® can be GDF definitions or TomTom®-defined definitions.

Some attributes do not have attribute codes representing their values.

Feature Code Type Attributes

Shapefile / Oslfile field names = FEATTYP, ARETYP, TRPELTYP, ELEMTYP

GDF-AS field name (in documentation) **= FEAT_CODE**

GDF-AR field name (in documentation) **= FeatClass**

Feature types are taken from Geographic Data Files (GDF) definitions and are identified by a 4-digit code in TomTom® MultiNet® data. See also **Features** earlier in this user guide.

Feature type codes "9000" to "9999" are TomTom®-defined features.

For a list of attribute names and codes, see the Appendix sections of the **MultiNet® 3.5.1 Specification**.

Attribute Types

Shapefile / Oslfile field name = ATTTYP

GDF -AS field name (in documentation) **= ATT_TYPE**

GDF-AR field name (in documentation) **= AttTyp**

MultiNet® Attribute Types are derived from GDF definitions. For a list of attribute names and codes, see the Appendix sections of the **MultiNet® 3.5.1 Specification**.

GDF Attributes

GDF ATTRIBUTION NAME ABBREVIATION	GDF ATTRIBUTION NAME	SHAPEFILE AND OSLFILE FIELD NAME ABBREVIATION	GDF ATTRIBUTION VALUE CODE	GDF ATTRIBUT VALUE
FT (two-alphabet character abbreviation)	Ferry Type	FT	1 2 3	Ferry connec Rail connecti Both

Note that most Shapefile and Oslfile field name abbreviations differ from GDF attribution abbreviations in data.

EXAMPLE: Plural Junction

- GDF attribution abbreviation = 2P.
- Shapefile and Oslfile field name abbreviation = PJ.

GDF User-Defined Attributes

GDF attributes are two alphabetic characters (e.g., JT). The GDF standard also allows for user-defined attributes, provided the following form is followed: "Any two-character code of which the first character is non alphabetic."

GDF USER-DEFINED ATTRIBUTION NAME ABBREVIATION	GDF USER-DEFINED ATTRIBUTION NAME	SHAPEFILE AND OSLFILE FIELD NAME ABBREVIATION	ATTRIBUTION VALUE CODE	ATTRIBUT VALUE
8D (one non-alphabetic and one alphabetic abbreviation)	Side of Line	SOL	0 1 2 3	Both sides Left side Right side On line

TomTom®-Defined Attributes Without an Attribute Code

TOMTOM®-DEFINED ATTRIBUTION NAME	GDF ATTRIBUTION NAME	SHAPEFILE AND OSLFILE FIELD NAME ABBREVIATION	ATTRIBUTION VALUE CODE	ATTRIBU VALU
Travel Time	none	Minutes	none	Travel time minutes

Composite Attributes and Sub-Attributes

Sometimes a feature needs more than one attribute to define a feature characteristic. In these cases, a feature characteristic is called a Composite Attribute and requires "sub-attributes" to be appropriately defined.

An example is the feature characteristic or Composite Attribute "Blocked Passage." To define a blocked passage at least two sub-attributes are necessary: Blocked Passage (location) "BP" and Vehicle Type "VT." Other available attributes for a composite blocked passage include Validity Period "VP" and Removable Blockage "RB."

See the Appendix sections of the **MultiNet® 3.5.1 Specification** for a list of Composite Attributes.

Note that Composite Attributes codes do not appear in your data—only the sub-attribute codes do.

Segmented Attributes (GDF Format Only)

A Segmented Attribute is an attribute that references part of a feature. See the Data Content GDF-AS or Data Content GDF-AR sections of this user guide for more information.

For a list of attribute names and codes, see the Appendix sections of the **MultiNet® 3.5.1 Specification**.

Relationships

A Relationship can exist between Features, but not between Attributes. The GDF catalogue pre-defines a number of feature relationships. Relationships are identified by 4-digit codes. GDF allows user-defined relationships as 4-digit codes beginning with "9000."

NOTE:
As with Feature Codes, "9000" to "9999" are TomTom®-defined Relationship Codes. Beginning with MultiNet® v. 3.5 release, no Feature Code values are repeated as Relationship Code values, i.e., all "9000" to "9999" codes are unique.

Example of a GDF-defined Relationship:

GDF RELATIONSHIP CODE	RELATIONSHIP NAME	FEATURES INVOLVED
1001	Road Element in Administrative Area	* Order 8 Area * Road Element

Example of a TomTom®-defined Relationship:

RELATIONSHIP CODE	RELATIONSHIP NAME	FEATURES INVOLVED
9501	Road Element in Order 9 Area	* Order 9 Area * Road Element

NOTE:
Features involved in a Relationship are sometimes referred to as "Partners."

NOTE:
Beginning with MultiNet 3.5.1, relationship records show full feature reference (GDF Datasets, GDF Section ID, and GDF Feature ID.

Beginning with the MultiNet 3.5.1 specification, four new relationships have been added:

- Address Area Boundary Element in Built-up Area (1070);
- Address Area Boundary Element in Named Area (1071);
- Address Area Boundary Element in Order 8 Area (1072); and
- Address Area Boundary Element in Order 9 Area (1073);

Please see Theme 11: Relationships in the **MultiNet® 3.5.1 Specification** document for details.

For a list of relationship names and codes, see also the Appendix sections of the **MultiNet® 3.5.1 Specification**.

Accessing Data Fields and Values

Before describing common MultiNet® data fields under the **General Field Definitions** heading later in this user guide, it is important to note that how one accesses the data fields and values in MultiNet® data differs depending on data format types. Below are examples.

In Shapefile

EXAMPLE: To find an attribute value and description for the road network, select any record in the *NW.dbf file:

FILE NAME	FILE IDENTIFIER	ATTRIBUTE FIELD CODE	ATTRIBUTE FIELD VALUE	ATTRIBUTE VALUE DESCRIPTION (FROM MULTINET® SHAPEFILE FORMAT SPECIFICATION DOC)
Network	**NW**	**FOW**	**10**	**Form of Way** **10: Part of a Slip Road**

In GDF-AS

Multiple *records* (GDF-AS) are required in order to decode fields and values in GDF-AS format. Dataset records are contained in individual files with the extension ".gdf."

See also Section 8 in this user guide: Data Content - GDF-AS for descriptions of the **record types**.

EXAMPLE: To find an attribute value and description for a road in a GDF-AS file, search the attribute records for the road feature:

1. Select a Line Feature record type 52 record in the *.gdf file that contains a Road Element feature code 4110 and obtain the Segmented Attribute Record ID (SATT_ID):

52 300105762 **4110**0 1 417329728 0 1 **92832** 510093262 5100714000

2. The Segmented Attribute Record ID is 92832. Search record type 44 for ID 92832. Attribute types (ATT_TYPE) and values (ATT_VAL) for the Road Element are defined in the record:

44 **92832** 9**FC** **7** 8C 4 HS 1

3. To find the definition of the attribute type **FC** from the last step, go to record 05, Attribute Definition Record. Attribute codes come immediately after the "05" in those records:

05FC10N **Functional Road Class** 0

4. To find the definition of Functional Road Class attribute value **7**, go to record 18, Attribute Value Definition Record:

18FC7 ENG**Local Roads of Minor Importance** 0

NOTE:
* As an alternative for steps 3 and 4 above, Features, Attributes and Relationship codes and values are contained in the Appendix sections of the **MultiNet® 3.5.1 Specification**.

* TomTom® also supplies a useful tool on this documentation DVD for exploring GDF-AS data: "GDF Viewer."

In GDF-AR

Multiple *files* (GDF-AR) are required in order to decode fields and values of a dataset.

EXAMPLE: To find an attribute value and description for a road in a GDF-AR file, you need to find the attribute records for a road feature:

1. Select a record in the Line Feature Record file (*.LIN) that contains a Road Element feature code 4110. Obtain the Line Feature Item ID (LneItemId):

84062 129575 **300095676** 1**4110**0 2 1 510095260 5100952560

2. The Line Feature ID is 300095676. Search the Feature Attribute Reference file for lines (*.FA2) and find the Line Feature ID. Find the ID for the corresponding Attribute Set Item ID (AttItemid).

84062 129575 **300095676** **197437**

3. The Attribute Set Item ID is 197437. Search the Attributes file (*.ATR) for the Attribute Set Item ID. Attribute types (AttTyp) and attribute values (AttValue) for the Road Element are defined in the record.

84062 129575 **197437** 1**FC8**

84062 129575 **197437** 2**DS2**

84062 129575 **197437** 3**8C6**.....

Unlike GDF-AS, value definitions need to be accessed outside of the files. For a list of attribute names and codes, see the Appendix section of the **MultiNet® 3.5.1 Specification**.

Differences Between Shapefile / Oslfile and GDF-AS

Due to design preferences and customer input, there are content differences (other than format differences) between the Shapefile and GDF-AS deliveries.

Shapefile Attribution Not Found in GDF-AS

The following Shapefile features contain attributes not represented in GDF-AS.

See the Shapefile **Product Files** listing for more information on all MultiNet® Shapefile files.

SHAPEFILE LAYER	ATTRIBUTE	DESCRIPTION
Administrative Areas (A0-A9)	FEATAREA	Area feature expressed in square meters (m^2)
Administrative Areas (A0-A9)	FEATPERIM	Perimeter of feature expressed in meters (m)
Address Areas (AA)	FEATAREA	Area feature expressed in square meters (m^2)
Address Areas (AA)	FEATPERIM	Perimeter of feature expressed in meters (m)
Administrative Places (AP)	FEATAREA	Area feature expressed in square meters (m^2)
Administrative Places (AP)	FEATPERIM	Perimeter of feature expressed in meters (m)
Area Structures (AS)	FEATAREA	Area feature expressed in square meters (m^2)
Area Structures (AS)	FEATPERIM	Perimeter of feature expressed in meters (m)
Built-Up Areas (BU)	FEATAREA	Area feature expressed in square meters (m^2)
Built-Up Areas (BU)	FEATPERIM	Perimeter of feature expressed in meters (m)
Junctions (JC)	JNCTTYP=0	Value of "0" (default in Shapefile) not found in GDF-AS
Land Cover (LC)	FEATAREA	Area feature expressed in square meters (m^2)
Land Cover (LC)	FEATPERIM	Perimeter of feature expressed in meters (m)
Direction of Traffic Flow (LF)	ONEWAY	Used for direction of flow (DF) for all vehicle types (VT=0) and passenger cars (VT = 11). No validity period (VP) associated with ONEWAY.
Line Structures (LS)	METERS	Feature length in meters
Land Use (LU)	FEATAREA	Area feature expressed in square meters (m^2)
Land Use (LU)	FEATPERIM	Perimeter of feature expressed in meters (m)
Network (NW)	METERS	Feature length in meters
Network (NW)	KPH	Calculated average speed in kilometers/hour
Network (NW)	MINUTES	Travel time in minutes
Network (NW)	ONEWAY	Used for direction of flow (DF) for all vehicle types (VT=0) and passenger cars (VT = 11). No validity period (VP) associated with ONEWAY.
Other Named Areas (OA)	FEATAREA	Area feature expressed in square meters (m^2)
Other Named Areas (OA)	FEATPERIM	Perimeter of feature expressed in meters (m)
Postal Districts (PD)	FEATAREA	Area feature expressed in square meters (m^2)
Postal Districts (PD)	FEATPERIM	Perimeter of feature expressed in meters (m)
Railways (RR)	METERS	Feature length in meters
Restrictions (RS)	VT = -1	Vehicle type -1 (Not applicable) is not available

		in GDF-AS
Water Areas (WA)	FEATAREA	Area feature expressed in square meters (m^2)
Water Areas (WA)	FEATPERIM	Perimeter of feature expressed in meters (m)
Water Lines (WL)	METERS	Feature length in meters

Other Differences

Functional Road Classes:

- Functional Road Classes are delivered in separate "Street" layers 00 - 08.

Sections:

- No sectioning available in Shapefile.

General Field Definitions

Many of the field attributes and values that are common to multiple files or records in MultiNet® data are detailed in this document section. Brief field definitions also are contained in the record layout sub-sections of each data format section of this user guide.

Functional Road Class

Shapefile / Oslfile naming: FRC

GDF naming: FC

Functional Road Classes are designed to categorize types of Transportation Elements based on their functional importance within the Transportation Network.

There are nine classifications of the Functional Road Class:

FRC ATTRIBUTE VALUE	SHORT DESCRIPTION	LONG DESCRIPTION
0	Motorways; Freeways; Major Roads	All roads that are officially assigned as motorways.
1	Major Roads Less Important than Motorways	All roads of high importance, but not officially assigned as motorways, that are part of a connection used for international and national traffic and transport.
2	Other Major Roads	All roads used to travel between different neighboring regions of a country.
3	Secondary Roads	All roads used to travel between different parts of the same region.
4	Local Connecting Roads	All roads making all settlements accessible or making parts (north, south, east, west and central) of a settlement accessible.
5	Local Roads of High Importance	All local roads that are the main connections in a settlement. These are the roads where important through traffic is possible, e.g.: • arterial roads within suburban areas, industrial areas or residential areas; • a rural road, which has the sole function of connecting to a national park or important tourist attraction.
6	Local Roads	All roads used to travel within a part of a settlement or roads of minor connecting importance in a rural area.
7	Local Roads of Minor Importance	All roads that only have a destination function, e.g., dead-end roads; roads inside living area; alleys: narrow roads between buildings, in a park or garden.
8	Other Roads	All other roads that are less important for a navigation system: • a path: a road that is too small to be

FRC ATTRIBUTE VALUE	SHORT DESCRIPTION	LONG DESCRIPTION
		driven by a passenger car; • bicycle paths or footpaths that are especially designed as such; • stairs; • pedestrian tunnel; • pedestrian bridge; • alleys that are too small to be driven by a passenger car.

NOTE:
Shapefile format also provides a "-1" attribute value to indicate that an FRC is not applicable to the feature.

For more detailed information on FRCs, see Functional Road Class in the **MultiNet® 3.5.1 Specifications** document on this documentation DVD.

Form of Way

Form of Way is an attribute applied to line features to describe the physical form of a road.

Shapefile / Oslfile naming: FOW

GDF naming: FW

Form of Way codes and definitions are below.

FOW ATTRIBUTE CODE	SHORT DESCRIPTION	LONG DESCRIPTION
1	Part of a motorway	Motorway: Any road officially signed as a motorway or highway. Does not include slip roads.
2	Part of a multi-carriageway	Multi-carriageway is the database representation of a road with more than one carriageway that is physically split.
3	Part of a single carriageway	Single carriageway: Generally, a road that is a single, unsplit carriageway. It may have one-way or two-way traffic flow.
4	Part of a roundabout	Roundabout: A road that forms a ring where traffic is allowed only in one direction. In some countries, these are known as traffic circles.
6	Part of an ETA parking place	ETA parking place: An ETA (Enclosed Traffic Area) parking place relates to *internal connections between* entrances/exits of parking areas. This also relates to a road with the sole function of connecting two different parking buildings.
7	Part of an ETA parking garage	ETA (Parking Building or Garage) is the database representation of traffic flow within a parking garage.
8	Part of an ETA unstructured traffic square	Because it is not possible to define the roads or the real traffic flow within an unstructured traffic square, abstract connections are defined. These abstract roads are characterised as Roads in Enclosed Traffic Area.

10	Part of a slip road	Slip road: A road that is designed to connect two roads together.
11	Part of a service road	Service road: A road running parallel to a main road that is designed to serve as access to surrounding roads, addresses or other destinations.
12	Entrance/Exit to a car parking area	Includes entrances/exits to parking garages, parking areas, rest areas.
14	Part of a pedestrian zone	Road designed for pedestrian traffic. Does not relate to stairs. Limited access by emergency or delivery vehicles.
15	Part of a walkway	Walkways: Road too narrow for any vehicle. Walkways relate to paths, bicycle paths, stairs, pedestrian tunnels and bridges.
17	Special traffic figure	A road that resembles a roundabout: A closed circular, elongated or rectangular construction of roads not recognized as a true roundabout.
20	Road for authorities	A road only used by official vehicles (e.g., emergency, fire, police).
21	Connector	A Connector is a road that is used to make a U-turn on a dual carriageway or between frontage roads on opposite sides of a freeway or dual carriageway.
22	Cul-de-Sac	A Cul-de-Sac is a dead-end road that has a circular turnaround area at its end to facilitate Uturns.

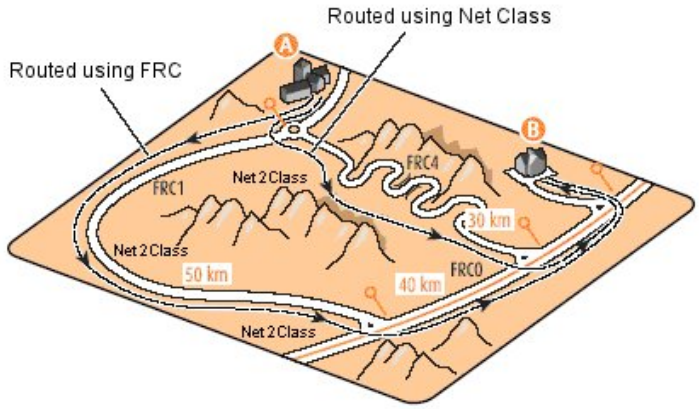
NOTE:
Shapefile format also provides a -1 attribute value to indicate "Not applicable."

Net Class

The Network Class of a Transportation Element is not necessarily the same as its Functional Road Class (FRC). Network Classes are optimized for routing purposes.

The purpose of the Network Classes is to build a closed and hierarchical network with a limited set of layers. Each Transportation Element is assigned a Network Class depending on its importance for routing.

A relatively unimportant road can become very important if it assures a short connection between two highways that are not connected by a short highway or another major road. See example below.



FRC4 Road also Tagged as Net 2 Class Shortens Route

Net 1 Class

Shapefile / Oslfile naming: NETCLASS

GDF naming: 8B

Net 1 Class is a classification of roads and ferries based on the importance of the network in which they are located. Net 1 Class is no longer supported by TomTom®.

For more detailed information on the Net 1 Class, see Net 1 Class in the **MultiNet® 3.5.1 Specifications** document on this documentation DVD.

Net B Class

Shapefile / Oslfile naming: NETBCLASS

GDF naming: 9B

Net B Class is a classification of roads and ferries based on the importance of the network where they are located.

There are six closed-network classifications of Net B Class:

NET B CLASS	DESCRIPTION
1	Connections between the most important cities on a continent; Most important cities on a continent have populations >= 300,000.
2	Most important connections between most important cities within a country; Most important cities in a country have populations >= 100,000.
3	Alternate connections between most important cities within a country.
4	Connections of less important cities within a country and between neighboring countries.
5	All remaining Road Elements and Ferry Connections used to travel between regions of the same country, and to neighboring countries.
6	All Road Elements and Ferry Connections used to travel within the same region of a country.

NOTE:
Net B Class is no longer supported in North American data. TomTom® recommends using **Net 2 Class** for routing in North America.

For more detailed information on Net B Class, see Net B Class in the **MultiNet® 3.5.1 Specifications** document on this documentation DVD.

Net 2 Class

Shapefile / Oslfile naming: NET2CLASS

GDF naming: 8C

Net 2 Class is a classification of roads and ferries based on the importance that the constituting roads and ferries have in the total road network.

There are seven classifications of Net 2 Class:

NET 2 CLASS	DESCRIPTION
0	Roads of international importance: Most important roads and ferries for through traffic that connect the most important municipalities of the country and of the neighboring countries.
1	Roads of national importance: Important roads and ferries for through traffic used to travel within the country.
2	Roads of regional importance: Most important roads for through traffic used to travel between different regions of the country.
3	Local roads of high importance: Roads making minor settlements accessible.
4	Local roads: All Road Elements that are used only to reach a certain address or destination. Also includes all Stubbles that are connected to Road Elements with Net 2 Class 0, 1, 2, 3 or 4.
5	Local roads of minor importance: Unpaved or poorly maintained roads that have no connectivity function but only a destination function. Also includes Stubbles that are connected to Road Elements with Net 2 Class 5.
6	All restricted roads: Roads inaccessible for normal traffic. Includes all Stubbles that are connected to Road Elements with Net 2 Class 6.

For more detailed information on Net 2 Class, see Net 2 Class in the **MultiNet® 3.5.1 Specifications** document on this documentation DVD.

Route Number Type

Shapefile / Oslfile naming: RTETYP

GDF naming: 6W

A Route Number Type is the database representation of the characteristics of a Route Number signpost.

A Route Number Type is used for display purposes: the types are used for displaying Route Number icons and to filter Route Numbers for small-scale maps.

A Route Number Type reflects the road sign, used by an official authority, to indicate its Route Numbers. A type represents the characteristics of the signpost. Route Number Type is a functional differentiation between signs, based upon the color of the characters and signs, the shape and the framework.

The Route Number Type is a number code attribute that is specific to the country. See the **Global_Route_Types** document in the data-specifications folder on this documentation DVD.

Center of Settlement Display Classes

Shapefile / Oslfile naming: DISPCLASS

GDF naming: 6B

Center of Settlement Display Class is the database representation of a classification of settlements based on their importance with respect to a map display.

The Center of Settlement Display Classes vary in some countries. Below is the most current information.

COUNTRY	CLASSIFICATION	DESCRIPTION
Canada	1	Not yet defined.
Canada	2	Settlement with at least 5 million inhabitants.
Canada	3	Settlement of 2 million – 5 million inhabitants.
Canada	4	Settlement of 1 million – 2 million inhabitants.
Canada	5	Settlement of 500 thousand – 1 million inhabitants.
Canada	6	Settlement of 200 thousand – 500 thousand inhabitants.
Canada	7	Settlement of 100 thousand – 200 thousand inhabitants.
Canada	8	Settlement of 50 thousand – 100 thousand inhabitants.
Canada	9	Settlement of 20 thousand – 50 thousand inhabitants.
Canada	10	Settlement of 10 thousand – 20 thousand inhabitants.
Canada	11	Settlement of 5 thousand – 10 thousand inhabitants.
Canada	12	Settlement with less than 5 thousand inhabitants.
COUNTRY	CLASSIFICATION	DESCRIPTION
San Marino	10	Most important settlement of a municipality of

COUNTRY	CLASSIFICATION	DESCRIPTION
		10.000-49.999 inhabitants.
United Kingdom	4	Most important settlement of a municipality >= 1.000.000 inhabitants for Cardiff, Edingburgh and Belfast. All other settlement display classes identical to **All Other Countries** defined below.
United States	1	Not yet defined.
United States	2	Settlement with at least 5 million inhabitants.
United States	3	Settlement of 2 million – 5 million inhabitants.
United States	4	Settlement of 1 million – 2 million inhabitants.
United States	5	Settlement of 500 thousand – 1 million inhabitants.
United States	6	Settlement of 200 thousand – 500 thousand inhabitants.
United States	7	Settlement of 100 thousand – 200 thousand inhabitants.
United States	8	Settlement of 50 thousand – 100 thousand inhabitants.
United States	9	Settlement of 20 thousand – 50 thousand inhabitants.
United States	10	Settlement of 10 thousand – 20 thousand inhabitants.
United States	11	Settlement of 5 thousand – 10 thousand inhabitants.
United States	12	Settlement with less than 5 thousand inhabitants.
COUNTRY	**CLASSIFICATION**	**DESCRIPTION**
Vatican City	11	Most important settlement of a municipality < 10.000 inhabitants.
COUNTRY	**CLASSIFICATION**	**DESCRIPTION**
All Other Countries	1	Not yet defined.
All Other Countries	2	Capital of country.
All Other Countries	3	Not yet defined.
All Other Countries	4	Most important settlement of a municipality >= 1.000.000 inhabitants.
All Other Countries	5	Most important settlement of a municipality of 500.000-999.999 inhabitants.
All Other Countries	6	Not yet defined.
All Other Countries	7	Most important settlement of a municipality of 100.000-499.999 inhabitants.
All Other Countries	8	Most important settlement of a municipality of 50.000-99.999 inhabitants.
All Other Countries	9	Not yet defined.
All Other Countries	10	Most important settlement of a municipality of 10.000-49.999 inhabitants.

COUNTRY	CLASSIFICATION	DESCRIPTION
All Other Countries	11	Most important settlement of a municipality < 10.000 inhabitants.
All Other Countries	12	All other settlements.

Water Display Class

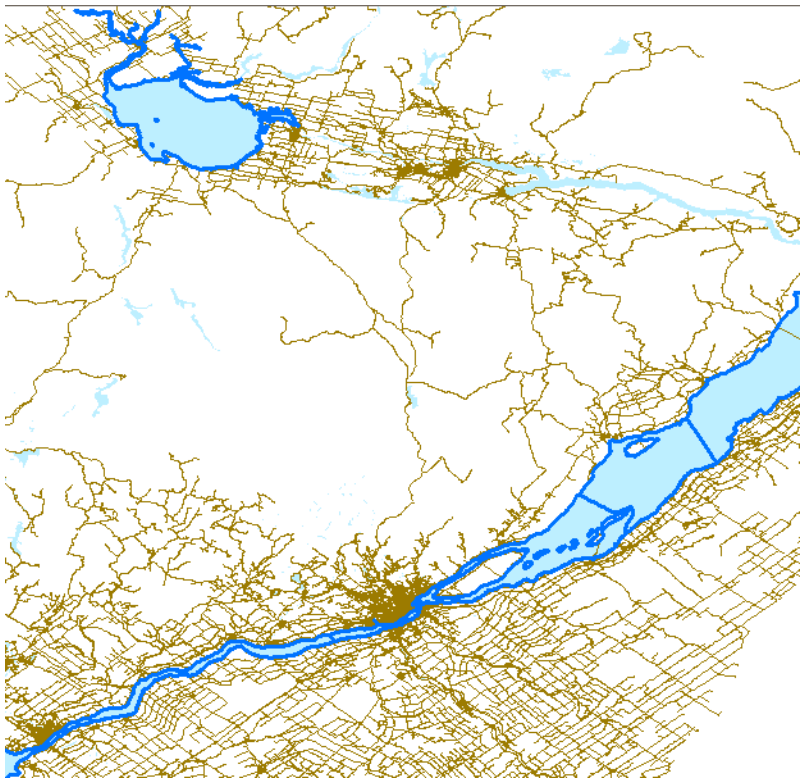
Shapefile/Oslfile naming: DISPCLASS

GDF naming: WD

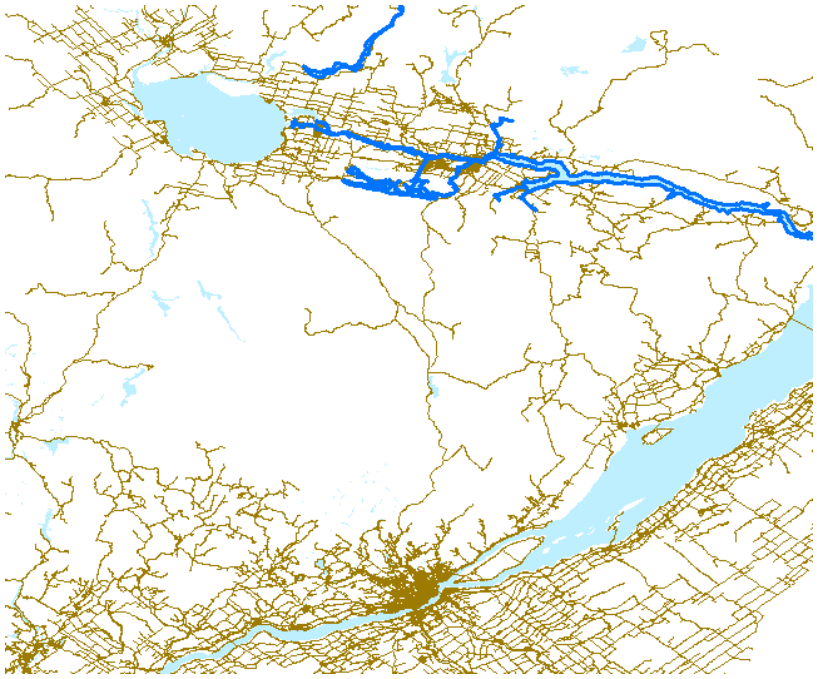
The Water Display Class is the database representation of a classification of water bodies. This classification is based on the importance of the role that a water body has with respect to its function as a landmark.

CLASSIFICATION	DESCRIPTION
1	All water bodies depicted on the Times Atlas of the World scale 1:12 900 000 (highest class).
2	All water bodies depicted on the Times Atlas of the World 1:2 500 000 that are identified by their name.
3	All water bodies depicted on a 1:200 000 to 1:300 000 source to be agreed upon, that are identified by a name.
4	All water bodies depicted on geometrical source materials that are identified by their name.
5	All water bodies depicted on geometrical source materials that are not identified by a name.

The following graphics demonstrate display class representation in an area of Quebec, Canada. The dark blue color outlines the display class water features.

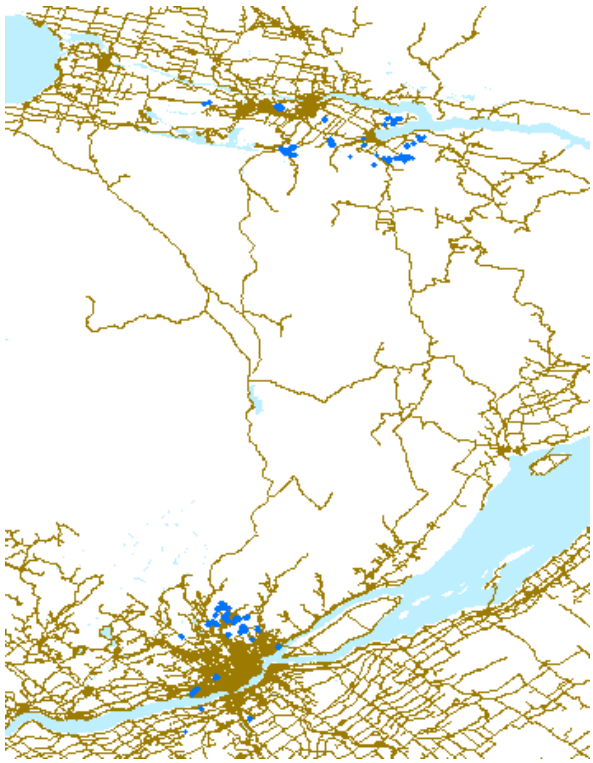


Display Class 1 Example

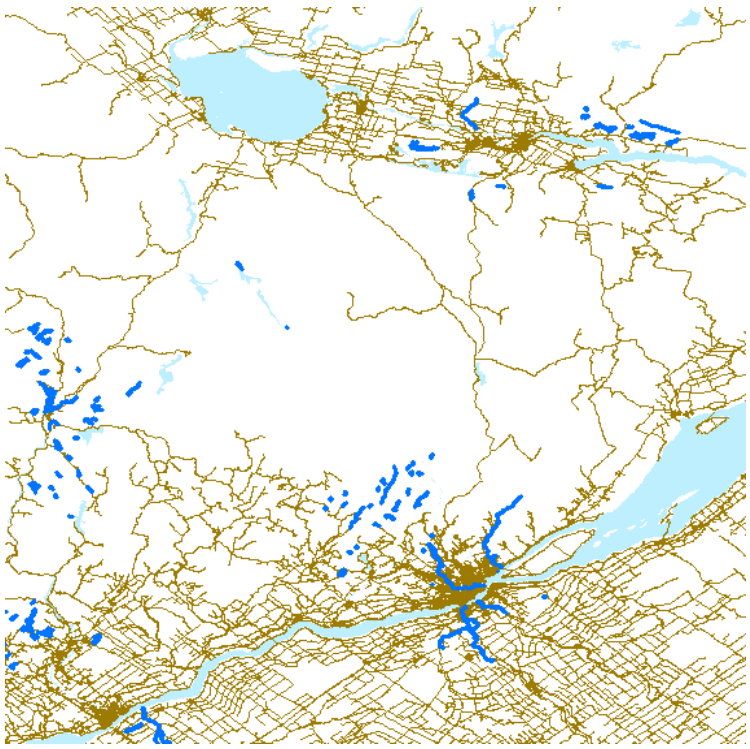


Display Class 2 Example

Display Class 3 Example



Display Class 4 Example



Display Class 5 Example

Time Domains

Shapefile / Oslfile naming: TIMEDOM

GDF name reference in data: VP (validity period), **OP** (opening period)

GDF-AS naming (in documentation)**: TIME_DOM**

GDF-AR naming (in documentation)**: TIMDOM**

"Sharp" and "Fuzzy" Time Domains

Time Domains are either:

- "sharp" - years, months, weeks, days, etc.; or
- "fuzzy" - times that do not have a universal definition.

A sharp time domain does not automatically rule out a complementary fuzzy time domain.

For example, if a road has the traffic flow restrictions:
"closed from 10 p.m. until 8 a.m." and "closed during snow fall,"

two separate Validity Periods are captured:
[(h22){h10}] and [(z18){z68}]

Combining of sharp and fuzzy time terms within the same brackets is ***not*** allowed.

NOTE:
See the Appendix sections of the **MultiNet® 3.5.1 Specification** document on this documentation DVD to decode the GDF time domain syntax.

The Time Domain syntax used in the following sections are all "sharp" time examples.

In Shapefile / Oslfile

The Time Domain table (TD) contains information identifying the time period that restricted access or restricted maneuverablility applies to edge elements or maneuver points. The field "TIMEDOM" is a GDF-coded assignment.

In GDF-AS

Record type 45 contains time domain information in GDF-AS format, if it exists. The attribute codes VP (Validity Period) and OP (Opening Period) appear in the Segmented Attribute record (record 44) if a transportation element contains a time domain restriction. Record type 44 points to the Time Domain record (record 45) via a time domain record ID.

In GDF-AR

The Attribute Time Domains relational table (.ATI) links information from the Attributes table (.ATR) to the actual time domain values located in the Time Domains table (.TIM).

EXAMPLE:

From the Attribute table (.ATR):

```
84062    108575    265195    6VP1000999999
```

Here, the Validity Period **VP** and Time Domain ID **1000999999** are identified.

From the Attribute Time Domains table (.ATI):

```
84062    108575    265195    61000999999    1
```

Here, the Time Domain ID **1000999999** is identified and points to the record in the .TIM table identifying the time domain string value (see below).

From the Time Domains table (.TIM):

```
84062    108575 1000999999 1    1[(M3f21){M10}]-[(M11f11){M3}]
```

The Time Domain value in GDF syntax is identified in this file:
[(M3f21){M10}]-[(M11f11){M3}]

GDF Time Domain translation of above example:

1st Part:

[(M3f21){M10}] = [(Starting date){Time duration}]

(Starting date) = **M3** = Month 3 (March); **f21** = Second Sunday
{Time duration} = **M10** = 10 Months

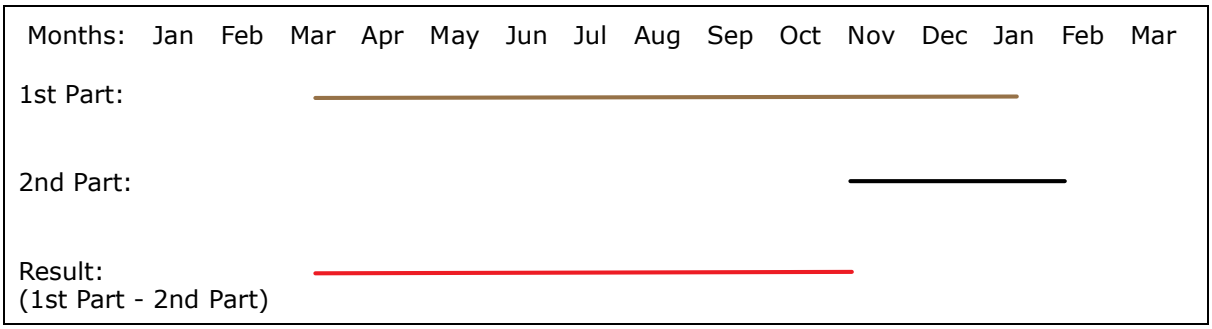
The second part of the time domain string is then subtracted ("-") from the first part.

2nd Part:

[(M11f11){M3}] = [(Starting date){Time duration}]

(Starting date) = **M11** = Month 11 (November); **f11** = First Sunday
{Time duration} = **M3** = 3 Months

The above time domain parts are illustrated below.



The above time domain string in simplified text:

From the second Sunday in March until the first Sunday in November.

A simplified time domain form from GDF 5.0 is also available beginning with the release of MultiNet® version 3.5. The syntax is simply [(Starting Date)(End Date)].

Example: **`[(M3f21)(M11f11)]`** =

- Starting Date: the second Sunday in March;
- End Date: the first Sunday in November.

Section 4: Data Content – Shapefile and Oslfile

Product Files

See Directory Files **Shapefile** or Oslfile sections of this user guide for file naming examples.

The files below are included in the MultiNet® Shapefile and Oslfile formats and are sorted here in alphabetical order by file identifier. Most file identifiers are linked to brief descriptions of the files in this document section.

See category names under the Category column in the table below to find the matching categories in the **MultiNet® Shapefile** or **Oslfile Format Specifications** documents for the record layouts for each file.

CATEGORY	FILE NAME	FEATURE TYPE	FILE IDENTIFIER
Streets	Street 0 (streets with FRC = 0)	line	**00**
Streets	Street 1 (streets with FRC = 1)	line	**01**
Streets	Street 2 (streets with FRC = 2)	line	**02**
Streets	Street 3 (streets with FRC = 3)	line	**03**
Streets	Street 4 (streets with FRC = 4)	line	**04**
Streets	Street 5 (streets with FRC = 5)	line	**05**
Streets	Street 6 (streets with FRC = 6)	line	**06**
Streets	Street 7 (streets with FRC = 7)	line	**07**
Streets	Street 8 (streets with FRC = 8)	line	**08**
Roads, Ferries, Address Area	Level 2 Roads	table	**2r**
Administrative Areas	Order 0	area	**a0**
Administrative Areas	Order 1	area	**a1**
Administrative Areas	Order 2	area	**a2**
Administrative Areas	Order 3	area	**a3**
Administrative Areas	Order 4	area	**a4**
Administrative Areas	Order 5	area	**a5**
Administrative Areas	Order 6	area	**a6**
Administrative Areas	Order 7	area	**a7**
Administrative Areas	Order 8	area	**a8**
Administrative Areas	Order 9	area	**a9**
Streets	Address Areas	area	**aa**
Streets	Address Area Extended Attributes	table	aaea
Streets	Address Area Names	table	aanm
Roads, Ferries, Address Area	Address Area Boundary Element Belonging to Address Area	table	**ab**
Administrative Areas	Administrative Area Structure Definitions	table	**ad**
Administrative Areas	Administrative Area Extended Attributes	table	ae

CATEGORY	FILE NAME	FEATURE TYPE	FILE IDENTIFIER
Administrative Areas	Area Replaced by Index Area	table	**ai**
Administrative Areas	Administrative Area Names	table	an
Administrative Places	Administrative Places	area	**ap**
Structures	Area Structures	area	**as**
Built Up Areas	Built Up Area in Named Area	table	**ba**
Built Up Areas	Built Up Area Extended Attributes	table	be
Administrative Areas	Boundary Line	line	**bl**
Built Up Areas	Built Up Area Names	table	bn
Built Up Areas	Built Up Areas	area	**bu**
Roads, Ferries, Address Area	Center Point of Freeway	point	**cf**
	Conversion Records	table	**cn**
Administrative Places	Administrative Place Extended Attributes	table	ep
Streets	Ferries	line	**fe**
Roads, Ferries, Address Area	Geocode	line	**gc**
Roads, Ferries, Address Area	Intersection Index	table	**ig**
Roads, Ferries, Address Area	Intermediate House Numbers	table	**ih**
Roads, Ferries, Address Area	Intersections	table	**is**
Roads, Ferries, Address Area	Junctions	point	**jc**
Land Use and Land Cover	Land Cover	area	**lc**
Roads, Ferries, Address Area	Lane Direction Information	table	**ld**
Roads, Ferries, Address Area	Lane End	table	**le**
Roads, Ferries, Address Area	Direction of Traffic Flow for Lane	table	**lf**
Roads, Ferries, Address Area	Lane Type Information	table	**li**
Roads, Ferries, Address Area	Lane Divider Information	table	**ll**
Roads, Ferries, Address Area	Lane Connectivity Information	point	**ln**
Roads, Ferries, Address Area	Lane Connectivity Path	table	**lp**
Structures	Line Structures	line	**ls**
Roads, Ferries, Address Area	Time Domains for Direction of Traffic Flow	table	**lt**
Land Use and Land Cover	Land Use	area	**lu**
Land Use and Land Cover	Land Use and Land Cover Extended Attributes	table	lxea
Land Use and Land Cover	Land Use and Land Cover Names	table	lxnm
Roads, Ferries, Address Area	Maneuvers	point	**mn**
Roads, Ferries, Address Area	Maneuver Path Index	table	**mp**
Extra Attribute Tables	Names	taqble	nm
Administrative Places	Administrative Place Names	table	np

CATEGORY	FILE NAME	FEATURE TYPE	FILE IDENTIFIER
Roads, Ferries, Address Area	Network	line	**nw**
Roads, Ferries, Address Area	Network Extended Attributes	table	nwea
Other Named Areas	Other Named Areas	area	**oa**
Other Named Areas	Census Tract (U.S. only)	area	**oa01**
Other Named Areas	Census Block Group (U.S. only)	area	**oa02**
Other Named Areas	Census Blocks (U.S. only)	area	**oa03**
Other Named Areas	Census Urbanized Areas	area	**oa04**
Other Named Areas	Core Based Statistical Areas (U.S. only)	area	**oa05**
Other Named Areas	Index Areas	area	**oa06**
Other Named Areas	Urban Agglomeration	area	**oa07**
Other Named Areas	Native Reservation	area	**oa08**
Other Named Areas	Special Charge Area	area	**oa09**
Other Named Areas	Neighborhood	area	**oa10**
Other Named Areas	Other Area Extended Attributes	table	oaea
Other Named Areas	Other Area Names	table	oanm
Administrative Areas	Official Languages	table	**ol**
Roads, Ferries, Address Area	Postal Code Information on Transportation Element	table	**pc**
Roads, Ferries, Address Area	Postal Code Name Information	table	pcnm
Postal Districts	Postal Districts	area	**pd**
Postal Districts	Postal Districts Extended Attributes	table	pdea
Postal Districts	Postal Districts Names	table	**pdnm**
Points of Interest	Point of Interest at Junction Relation	table	**pe**
Points of Interest	Points of Interest	point	**pi**
Points of Interest	Points of Interest Extended Attributes	table	**piea**
Points of Interest	Points of Interest Names	table	pinm
Roads, Ferries, Address Area	Lane Dependent Toll Payment Method	table	**pm**
Administrative Places	Place Within Place Relation	table	**pp**
Points of Interest	Service POI Belonging to Service POI	table	**pr**
Structures	Point Structures	point	**ps**
Roads, Ferries, Address Area	TMC Information Along Road Element	table	**rd**
Roads, Ferries, Address Area	Route Numbers	table	**rn**
Railways	Railways	line	**rr**
Railways	Railway Extended Attributes	table	rrea
Railways	Railway Names	table	rrnm
Roads, Ferries, Address Area	Restrictions	table	**rs**
Points of Interest	Service in Named Area	table	**sa**
Roads, Ferries, Address Area	Official Street Codes	table	**sc**
Structures	Structure Transportation Elements Relation	table	**se**
Roads, Ferries, Address Area	Signpost	point	**sg**

CATEGORY	FILE NAME	FEATURE TYPE	FILE IDENTIFIER
Roads, Ferries, Address Area	Signpost Information	table	**si**
Roads, Ferries, Address Area	Speed Restriction per Lane	table	**sl**
Centers of Settlements	Centers of Settlements	point	**sm**
Centers of Settlements	Centers of Settlements Extended Attributes	table	smea
Centers of Settlements	Centers of Settlements Names	table	smnm
Roads, Ferries, Address Area	Signpost Path Index	table	**sp**
Roads, Ferries, Address Area	Speed Restrictions	table	**sr**
Roads, Ferries, Address Area	Speed Restriction Time Domains	table	**st**
Structures	Structure Extended Attributes	table	sxea
Structures	Structure Names	table	sxnm
Roads, Ferries, Address Area	Transportation Element Belonging to Area	table	**ta**
Roads, Ferries, Address Area	TMC Location Index	table	**tc**
Roads, Ferries, Address Area	Time Domains	table	**td**
Roads, Ferries, Address Area	TMC Path Index	table	**tg**
Roads, Ferries, Address Area	TMC Path Location Index	point	**ti**
Roads, Ferries, Address Area	TMC Location	table	**tl**
Roads, Ferries, Address Area	Tourist Roads	table	**to**
Roads, Ferries, Address Area	TMC Path	table	**tp**
Roads, Ferries, Address Area	Traffic Sign	point	**ts**
Roads, Ferries, Address Area	Traffic Sign Along Road Element	table	**tt**
Points of Interest	Vicinity Relation	table	**vr**
Water Areas/Lines	Water Areas	area	**wa**
Water Areas/Lines	Water Lines	line	**wl**
Water Areas/Lines	Water Areas/Lines Extended Attributes	table	wxea
Water Areas/Lines	Water Areas/Lines Names	table	wxnm
Extra Attributes	XML Object Reference	table	**xo**

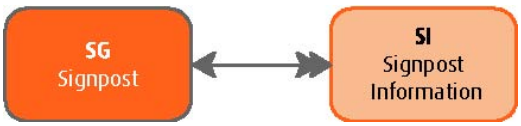
Shapefile Data Model

To show the various Shapefile files are linked and inter-related, refer to the **Shapefile Data Model** in the Appendix section of this user guide.

This explains the meaning of the possible relations between tables indicated by arrows in the Shapefile Data Model.

	RELATIONSHIP DESCRIPTION
	0/1 to 0/1 0/1 to 0 or many (0...n) 0/1 to many (1...n) 0/1 to 1 1 to 1 1 to 0 or many (0...n) 1 to many (1...n) many (1...n) to many (1...n) 0 or many (0...n) to 0 or many(0...n)

EXAMPLE: Consider the Relation between the Signpost Table (SG) and the Signpost Information Table (SI):



This means that every element of SG is related to multiple elements in SI, and every element in SI is related to exactly one element in SG. In other words, each Signpost can contain one or more sections of information: an airport pictogram and a parking pictogram. Each pictogram is a different record in SI. However, each pictogram in SI refers to exactly one Signpost.

File Definitions

On the following pages are brief descriptions of MultiNet® Shapefile files. File identifiers are in parenthesis next to the file names. Attribute descriptions are included in the **MultiNet® Shapefile Specification** document on this documentation DVD.

Note that in Shapefile and Oslfile formats:

- If a feature attribute is not captured for a geographical area, the field in the .dbf file is empty.
- If an entire feature is not captured for a geographical area (e.g., *a3, *a4 for North America), the files are delivered, but will contain no data.
- Extended file field definitions below appear under <**FIELD NAME**> text.

Roads, Ferries, Address Areas

Network (NW)

The Network (NW) theme contains all of the topological Transportation Elements (Roads, Ferries, Address Area Boundaries Elements) within the MultiNet® Shapefile product set. The Network theme is useful for many GIS applications. For example:

- Displaying all Transportation Elements in one theme;
- Making queries on all Transportation Elements;
- Supporting vehicle routing applications.

Extended attributes can be assigned to the network layer in some geographical locations. The file extension to identify extended attributes for the network layer is *nwea.dbf.

The Oneway, F_BP and T_BP (Blocked Passage) fields in this layer reflect the restrictions for Passenger Cars (VT=11 & VT=0) as they also are available in the Restrictions (RS) table. The Time Domain Information is not taken into account to populate these fields. Whether a Blocked Passage is removable or not also is found in the RS table.

PJ

The PJ (Plural Junction) field holds information to indicate whether a driving instruction needs to be generated. Possible values are:

ATTRIBUTE CODE	DEFINITION	DESCRIPTION
0	Not part of a plural junction	0 is the default value
1	Intersection Internal	In this case, no special instructions are needed for guidance.
2	Indescribable	There may be unusual turns or maneuvers that cannot be clearly conveyed in a single instruction. Display of the maneuver is necessary in this case.
3	Maneuver	In this case, special instructions are needed for guidance before the start of the Road Element.

Procstat

This field indicates the level of attribution for a particular Road Element or Ferry Connection:

1: Fully attributed - The map data is suitable for use in the most demanding high-end applications like turn-by-turn navigation and traffic telematics.

2: Basic attributed - The map data is suitable for most basic applications, although not yet compliant with the specifications of all demanding high-end applications.

3: Incompletely attributed - The map data only has a few attributes or default values for certain attributes.

Please refer to the **Shapefile & Oslfile Data Model** in the Appendix section of this user guide for a visual representation of the interconnections of the Network layer with all other MultiNet® Shapefile and Oslfile layers.

Oneway

The ONEWAY field indicates whether a road element is open in both directions (blank); open in positive direction (FT); open in negative direction (TF) or closed in both directions (N). Note that the restrictions table (RS) contains the most restrictive information and should be considered over values that may appear contrary to information in the ONEWAY field.

Example: The NW ONEWAY field is filled with "N" indicating closed in both directions (at all times). The RS table indicates that the direction of traffic flow is actually open in the positive or negative direction at certain times of the day for the same road element. These times are indicated and linked from the RS table to the time domain values in the TD table.

Kph

The KPH field in the Shapefile Network file (NW) represents the average speed over the entire distance of a road. This calculation is based on the Functional Road Class (FRC), Form of Way (FOW) and whether the Road Elements travel through Built Up Areas (BUAs).

Adas

The ADAS field in the Shapefile Network file (NW) indicates whether the selected Road Element is compliant with **A**dvanced **D**river **A**ssistance **S**ystems requirements. Road geometry is considered ADAS compliant when the absolute positional accuracy of the geometry is +/- 5m and the relative positional accuracy is +/- 1m. The content of this field is either "0" if the geometry is not compliant, or "1" if the geometry is compliant.

Trans

The TRANS field in the Shapefile Network file (NW) represents the MultiNet concept of "Transition," meaning that a road element that is flagged as a Transition element indicates that part of the Road Network Geometry does not truly represent the actual road centerline.

Dynspeed

The DYNSPEED field in the Shapefile Network file represents a roadway that may be subject to speeds regulated by variable or dynamic traffic signs (e.g., electronic traffic signs).

Junction (JC)

The Level 1 Line Features that make up the Transportation Network for navigation are bounded by Junctions at the following locations:

- Start and end of a road (dead-end);
- Road crossing at grade;
- Change of a road characteristic (Attribute value like Street Name or Number of Lane);
- Crossing with an Administrative Area or Built-up Area (for example, at a municipality border);
- Connection between Road Network Geometry and Ferry Geometry;
- Where a TMC (traffic information) Location refers to a point on the Road Network;
- Crossing with Railway.

Note:

In Europe, Junctions also are found at Address Area boundary crossings and when constructing an Intersection or a Road (Level 2 Features).

In the U.S., a Junction is created on a Road Element every time that a Road Element intersects another Feature. The Road Element is at the same level as the Level 0 planar graph edges.

Junctions with multiple Types are provided in the JCEA (Junction Extended Attributes) table.

Junctions are an integral part of **Level 2 Roads**. See also **Intersections** later in this section.

Junction IDs on dataset boundaries have a "10000" prefix. See also **Working with Junctions on Dataset Boundaries in Shapefile** later in this user guide.

Please refer to the **Shapefile & OslfileData Model** in the Appendix section of this user guide for a visual representation of the interconnections of the Junction layer with all other MultiNet® Shapefile and Oslfile layers.

Geocode (GC)

The geocode theme is a reference theme designed exclusively for geocoding. This theme contains all of the edges/lines/arcs and attributes required for address geocode operations. The parsed addresses conform to normal postal standards for the spelling of street abbreviations and road names.

Nameform

The NAMEFORM attribute is not implemented.

Fullname

The FULLNAME field is, in most cases, the summation of the PREDIR, NAMEPREFIX, NAME, NAMESUFFIX and SUFDIR fields. **This field should be used to obtain the full street name**.

Note: Concatenation of the PREDIR, NAMEPREFIX, NAME, NAMESUFFIX and SUFDIR fields will not always result in a properly formatted street name.

Nameprefix and Namesuffix

The NAMEPREFIX and NAMESUFFIX fields in the GC file are used to store the prefix or suffix portions of the FULLNAME. Often, the street type is represented as a prefix or suffix, depending on language. See example below.

EXAMPLES:

COUNTRY	FULLNAME	NAME	NAMEPREFIX	NAMESUFFIX
Germany	Lehenweg	Lehen		weg
Spain	Calle de Vilamalla	Vilamalla	Calle de	
Canada (QC)	Rue Principale	Principale	Rue	
Canada (NS)	Ellsworth Ave	Ellsworth		Ave
U.S.	Greenview Rd	Greenview		Rd

See **Geocoding with MultiNet® Shapefile** in the How to Use MultiNet® Shapefile section of this user guide for usage.

See also the "Geocode" portion of the **Shapefile & Oslfile Data Model**.

Postal Code Information on Transportation Element (PC)

The Postal Code Information on Transportation Element describes the main Postal Codes per side and per transportation element. Also the sub-postal code information is described, ordered from start to end junction per side of the transportation element.

Postal Code Name Information (PCNM)

The Postal Code Name Table contains all captured names, in different languages. The table can be linked to the PC table via the POSTCODE attribute.

Intermediate House Numbers (IH)

The Intermediate House Numbers describe the order of House Numbers on a street, side dependent. This table only contains the individual house numbers for captured intermediate house numbers. These are primarily present in case of irregular house number structures.

Transportation Element Belonging to Area (TA)

The Transportation Element belonging to Area describes the relation between the Transportation Elements and the areas they belong to. The area types are limited to Administrative Areas, Administrative Places, Built-up Areas and Index Areas.

Address Area Boundary Element Belonging to Address Area (AB)

Address Area Boundary Element belonging to Address Area (AB) contains the relation between the Address Area Boundary Element and the Address Area (AA) that it bounds. See also **Address Areas** in this document section.

Note:

This feature is not currently available for MultiNet® North America.

Official Street Codes (SC)

The Official Street Codes are currently used only in Europe. An Official Street Code represents a unique reference of streets within a country. A street in this sense is a logical unit having the same official street name. The code is provided by the official authorities to conveniently link statistics and other official data referring to the particular streets.

Route Numbers (RN)

The Route Numbers table contains all Route Numbers for Road Elements separately with their own type and direction. See **Route Number Types** earlier in this user guide for details on the RTETYP field. See also **Route Numbers** in the How to Use MultiNet® Shapefile section of this user guide for Route Number usage.

Shieldnum

Beginning with MultiNet® Shapefile v. 4.4, the SHIELDNUM field takes the place in the table where previously the ROUTENUM field was located. The SHIELDNUM field contains the route number portion found on a signpost shield.

Example:

SIGNPOST	SHIELDNUM CONTENT
	88

Routenum

Beginning with MultiNet® Shapefile v. 4.4, the ROUTENUM field represents the full route number (prefix and the route number found on a signpost shield).

Example:

SIGNPOST	ROUTENUM CONTENT
	AB-88

Routenam

Beginning with MultiNet® Shapefile v. 4.4, the ROUTENAM field represents the route name associated with the route number.

Example:

SIGNPOST	SHIELDNUM CONTENT
	Bicentennial Hwy

Extertnam

Beginning with MultiNet® Shapefile v. 4.4, the EXTERTNAM field represents the extended route name associated with the route number.

Example:

SIGNPOST	SHIELDNUM CONTENT
	Bicentennial Highway

Tourist Roads (TO)

The Tourist Roads table contains the Tourist Road name and types of Tourist Roads. One Transportation Element can belong to different Tourist Routes. Each Tourist Route Name is referenced to a Transportation Element.

Maneuvers (MN)

A Maneuver is a mandatory, preferred or prohibited access of a Transportation Element in relation to another Transportation Element.

The Maneuvers table is a table of Attributes relating to the type and structure of a Maneuver Relationship. The Relationship relates access to one Transportation Element from another Transportation Element. This table also contains Junction geometry.

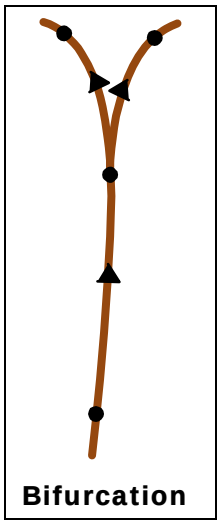
See also the "Maneuvers & Restrictions" portion of the **Shapefile & Oslfile Data Model** in the Appendix section of this user guide.

Feattyp

Maneuver feature types include: Bifurcation, Priority, Prohibited, Restricted and Calculated or Derived Prohibited.

Bifurcation

Bifurcation maneuver types suggest that guidance is needed at a junction because there is more than one obvious route to take.



Priority

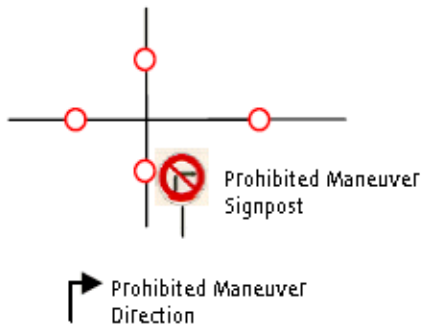
Priority maneuver is a maneuver that has priority over another maneuver at an intersection. Priority maneuvers are valid in both directions of a maneuver path.

A Priority maneuver is useful for both guidance suppression and guidance encouragement:

- **Guidance Suppression:** A route that includes the entire path of this maneuver should suppress the guidance to turn at the decision point in the maneuver. It can either be suppressed completely or replaced with lesser guidance ("stay left" instead of "turn left"), since continuing on this path is obvious.
- **Guidance Encouragement:** A route that includes one (but not both) of the Road Elements of the maneuver should encourage guidance. In a route that goes straight (usually requiring no guidance) it now would say "continue straight on."

Prohibited

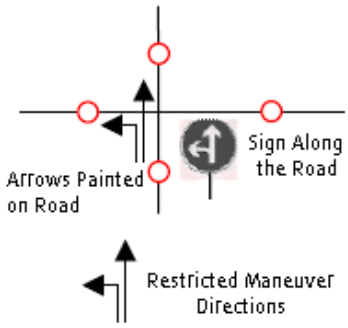
This type of maneuver is physically possible, but legally prohibited.



Prohibited Right Turn

Restricted

Restricted maneuvers are legally defined by traffic signs along the road or painted on the road. In the example below, both signs along the road and painted on the road indicate north and west as valid directions from the intersection. Therefore, direction of travel at this intersection is restricted to north and west only.



Restricted Maneuvers

Calculated or Derived

Calculated/Derived Prohibited Maneuver is a maneuver type that is created as an alternative for Restricted Maneuvers and Blocked Passages.

Image Maneuver

An Image Maneuver represents a path through a junction where a Junction View is advised. A Junction View is an image showing a simplified representation of a complex traffic situation where the advised route to follow is indicated.

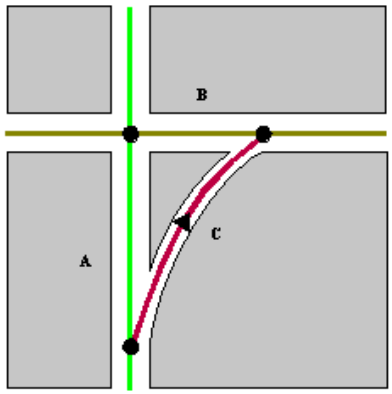
Junction View

Promantyp

Prohibited maneuver types are **Prohibited**, defined above, and Implicit:

Implicit

Implicit maneuvers are determined when potential paths of travel may be legal but most likely are prohibited. In the example below, the implicit maneuver is the red line even though the same Road Element may be reached by following the potential path (green line) from A and turning right at the intersection.



Implicit Maneuver

Maneuver Path Index (MP)

The Maneuver Path Index table describes the path of a Maneuver Relationship from start (TRPELID) to end (TRPELID). The Sequential Number (SEQNR) Attribute contains the exact position that an Element occupies in a Maneuver Relationship chain.

See **Maneuvers and Routing** in the How to Use MultiNet® Shapefile section of this user guide for usage.

Signpost (SG)

Signposts are useful for directional and destination information. Transportation Elements that lead to a destination indicated by a signpost can be linked.

The SG table includes the Junction geometry of the decision point on the signpost path.

See also the "Signpost Information" portion of the **Shapefile & Oslfile Data Model** in the Appendix section of this user guide.

Signpost Path Index (SP)

The SP table describes the path of a Signpost. The first Transportation Element is the start of the path and the last Element is the end of the path. The Sequential Number (SEQNR) Attribute contains the exact position that an Element occupies in a Signpost Path chain.

Signpost Information (SI)

The SI table includes signpost text and/or pictogram descriptions. If a signpost has multiple textual descriptions (for example, when the same destination is described in two languages), or multiple pictograms (for example, Railway Station with Parking Facility on the same signpost), then the records are repeated in the SI table for each textual description or pictogram, and ordered by a Textual Context Sequential Number (SEQNR).

The different signpost-related tables are linked by means of a Signpost ID.

INFOTYP

The INFOTYP field contains two-character GDF attribute codes describing the type of information on the signpost. Possible types are listed in the **MultiNet Shapefile Specification** on this documentation DVD.

Traffic Signs (TS)

Traffic Signs is a point feature in Shapefile format. Traffic sign type and position are indicated as file attributes, when known. See also **Traffic Signs** in the How to Use MultiNet® Shapefile section of this user guide.

Traffic Sign Along Road Elements (TT)

Traffic Sign Along Road Elements is a table in Shapefile format. Position of the traffic sign along a Road Element and validity direction are indicated as file attributes, when known. See also **Traffic Signs** in the How to Use MultiNet® Shapefile section of this user guide.

TMC Information Along Road Elements (RD)

This table provides TMC chain information on transportation elements for all locations captured on the network with reference to the TMC path(s) where they are located. The same Transportation Element might be repeated if several locations are located on it and/or if they are part of several TMC Paths.

Definition of RDSTMC value "ABCCDEEEEE" for Level 1 Elements:

- A = Direction of Road Element (from start Junction to end Junction) compared with the TMC chain direction:
  - **+** = in positive direction and external to the TMC point location;
  - **-** = in negative direction and external to the TMC point location;
- B = EBU (European Broadcasting Union) Country Code;
- CC = TMC Location Code;
- D = TMC Direction of the Chain;
  - **+** = in positive direction and external to the TMC point location;
  - **-** = in negative direction and external to the TMC point location;
  - **P** = in positive direction and internal to the TMC point location;
  - **N** = in negative direction and internal to the TMC point location.
- EEEEE = TMC Point Location Code (found in the official TMC location Databases).

See **TMC Location Structure in MultiNet® Shapefile Data** later in this user guide for a description and comparison with Complex Feature location codes.

See also the "TMC Information" section of the **Shapefile & Oslfile Data Model** in the Appendix section of this user guide.

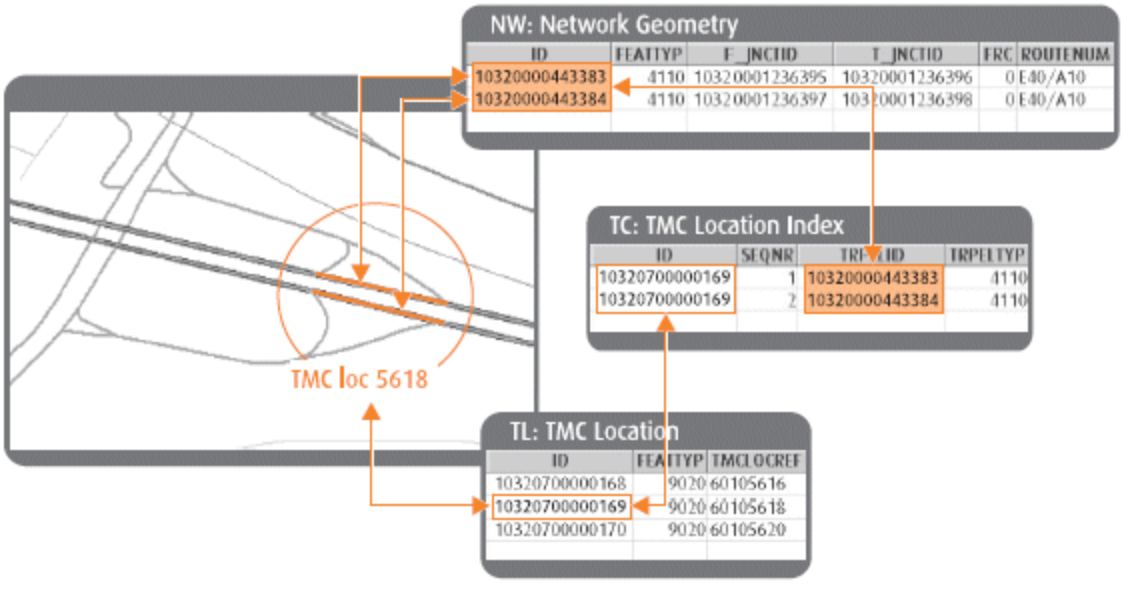
TMC Location (TL)

The TL and TP Tables contain a link to the actual location references in the specific TMC database of a given country. The bounding TMC Location References of a path in the TP Table are in the TL Table. The TMCLOCREF field is a field that is coded for elements represented as Complex Features. See **TMC Location Structure in**

MultiNet® Shapefile Data later in this user guide for a description and comparison with Level 1 location codes.

TMC Location Index (TC)

The Location Index table includes a list of all Transportation Elements belonging to the same TMC Location or Path. A TMC Location also can include Junctions. See graphic below.



Relating IDs in the NW, TC and TL Tables

The orange Road Elements in the figure above (bounded by two Junctions that are also bounding Access/Exit Ramps) belong to one TMC Location, whose ID is in both the TC and TL Tables.

TMC Path (TP)

A TMC Path is defined by the chain of TMC Locations using the positive or negative offset in one direction of the traffic flow.

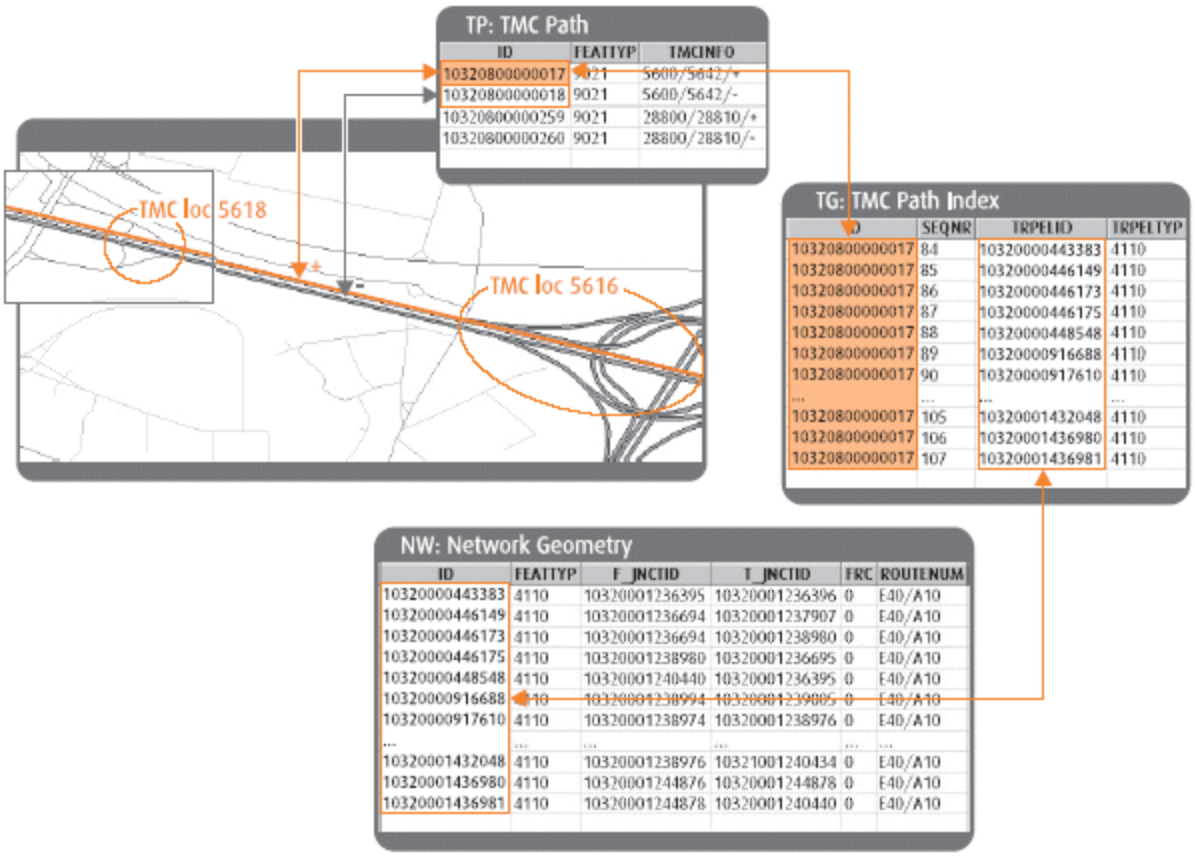
A TMC Path:

- starts where a TMC Location does not refer to a previous TMC Location (no negative offset in the location table);
- ends where a TMC Location does not refer to a next TMC Location (no positive offset in the location table).

See an example taken from the TP table in **TMC Paths in MultiNet® Shapefile Data**.

TMC Path Index (TG)

The TMC Path Index table describes the path of a TMC Path Relationship. The Sequential Number (SEQNR) Attribute contains the exact position that an Element occupies in a TMC Path Relationship chain. See figure below.



Location and Sequence of Road Elements in a TMC Path

The TMC Path that is bounded by the illustrated TMC Location consists of 25 Road Elements. The Road Elements are sequentially ordered in the TG Table, and each has the same TMC Path Identification. The TP table shows that the path runs from TMC Location Reference 5600 to 5642. TMC Location 5618 is located in this path.

See also **Linking the TMC Path to the Network Geometry**.

TMC Path Location Index (TI)

The TMC Path Location Index table describes the sequence of the TMC Locations along its related TMC Path along with a simplified geographical point representation. This table is available only for the U.S. For other countries this table cannot be provided because of licensing issues.

Level 2 Roads (2R)

Level 2 roads form a generalized representation of the Road Network. The first and last Elements of a Level 2 Road are always an Intersection. See **Level 2 Roads** earlier in this user guide.

The Level 2 Roads table describes all of the Transportation Elements that form a functional unit between the two Intersections.

See also **How to Use Level 2 Roads** in the How to Use MultiNet® Shapefile section of this user guide.

Intersections (IS)

Intersections are Level 2 objects. The Intersection table represents one component necessary to define an intersection. This table contains extra Attributes, Intersection Type and Freeway Intersection Type, for an Intersection. The table also contains the Official Name and Number of the Intersection, if present.

A Relation can be made between the IG Index table and the IS Intersection table via the Intersection ID field. See **Intersection Index** below.

See also **How to Use Intersections** in the How to Use MultiNet® Shapefile section of this user guide.

Intersection Index (IG)

An Intersection is comprised of one or more Junctions and Transportation Elements. The basic table that describes an Intersection by its Junction(s) and/or Transportation Elements(s) is the IG Intersection Index table. This table builds an Intersection Geometry Index, giving a sequence number to all the Elements within the Intersection, and defining the Feature Type of these Elements, whether Junctions, Road Elements, Ferry Elements or Address Area Boundary Elements.

The ELEMID field in the IG table corresponds to the Transportation Element ID in the NW table. Finally, it is stored in the Center Point of Freeway (CF) table.

See also the "Roads & Intersections" portion of the **Shapefile & Oslfile Data Model** in the Appendix section of this user guide.

Center Point of Freeway (CF)

A Center Point of Freeway represents the central position of a Freeway Intersection by a Point Feature. The Center Point of Freeway is always located on top of one of the Road Elements forming part of the Intersection. This Point Feature gets the same Intersection ID as the Intersection it represents.

Restrictions (RS)

Restrictions and Maneuvers are used to identify restricted movements on Transportation Elements and to limit the number of Transportation Elements used in a route calculation. A Restriction limits access to part or all of a Transportation Element.

Please refer to record *RS* in the **MultiNet® Shapefile Format Specification** document on this documentation DVD for the list of restriction types and values.

See also the "Maneuvers and Restrictions" portion of the **Shapefile & Oslfile Data Model** in the Appendix section of this user guide.

Time Domains (TD)

This table represents time domain restrictions on the road network.

See **Time Domains** earlier in this user guide for a description of the TIMEDOM attribute.

Speed Restrictions (SR)

The Speed Restrictions table contains speed information for Vehicle Types, Direction of Speed Restriction Validity, type of speed restriction and the speed for the selected transportation element.

Speed

The unit of measure for the SPEED attribute is defined in the country (Administrative Order A0) area feature's MUNIT field. The SPEED field represents either the maximum, recommended or lane-dependent speed for a single Road Element. Note that a particular Road Element can be flagged in the NW file with an average speed that may be higher than the SR maximum speed value.

Speedtyp

Speed restriction types tagged "undefined" ("0") can be due to no existing sign posts indicating a maximum or recommended speed.

Valdir

The VALDIR field indicates whether the speed restriction is valid in the positive, negative or both directions of the related transportation element.

NOTE:
A road element flagged as a oneway may be assigned speed restrictions in both directions. The speed restrictions that are assigned to the opposite direction of the oneway road element can be ignored.

Verified

The VERIFIED field in the Shapefile Speed Restriction file (SR) indicates whether the speed values were verified by reliable sources ("1") or were calculated ("0" - not verified).

Example:

In North America, a Major Slip Road is an example of a road tagged both with a SPEEDTYP = "0" (undefined) and VERIFIED = "0" (not verified).

Speed Restriction Time Domains (ST)

If a Speed Restriction applies to a specific time period, this table links the transportation element to a TIMEDOM field. See also **Time Domains** earlier in this user guide.

Lane Divider Information (LL)

The Lane Divider Information table indicates the type of separator on the road in between two lanes. The divider type (DIVIDERTYP) represents a lane's separator with its neighboring lane, starting with the first lane. Lanes are identified with a counter from right to left taking into account the direction of the Road Element From-To direction.

NOTE:
The VALIDITY attribute in the LL, LD and LF tables relates the validity of the main attribute of those files to the road lanes. Values in the VALIDITY field always start with "R," indicating lane identification is from right to left. Subsequent numbers following the "R" is either "0" or "1" for each lane:

- "0" indicates that the attribute is not valid for the lane;
- "1" indicates that the attribute is valid for the lane.

Lane Direction Information (LD)

Lane Direction represents the direction a lane is leading to, indicated on sign plates or indicated on the road.

NOTE:
The VALIDITY attribute in the LL, LD and LF tables relates the validity of the main attribute of those files to the road lanes. Values in the VALIDITY field always start with "R," indicating lane identification is from right to left. Subsequent numbers following the "R" is either "0" or "1" for each lane:

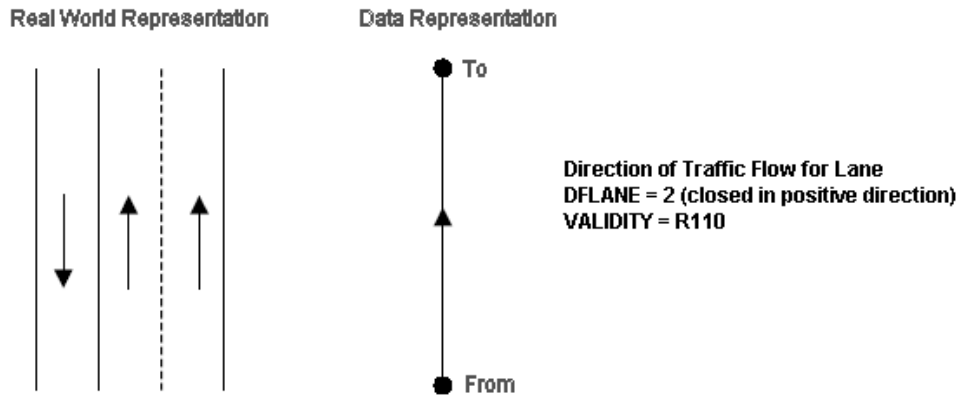
- "0" indicates that the attribute is not valid for the lane;
- "1" indicates that the attribute is valid for the lane.

Direction of Traffic Flow for Lane (LF)

The Direction of Traffic Flow for Lane table indicates the direction of traffic flow for each road lane. The DFLANE attribute represents a lane's direction of traffic flow. Lanes are identified with a counter from right to left taking into account the direction of the Road Element From-To direction.

NOTE:
The VALIDITY attribute in the LL, LD and LF tables relates the validity of the main attribute of those files to the road lanes. Values in the VALIDITY field always start with "R," indicating lane identification is from right to left. Subsequent numbers following the "R" are either "0" or "1" for each lane:

- "0" indicates that the attribute is not valid for the lane;
- "1" indicates that the attribute is valid for the lane.



VALIDITY Example for Direction of Traffic Flow for Lane

Time Domains for Direction of Traffic Flow (LT)

This table holds time domain restriction information for direction of traffic flow, if applicable.

Lane Connectivity Information (LN)

Lane Connectivity is a relationship between a Road Element, Junction and another Road Element. The Lane Connectivity Information table identifies a junction point where a sign indicates a lane change. The FROMTO lane information is in the format x/y: where x = the From lane, and y = the To lane.

Lane Connectivity Path (LP)

The Lane Connectivity Path table identifies the Road Elements in the path comprising the lane connections. The IDs in the Lane Connectivity Path and the Lane Connectivity Information table relate the two tables.

Lane Type Information (LI)

The Lane Type information file identifies what type of lane the flagged road element represents.

Types of lanes identified in this table include:

- Exit/Entrance Lane
- Shoulder Lane/Emergency Lane
- Parking Lane
- HOV Lane

See the **MultiNet® Shapefile Specification** document on this documentation DVD for details.

Lane End (LE)

The Lane End file identifies the road element that is flagged as being the end of a lane or the beginning of a lane.

Speed Restriction per Lane (SL)

This file identifies speed restrictions that apply to lanes of a roadway. The types of vehicles and the lane direction(s) that the speed restriction affects are also identified.

Lane Dependent Toll Payment Method (PM)

The Lane Dependent Toll Payment Method layer describes the available payment methods at a toll station and identifies the lane that the toll payment method is valid for.

Streets

Street (00-08)

Street layers 00–08 are subsets of the Network layer. The Street layers contain road geometry divided on Functional Road Class. These layers are provided to facilitate map display. Stubbles are not included. The Road and Ferry Elements are in separate tables for ease of use. For the Road layers 00, 01, 02, 03, 04 and 05 the road geometry is dissolved to speed up visualization.

Ferries (FE)

Ferry Geometry is present both as part of the Transportation Network Geometry in the Network layer (with all basic and Extended Attributes, including Official and Alternative Name and Restrictions/Time-dependent Restrictions) and also as a separate FE Ferry layer.

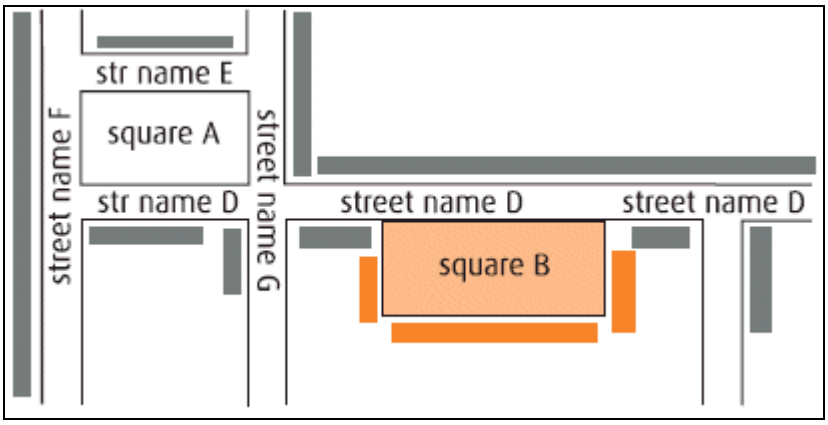
In the FE Ferry layer, only the more basic attributes are present in order to ensure the integration with the rest of the Street layers or Road Network Geometry.

Address Areas (AA)

Note:

This feature is currently available only for MultiNet® Europe.

An Address Area is a square or place that should not be used for routing purposes. However, it is important as a destination because it contains addresses that cannot be related to the street name of the road that passes by or through. This is illustrated by the following drawing.



Street names D, E, F and G are officially assigned to both sides of the streets. Square B has address information that is different from that of the streets, and is as such defined as an Address Area with its own address information. Square A does not have any address information of its own; therefore, it is not considered as being an Address Area.

An Address Area is included in the MultiNet® Shapefile product in two different ways:

- As a part of the Transportation Network with the Feature Type Address Area Boundary Element. The relation between the Address Area Boundary Element and its Address Area is stored in the table AB (**Address Area Boundary Element belonging to Address Area**).
- As a distinct Area Feature bounded by its boundary elements.

Railways

Railways (RR)

A Railway in the TomTom® database represents the approximate centerline of a railway. Generally, only the railway lines for passenger traffic are captured. Metro subways and tramways are not captured.

Railways are not considered a part of the main Transportation Network, because they have no real direct connectivity or routing functionality. A separate RR Railway layer is provided in MultiNet® data with basic attributes.

Points of Interest

Points of Interest (PI)

A Point of Interest (POI), also called "Service," is a point representation of an activity at a specific location. "Service" represents the activity and not necessarily the building in which the activity takes place. Although the point also may serve as a destination landmark, the point does not necessarily represent an entire physical object.

cltrpelid

For a POI that is not captured at a Junction, the Relation with the Transportation Network is made by means of an Attribute of an Entry Point. The Attribute is duplicated for the POI that belongs to the Entry Point. This Attribute, CLTRPELID ("Closest Transportation Element ID"), defines the closest Transportation Element.

relpos

When a POI is not captured at a Junction, it has an *indirect* Relation with a Network Junction, by means of the Transportation Element that the Junction belongs to. A Network Junction is either a "From Junction" or a "To Junction." The Attribute RELPOS indicates the Relative Position from the "From Junction." RELPOS is a number that ranges from 0 to 100, with 100 representing the total length of the Transportation Element. The default of RELPOS being -1 indicates that there is no relative position captured. When RELPOS is 0-49, the "From Junction" is related to a POI and can be used for routing purposes. When RELPOS is 50-100, the "To Junction" is related to the POI and can be used for routing purposes.

extopoiid

When dealing with POI data originating from an external source, MultiNet® Shapefile stores a link to that source data in this attribute.

See **Points of Interest** in Section 3 of this user guide for more information. See also the "Point of Interest" section of the **Shapefile & Oslfile Data Model** in the Appendix section of this user guide.

Points of Interest Extended Attributes (PIEA)

Note:

In European data, the ATTTYP field in the PIEA table also stores POI gecoding accuracy levels (6A). See **Geocoding Points of Interest and Accuracy Levels** earlier in this user guide.

See the **MultiNet® Shapefile Specification** document for a list of POI Features and Attributes for the PIEA table. See also the **All_Codes** database on this Product Documentation DVD.

Service POI Belonging to Service POI (PR)

POI-to-POI Relationships are called "Service Belonging to Service" Relationships. For example, the Relationship "Restaurant Belonging to Hotel" can be interpreted as follows:

- The Restaurant is accessible only through the Hotel, for example via an Entry Point.
- The Restaurant is functionally subordinate to or part of the Hotel.

Each POI has its own geometry and basic Attributes stored in the PI Geometry Table. The PR.dbf Attribute table includes the Relationship between a POI and its Entry Point. Even if a POI coincides with its Entry Point, these are still two different Elements in the PI table, and both are related through the PR.dbf Attribute table.

Point of Interest at Junction Relation (PE)

A topological POI corresponds with a Junction on the Transportation Network: a point feature in the PI layer has a point feature located on the exact same location in the Network layer, where it represents a Junction. A non-topological POI does not correspond with a Junction on the Transportation Network. MultiNet® Shapefile represents a Junction as an Attribute of a Transportation Element and as a Point Feature stored in the JC table.

Vicinity Relation (VR)

A Vicinity Relation is captured when a POI is located in one Administrative Area but functionally belongs to another Administrative Area. For example, Brussels National Airport in Belgium, located in the municipality Zaventem, functionally belongs to the capital Brussels.

Service in Named Area (SA)

The Service in Named Area file identifies POIs that lie within a designated area. These include Administrative Places, Administrative Areas and Index Areas.

Relations towards the Index Areas and Administrative Places are built based on MultiNet® relationship 1014 for all Services, Centers of Settlement and Entry Points.

Centers of Settlements

Centers of Settlements (SM)

A Center of Settlement ("City Center") contains the central point and name of an Administrative Area, Administrative Place, Postal Area, Built-up Area, Census Area, Hamlet or Neighborhood. A central point typically is located at a major intersection or coincides with a POI captured for an important activity (e.g., Church, City Hall, Railway Station) in a Center of Settlement.

As in the PI layer, the SM layer contains the **CLTRPELID** and **RELPOS** fields. Click on these links for a description.

Water Areas/Water Lines

Waterways, like Land Cover and Land Use, enrich a digital map display by providing context.

A Water Element can be:

- A Line Feature representing the centerline of a water course;
- An Area Feature representing water.

A Water Course or Area Feature does not necessarily have a clear object extent and a definite boundary. A Water Course or Area Feature may be intermittently dry—like a river that is dry during part of the year—or may be covered with ice. In the digital map, therefore, the boundary may be arbitrary.

Water Areas (WA)

The Water Areas file represents the geometery associated with water area features and includes relative area and perimeter attribution.

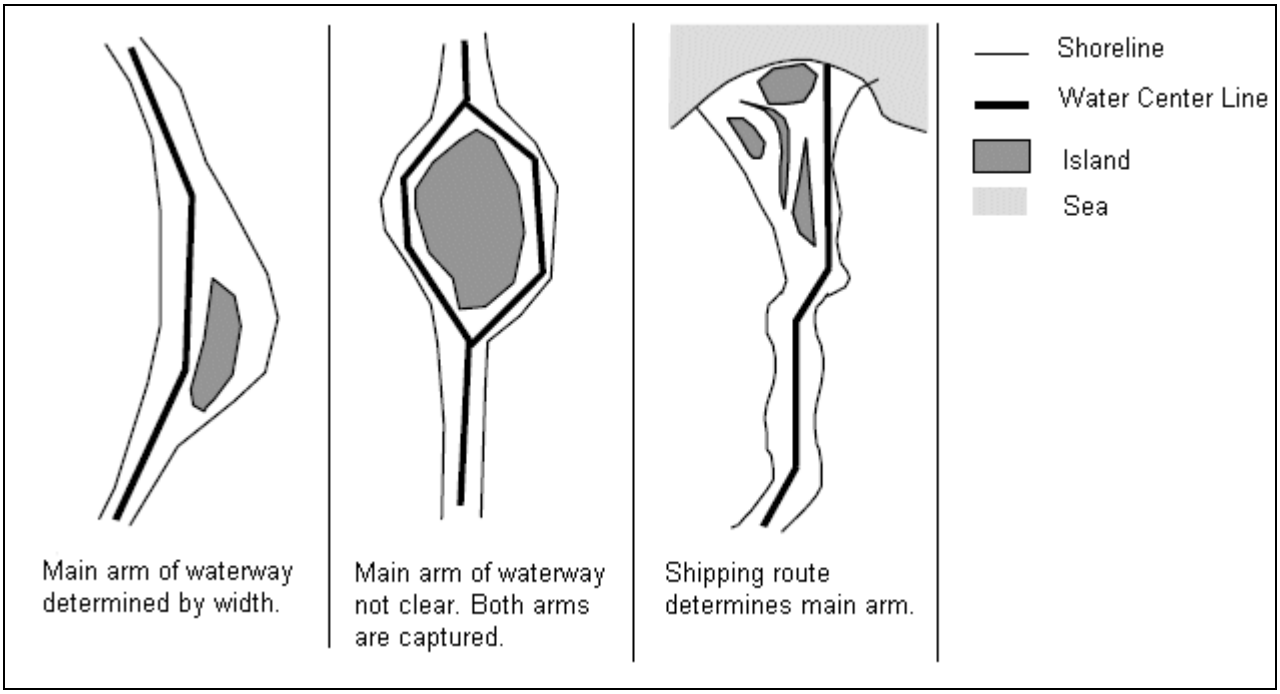
NOTE:
Swimming pools, marshes, swamps and glaciers are not considered Water Elements.

See also **Water Display Class** earlier in this user guide for a description of water display classes.

Water Lines (WL)

Water Lines represent only linear water bodies (rivers, canals). A Water Center Line represents the main river arm. Minor river arms are not taken into account.

When it is not clear which arm is the main river arm, the Water Center Line is then captured for both arms. A waterway's width, and/or the shipping lane and other factors will determine which is the main arm. Within river deltas or river mouths, the main arm generally corresponds with the shipping lane.



See also **Water Display Class** earlier in this user guide for a description of water display classes.

Land Use and Land Cover

Land Use Areas (LU)

Attribution for this layer includes Area and Perimeter; classification codes for Park/University or College/Golf Course/Building; and display types and values for most features. See a general description of **Land Use** earlier in this user guide. See also **Land Use and Land Cover Display Types**.

Land Cover Areas (LC)

Attribution for this layer includes Area and Perimeter, and display types and values for most features. See a general description of **Land Cover** earlier in this user guide. See also **Land Use and Land Cover Display Types**.

Built-up Areas

Built-up Area (BU)

Attribution for this layer includes Area and Perimeter, and display types and values for most features. See also **Built-up Areas** earlier in this user guide.

Built-up Area in Named Area (BA)

This layer indicates what type of Named Area Feature the Built-up Area resides in.

Relations towards the Index areas and Admin Places are built based on MultiNet® relationship 9203 for Built-up Areas.

Relations towards the Administrative Areas Order 8 are built based on the MultiNet® relationships 1007 for Built-up Areas.

Administrative Areas in Shapefile / Oslfile

All Administrative Order Units are stored in separate layers. Their Attributes are stored in the Geometry tables A0, A1,...A9. Each Administrative Area Feature of a specific order has its own Feature Code. For each record, the table contains references to all the higher-level Codes of the Administrative Areas that contain the Administrative Area in question. The structure of a specific table, then, depends on the Administrative Order that it is for. See the Administrative Areas section of the **Shapefile Format Specification** document for details.

Because of the importance of the municipality and sub-municipality level for daily reference and map display on different zoom levels, Order 8 and Order 9 contain three additional Attributes: POPCLASS, POP and CITYCENTER. See the Administrative Areas section of the **MultiNet Shapefile Format Specification** document for details.

Census Places are in the Administrative Place (AP) table.

See the "Administrative Areas" portion of the **Shapefile & Oslfile Data Model** in the Appendix section of this user guide.

See also **Administrative Areas** in the Understanding section of this user guide.

Order (A0-A9)

At least 10 levels of Administrative Orders are defined for each country. The highest level, Order 0, is always the Country, which is made up of all lower-level units. Order 8 is also always present. The name of this level and the extension of its units are country dependent. Order 8 is the lowest level that covers the whole territory of the country. It is especially important because many Relations between Features and the Order 8 Administrative Areas are made in the TomTom® database.

The intermediate orders from 1 to 7 and the lowest level, Order 9, may or may not be used, depending on a country's political hierarchy. See the Release Notes document for each country's Administrative Order.

See also **Administrative Boundaries and Shorelines** later on in this user guide to see how Administrative Areas are defined in coastal areas.

Area Replaced by Index Area (AI)

Relations towards the Index Areas are built based on MultiNet® relationship 9204.

Official Languages (OL)

This table links the Administrative Area Order feature IDs to the Official Language of that Administrative Area.

Administrative Area Extended Attributes (AE)

The following is a list of Administrative Area extended attributes:

ADMINISTRATIVE AREA	ATTRIBUTE TYPE (ATTTYP)	DESCRIPTION	ATTRIBUTE VALUE (ATTVALUE)
Administrative Areas (1111…1119)	9M	Major Road Feature	1
		Major Road Stubble	2
	2M	Tourist Municipality	1
	3D	Left-Side Driving	1
		Right-Side Driving	2
	2N	Artificial	1

Boundary Lines (BL)

The Boundary Lines geometry file represents the dividing outline of two Administrative Areas or the boundary of an Administrative Place. The Boundary Line layer is also useful in defining coastlines where Administrative Areas are displayed with a buffered shoreline. See also **Administrative Boundaries and Shorelines** later in this user guide to see how Boundary Lines might be used.

Administrative Area Structure Definitions (AD)

The Administrative Area Structure Definition table contains the definition of a certain Administrative Order level, e.g., “Municipality” for Administrative Order 8 Area, FEATTYP 1119. The definition is defined per country and can be listed for multiple languages.

Administrative Places in Shapefile / Oslfile

Like other Administrative Features, an Administrative Place has its own geometry in the AP Layer. Its Code and Name are Attributes in the Geocode (GC) Layer.

See the "Administrative Areas" portion of the **Shapefile & Oslfile Data Model** in the Appendix section of this user guide.

Administrative Places (AP)

Administrative Places are used in U.S. data for cities, towns, townships, etc. In the U.S., cities sometimes cover several counties and parts of counties; therefore, they do not fit into the hierarchical structure set out by TomTom®. Administrative Place definitions are also currently used in Ireland.

See also **Administrative Places** in Section 3 of this user guide.

Place Within Place Relation (PP)

In Shapefile format, the Place Within Place Relationship is present between Administrative Places and Administrative Areas, and between Index Areas of different hierarchy levels. Relationships between Index Areas and Administrative Areas no longer exist.

Postal Districts

Postal Districts (PD)

Postal Code information in the TomTom® database is captured both as an Attribute of a Transportation Element (Road Elements or Address Area Boundary Elements) and as a Postal District. A Postal District includes the boundaries of a postal area as defined by the national postal organization of a country.

The *Main Postal Code* is the database representation of the complete postal code or the portion of the official postal code defined by the national postal organization that basically refers to an area.

Poland

In the largest cities in Poland, Postal Districts represent a grouping of postal areas that have a postal code starting with the same characters.

Russia

In Moscow, Postal Districts represent a grouping of postal areas that have a postal code starting with the same characters.

U.K.

Postal Districts in the U.K. are not a representation of the U.K.'s postal districts but of the Postal Sectors, which are a subdivision of postal districts.

U.S.

- Postal Districts are ZIP Code areas. Point ZIP Codes are not represented in this product.
- In the U.S., TomTom® defines wilderness areas, forests and parks as "zero-delivery areas" and reserves postal codes 00000 to 00199 for these areas. These postal codes do not represent actual United States Postal Code (USPS) ZIP Codes.

Postal District Names (PDNM)

The standard name for Postal District is the most common name of a postal area as defined by the national postal organization.

In a monolingual municipality, the standard name has the language code of the language officially used in the municipality.

In a multilingual municipality, if a common name exists for each official language, the standard name is captured for each common name and the language codes are the languages officially used in the municipality.

In a multilingual municipality, if a common name does not exist for each official language, the standard name is captured for the most common name and has the language code of either:

- the official language that reflects the origin of the name; or the official language that is recognized as official at the national level.

In case the options above are not decisive, the postal name has the language code of one of the official languages.

Postal District Name Types

Postal District name types are presented as a bitmask value in this table.
To retrieve Official Names globally:

- use bitmask value = "5" (bitmask "1" ("Official Name") + bitmask "4" (U.S. only – "Last Line Name")).

To retrieve Alternate Names globally:

- use bitmask value = "2" ("Alternate Name")

Note that in the U.S., options of names that are "Acceptable" (bitmask "8") or "Not Acceptable" (bitmask "16") are also available.

Other Named Areas

Other Area Names (Census Districts, Census Blocks, Census Block Groups, Census Tracts, Metropolitan and Micropolitan Statistical Areas, Index Areas, Urban Aggolmerations, Native Reservations, Census Urbanized Area Features, Special Charge Areas and Neighborhoods) are neither Administrative Areas nor Administrative Places. However, each Area serves a special purpose for a census. The Area geometry is included in the Other Named Areas (OA) layer, which includes—among other Attributes—the URBANAREA Attribute to distinguish between urban and rural Areas.

NOTE:
Other Named Areas are not included as Attributes to any other feature.

Census District (Census Tract in U.S.) (OA01)

A Census District refers to an area for which on official body collects statistical information such as population figures.

The official body can define several types or levels of census areas whether or not they are organized in an hierarchical way.

In the U.S., Census Tracts are small statistical subdivisions (averaging about 4,000 persons) of counties generally characterized by stable boundaries.

Census Block Group (U.S. Only) (OA02)

Census Block Groups are a collection of Census Blocks within a Census Tract, sharing the same first digit of their four-digit identifying numbers.

Census Blocks (U.S. Only) (OA03)

A Census Block is the smallest geographic unit for which the U.S. Census Bureau tabulates data. Generally bounded by streets, legal boundaries and other features, approximately 8.5 million Blocks are identified in Census 2000.

Census Urbanized Areas (OA04)

An Urban Area is a Census District that is located in an urban area.

Core Based Statistical Areas (U.S. Only) (OA05)

A Core-Based Statistical Area consists of a county containing an Incorporated Place or Census Designated Place with a population of at least 10,000, along with any adjacent counties that have at least 25% of employed residents of the county who work in the CBSA's core or central county. CBSAs are categorized as being either Metropolitan or Micropolitan.

- Each Metropolitan Statistical Area must have at least one urbanized area of 50,000 or more inhabitants.
- Each Micropolitan Statistical Area must have at least one urban cluster of at least 10,000 but less than 50,000 population.

Index Areas (OA06)

Index Areas occur where administrative divisions of a country do not provide clear address selection or do not allow address selection at all. The following are examples of when Index Areas occur:

- Where different Administrative Areas have the same name;
- Where Administrative Areas at a different level are considered for addressing on the same level;
- Where the names of Administrative Areas are not suitable for addressing because they are not known by the public;
- Where the surface of an Administrative Area does not correspond with the area that is experienced as one unit for addressing.

Urban Agglomeration (OA07)

Urban Agglomerations refer to the complete urbanized area of a city: the city and its surroundings. Because of its expansion, a city absorbs its neighboring settlements to form one big area with a concentration of buildings.

Since expansion of a city does not necessarily stop at municipality borders, municipality borders do not limit an Urban Agglomeration. Generally, the surrounding municipalities of a city or parts of them are parts of the urbanized area associated with that city.

Native Reservation (OA08)

A Native Reservation is the database representation of an area permanently and exclusively designated for native people of a certain country.

Special Charge Area (OA09)

Special Charge Area is a rudimentary visualization of a Road Element Special Charge attribute. A Special Charge Area does not replace the Road Element Special Charge. The Special Charge Area is used mainly for map display purposes.

A Special Charge Area is always composed out of adjacent faces.

Neighborhood (OA10)

A Neighborhood is a geographically localized area within a city or town with distinctive characteristics and considerable social interactions between inhabitants. A Neighborhood does not fit specifically in an Administrative structure or in an Index Area Structure.

Conversion Records (CN)

Numeric fields are right aligned with leading spaces to complete the length of the field. The TABEXT field is left aligned with trailing spaces to complete the length of the field. The table is only populated in the Dataset Product Type. It is not populated for a small partition or the Administrative Product Type.

A full discussion of conversion records and split indicators, their representation and use in MultiNet® data is found later in this user guide under **Dataset and Section Crossing**.

Structures (Brunnels)

A MultiNet® Stucture is the database representation of a construction used to ensure a direct passage of a transportation element over another transportation element, over a cavity or under the earth's surface.

In Shapefile format, structures are stored as:

- Area Structures (AS) – Aqueducts;
- Line Structures (LS) – Bridge, Aqueduct or Tunnel; and
- Point Structures (PS). – Bridge, Aqueduct or Tunnel.

As a group, these structures are known as "Brunnels."

NOTE:
Only point brunnels are included in a Grade Separated Crossing (GSC).

See also **Level Differences and Structures** in the How to Use MultiNet® Shapefile section of this user guide for details and use of Brunnels in Grade Separated Crossings.

Structure Transportation Elements Relation (SE)

This table relates a Structure to an Element in the Transportation Feature Network.

Extra Attributes

Names (NM) and Extra Attributes (EA) files are briefly described in the Extra Attributes section of the MultiNet Shapefile Format Specification document on this documentation DVD. Below is a description of the XML Object References file (XO).

XML Object References (XO)

The XML Object Identifier is a worldwide unique and stable identifier for an object in the database. A stable identifier refers permanently to an object in the database. This identifier remains linked to the object as long as the object exists. If the object is removed from the database, the identifier is not reused to identify other objects.

Section 5: Shapefile Format

Versions Supported

This TomTom® product is compatible with Environmental Systems Research Institute's (ESRI®) ArcView® software version:

- ArcView® 3.1 or higher.

This product also can be read by ArcGIS® 8.x. and higher.

See your GIS documentation to add a shapefile.

Format Specifics

Shapefile is a widely used open format that represents spatial data in layers. It was developed by ESRI®, Inc.

MultiNet® Shapefile is easy to integrate in an application environment because of its layered data model and standard GIS format. With Shapefile format you can:

- Import into commercial GIS software and other applications;
- Implement as geo-objects in a relational database management system (RDBMS) with spatial functionality;
- Use layers with defined themes and a clearly displayed set of attributes;
- Extend with new feature layers.

Note: Area features are generalized to limit the number of shape points to <=500 000 per feature.

Shapefile IDs

See "Shape IDs" in the **TomTom MultiNet® and Enhancements Directory Structure and File Naming** document, located in the format-specification folder of this documentation DVD for a detailed description of the Shapefile ID components.

AX Folder

Next to the core map folders, which are tiled to manageable data size tiles, there is also an "ax" folder. This folder contains all Administrative Areas and their Boundary Lines for a complete country or set of countries.

Note: Feature IDs may differ between the Administrative Areas in the dataset Shapefile folder and the ax folder.

If Administration Areas in the dataset Shapefile folders are split across multiple datasets, then each of the instances in the dataset Administrative Area layers will have multiple feature IDs. In the ax folder, the Administrative Areas will be merged into one feature that has one feature ID. Therefore, the feature IDs in the dataset folders cannot all match with the feature IDs in the ax folder.

To use ax Administrative Areas for referencing, discard or ignore the first or first 2 characters of the feature ID prefix (characters that contain the dataset number).

Dataset Borders in the AX Folder

In former products the Administrative Boundary edges on the TomTom Database tile borders were merged, not taking into account the merging of the line features on the other side of the tile. This caused the line features to be different on each side of the border. In current products the line features of the Administrative Boundary edges in the ax folder are no longer merged (chained).

Directories and Files

See "Directory Structure and File Naming" in the **MultiNet® and Enhancements Directory Structure and File Naming** document, located in the data-spec folder of this documentation DVD.

Record Layouts

See the **MultiNet® Shapefile Format Specification** document on this documentation DVD for all Shapefile record layouts.

Section 6: Oslfile Format

Versions Supported

This MultiNet® product format is compatible with Oracle® Spatial versions 8i and 9i. See the **MultiNet Release Notes** for further updates and information on Oracle format compatibility.

Format Specifics

While it is not possible to establish guidelines for installing data that are as straightforward as the guidelines for installing software, some general information can be useful when you start working with the TomTom® MultiNet® database. This section covers how the databases are divided into smaller datasets or partitions and how they are related to other TomTom® database products.

Directories and Files

See "Directory Structure and File Naming" in the **Global Directory Structure** document, located in the data-spec folder of this documentation DVD.

SQL Scripts

SQL Scripts are compatible with Oracle® Spatial 8i or 9i. Two sets of SQL scripts are provided (one for individual tiles and one for individual countries) that perform the following tasks:

- Create tables;
- Load tables;
- Remove duplicate junctions;
- Create primary keys;
- Create foreign keys;
- Drop tables;
- Drop primary keys;
- Drop foreign keys.

Control Files

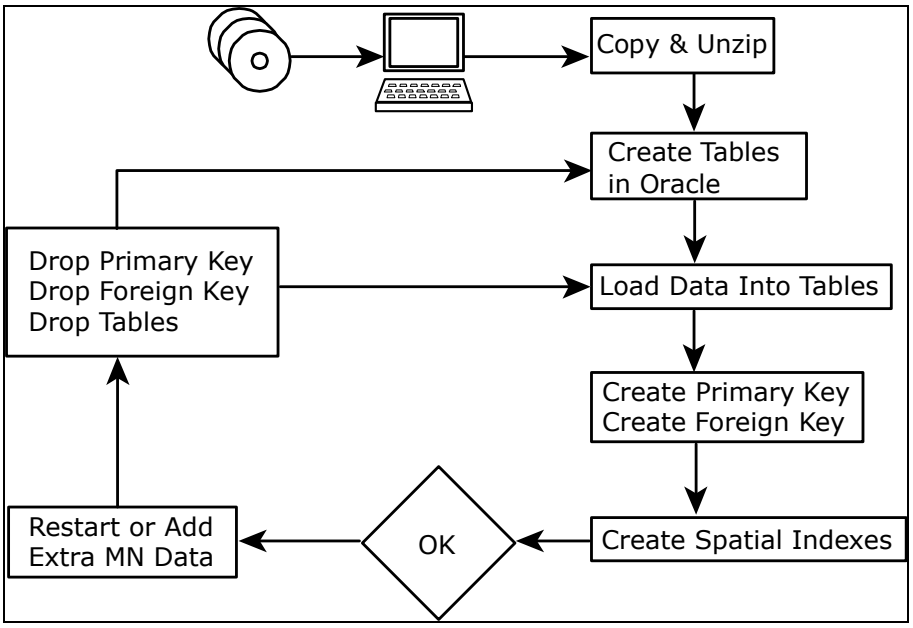
Control files are compatible with Oracle® Spatial 8i or 9i. Two sets of control files are provided. Each table in each tile has one control file for an individual tile load and one control file for a country load.

MultiNet® Oracle Specification Document

See the **MultiNet® Oracle Specification** document on this documentation DVD for more details on SQL scripting.

Loading Oslfile Into a Database

The following diagram describes the process flow of importing the MultiNet® Oslfile spatial data into your database.



Setting up the Working Directory

The data files are compressed on the DVD. Copy the entire DVD to your disk and unzip the data files. The .ctl files and .dat files should be in the same working directory.

Settings for Decimal Point

The data is provided with use of the decimal point. In order to load the data correctly in your Oracle® Spatial database, you may have to change your client environment

settings—NLS_LANG—to a decimal point. All Oracle® installations in Europe, except for the U.K., have a default comma setting.

To change the settings use the command: SET NLS_LANG=AMERICAN_AMERICA

Creating Tables in Oracle®

Use the "create_xxx_tables.sql" or "create_xxx_all_tables.sql" to create the tables.

- "create_xxx_tables.sql" makes it easy to pick the tables you need to load into your Oracle® Spatial database. This SQL script makes use of the single <<xxx>>_<<zzzz>>.sql in the same directory.
- "create_xxx_all_tables.sql" was created to import ALL provided tables into your Oracle® Spatial database.

Loading the Data into Tables

To load the TomTom® MultiNet® data into your Oracle® Spatial database, use the SQLLOADER of Oracle®.

Two batch files also have been created: one to load all the data into a country-specific table; and another to load all the data into a more general table.

By running the batch files, all the data is loaded automatically into your Oracle® Spatial database. Before you can work with these batch files you have to replace the user/password with your personal settings.

NOTE:
Depending upon the operating system you are using you have to make the file load_data.bat executable; e.g., Unix : Chmod +x load_data.bat

Batch file examples:

- "load_CHE_CHE.bat" (load all the Switzerland data into CHE tables).
- "load_CHE_MN.bat + load_AUT_MN.bat" (load all the Switzerland data into the MN tables and Load all the Austria data into the MN tables).

Additional Scripts to Create Primary/Foreign Keys and Build Spatial Indexes

Use the provided SQL-scripts to create the primary and foreign keys on the existing tables and to build spatial indexes. Scripts are provided for these situations.

EXAMPLES:

- CREATE_MN_FOREIGN_KEYS.sql
- CREATE_MN_PRIMARY_KEYS.sql
- CREATE_MN_SPATIAL_INDEXES.sql

NOTE:
Once you have created primary and foreign keys it can be useful to drop these keys for several reasons. For example, to load additional data into the tables you have to drop the foreign keys. To speed up the load process we recommend you drop the primary keys as well.

Joining Partitions

One of the first actions when working with new spatial data is often the joining of different databases into one database. Database partitions and technical datasets are geometrically seamed by TomTom®. See **Common Geographical Database Operations** in the How to Use MultiNet® Shapefile & Oslfile section of this user guide.

Displaying Textual Attribute Information in Oslfile

All data is delivered in UTF-8. It may be necessary to define or redefine this Codepage on the system or the import software application in order to correctly display the textual characters in the tables. What Codepage you should use for a specific country is mentioned in the **Release Notes**.

Record Layouts

See the **MultiNet® Oracle® Format Specifications** document on this documentation DVD for all Oslfile record layouts.

Section 7: How to Use MultiNet® Shapefile and Oslfile

Introduction

This document section gives information about and examples of some common applications and uses of MultiNet® Shapefile data.

Common Geographical Database Operations

Feature selection, table join, spatial join and summary and dissolve are the basic tools for any geographical analysis.

Feature Selection

It may be necessary to separate or to combine Attributes or Features before you can make the proper selection. Data can be selected as follows:

- From the map view;
- By overlaying data, then selecting particular Features from one theme based on how the Features relate to the Features of another theme;
- By using a query to automatically select items from a table: this is accomplished by selecting the right Feature Type Code, Attribute Type Code and Attribute Value Code.

EXAMPLE: To select all lakes for a dataset, you would select the records with Feature Code "4310" from the FEATTYP Attribute of the Water Area Geometry table (WA). From that subset select TYP Attribute Value Code ="2" for the Water Attribute Type, indicating a lake.

Table Joins

The following types of table joins are permissable:

- Geometry tables can be joined with Attribute tables;
- Attribute tables can be joined with other Attribute tables.

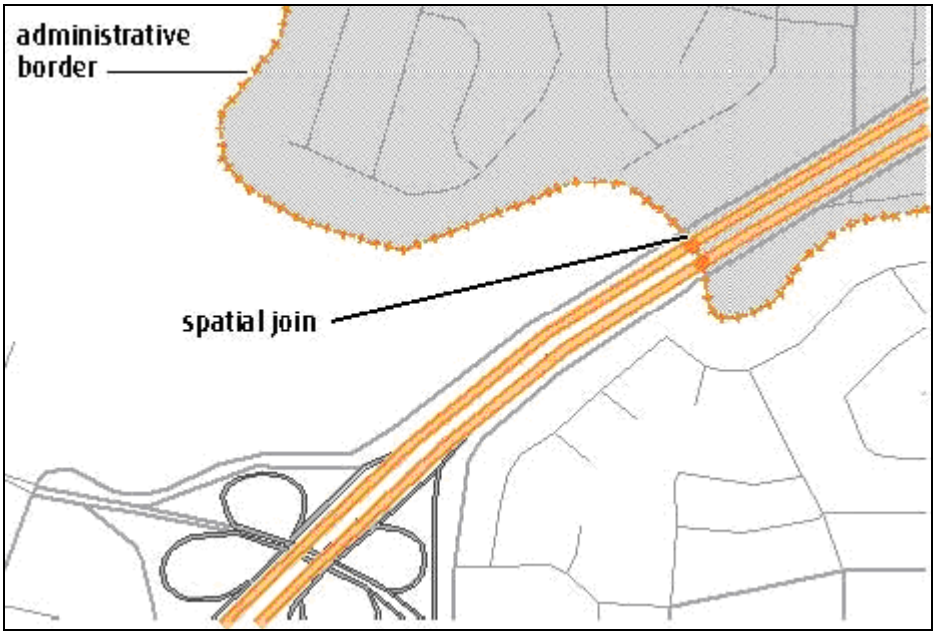
Two Geometry tables cannot be joined together.

Two or more tables can be linked based on a common reference feature. You can join two tables by an exact-match link of a unique record identifier in one table to one or more of the unique record identifiers in another table. A record identifier is a field such as a Feature ID. A record identifier can identify one or more records in a table.

Spatial Joins

A spatial join combines two or more Features, based on their geographical information. A spatial join is similar to an attribute join but is based on the spatial relationship between the Features (e.g., nearby, adjacent, inside or outside). As such, one Feature's records are joined into another Feature's basic Attribute table based on whether the Features' geometries correspond with a certain spatial relationship.

EXAMPLE: When the roads in one Administrative Area are connected across the border with the roads in an adjacent Administrative Area, each road is connected spatially (the databases are "seamed"). The roads are physically connected, as they are in the real world. The Attributes of the road on one side of the border are available to the road on the other. This connection is necessary for routing.



Joining Partitions: Features and Relationships that Cross Partitions

Features

- All Features on partition borders are delivered in all adjacent partitions with their complete Attribute set.
- A Feature that crosses a partition is split on the border. The Feature contains its complete Attribute set in all partitions.
- When joining adjacent partitions, a geometrical join of the Features with the same Feature ID and Feature Type code results in the complete Feature containing all its Attributes.

Relationships

- A Relationship that crosses a partition contains all Features, with their complete Attribute set, within the Relationship as if all Features that are referenced by the Relationship were present in that partition.

  EXAMPLE: A Parking Facility that belongs to a Shopping Center in another partition will result in a complete functional Relationship record in the Parking Facility's partition, even though the Shopping Center is not physically present in the Parking Facility's partition.
- A Relationship that is built of multiple referencing records contains only the records that have at least one of the references present in the partition.
- When joining neighboring partitions, the records of the Relationship have to be added in the same Feature Relationship. All double references have to be removed afterwards. There is no need to update fields in one of the Relationship records.

Summary and Dissolve

Summary and dissolve operations are manipulations that can affect your data more permanently than using the join operations.

A summary of data (also known as an "aggregation") can be both tabular and geographic.

A dissolve selects one or more areas, then dissolves the boundaries between them to make a larger area that includes the total information of all the areas. For non-adjacent areas like exclaves, just the Attribute information is appended.

The above definitions roughly depict the scope of the basic operations involved in any GIS project. However, the approach and algorithms behind these operations vary over the wide range of available GIS packages. For more information on the details of these basic operations, please see the manuals and user guides for your specific GIS package.

Working with Junctions on Dataset Boundaries in Shapefile

IDs of Junctions that appear on dataset boundaries have a "10000" prefix in their ID.

Example of a Junction (JC) Shapefile ID:

108400510297093

Example of a Junction (JC) Shapefile ID that appears in the same dataset as above but on a dataset boundary:

100000500141131

In order to find which other dataset(s) the above junction appears in, query the junction (JC) layers for all junctions with an ID prefix of "10000" and dump that ID out along with the alpha country and dataset/tile codes (<ctry><tile>_____jc.dbf) from the *jc.dbf files for all tiles. Matching IDs can then be identified for boundary datasets.

How to Use Intersections

An Intersection is composed of one or more point locations or a combination of one or more line and point locations. The basic table that describes an Intersection by its Junction(s) (points) and/or Transportation Element(s) (lines) is the Intersection Index table (IG). This table builds an Intersection Geometry Index (IS), giving a sequence number to all the Elements within the Intersection and defining the Feature Type of these Elements, whether Junctions, Road Elements, Ferry Elements or Address Area Boundary Elements.

A Relation can be made between the Index table (IG) and the Intersection table (IS) via the Intersection ID field. The IS table contains extra Attributes, Intersection Type and Freeway Intersection Type, for an Intersection. The table also contains the Official Name and Number of the Intersection so that the name of the Intersection can be retrieved for every Element of the Intersection.

The ELEMID field in the IG table is provided to retrieve information about the Transportation Elements in the Network layer (NW) ID field.

Finally, a Center Point represents the central position of a Freeway Intersection by a Point Feature in a separate Center Point of Freeway layer (CF). The Center Point of Freeway is always located on top of one of the Road Elements forming part of the Intersection. This Point Feature gets the same Intersection ID as the Intersection it represents. It is stored in the CF table.

How to Use Level 2 Roads

All the Transportation Elements forming one functional unit between two Intersections are described in the Level 2 Roads table (2R.dbf). Every Element within a Level 2 Road gets a sequential number and a Feature Type or Intersection. The first and last Elements of a Level 2 Road are always Intersection Features.

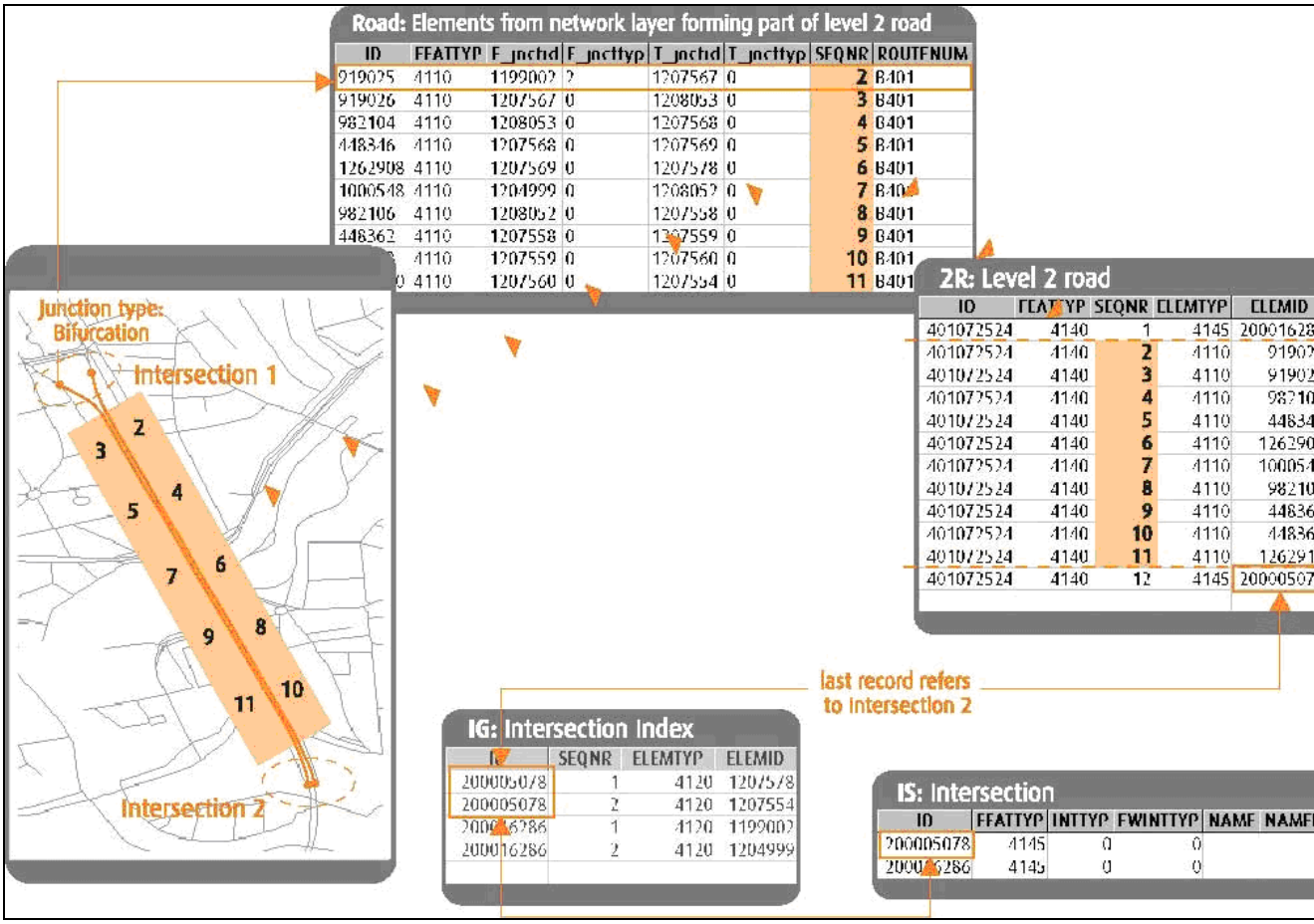
The ELEMID field can relate to the NW table if the Element is a Transportation Element, or to the IG table if the Feature Type refers to an Intersection.

The advantage of Level 2 Roads is that they form an even more generalized representation of the Road Network, treating the carriageways of the same Double Carriageway as one functional unit and taking Transportation Elements up to the level where routing decisions/instructions have to be generated.

NOTE:
The generalization referred to in this context is only a logical generalization and not a geometrical generalization (i.e., a reduction of the number of shape points).

Example of a Level 2 Road

The following drawing shows an example of a Level 2 Road Feature in MultiNet® Shapefile. It shows its comprising elements as a theme (geometrically) and in a tabular structure (relationally).



The orange bar indicates all the Road Element parts of a Level 2 Road (five per carriageway). The Level 2 Road shown is a highway segment giving access to a city center and overpassing all crossing Road Elements. It is split up in Road Elements at Level 1 because of crossings with Administrative boundaries, Built-up Area boundaries or other features (not shown on the map theme).

The first Junction of the first Road Element has Junction Type "Bifurcation," which is visible on the map theme. Linking the Element ID to the Level 2 Road ID, the complete Level 2 Road structure is retrieved, with the Intersections at the outer ends of the Level 2 Road. More information about the other Elements that are part of these Intersections is found in the IG table. The Type and Name of the Intersection is found in the IS table.

Level Differences and Structures

Levels

Not all Transportation Elements are on the same level. Therefore, a Road Element should not be connected to its intersecting Road Elements if it overpasses them.

If intersecting Transportation Elements are at the same level, they are connected in the Network by a "Crossing at Grade." A Turn routing advisory may be generated at this Junction if no maneuver restrictions or traffic flow directions apply that could prevent the turn.

If intersecting Transportation Elements are not at the same level, they are at a "Grade Separated Crossing."

Crossing at Grade

Transportation Elements are bounded by Junctions. Level differences can be checked by comparing the "From" and "To" Junction Elevation for two adjoining Transportation Elements (ELEV field in the JC layer). The value is 0 if all the Transportation Elements bounding the same Junction are at the same level and are therefore "crossing at grade."

Grade Separated Crossing (GSC)

- The position where GSC elements cross must be represented by a Point Brunnel.
- A GSC is a relationship and must contain at least two elements next to the Point Brunnel.
- In Shapefile format, see examples below for layers and fields involved in identifying a grade separated crossing.

TABLE OR LAYER	FIELD	GDF ATTRIBUTE	ATTRIBUTE VALUES	ATTRIBUTE DESCRIPTION
PS (Point Structure)	STRUCTTYP	BT	0, 1, 3, 4	**Brunnel Type** – 0 = Not applicable; 1 = Bridge; 3 = Aqueduct; 4 = Tunnel.
NW (Network)	PARTSTRUC	7X	0, 1, 2	**Part of a Structure** – 0 = Not applicable; 1 = Part of a tunnel; 2 = Part of a bridge.
SE (Structure Transportation Elements Relation)	ELEV	5U	-9 to 9	**Transportation Element Level in Grade Separated Crossing –** Negative numbers indicate element is below another element in the relationship; Positive numbers indicate

				element is above another element in the relationship. Elements are identified by their IDs in this table.

Other Indicators for Different Levels

Besides the layers and fields indicated in the example above, there are other indicators in MultiNet data that represent elements at different levels:

TABLE OR LAYER	FIELD	GDF ATTRIBUTE	ATTRIBUTE VALUES	ATTRIBUTE DESCRIPTION
JC (Junction)	ELEV	8Z	-9 to 9	**Z-Level Information**** – Negative numbers indicate junction is below ground level; Positive numbers indicate junction is above ground level. Default is "0" (Ground level)
NW (Network)	F_ELEV, T_ELEV	8Z	-9 to 9	**Z-Level Information*** – Negative numbers indicate road element is below ground level; Positive numbers indicate road element is above ground level. Default is "0" (Ground level)
LS (Line Structures)	STRUCTTYP	BT	1, 3, 4	**Brunnel Type** – 1 = Bridge; 3 = Aqueduct; 4 = Tunnel.

Notes:

* Indications of a bridge or tunnel are set only where two line features cross. It is possible that a road element segment that is in reality a brunnel, will show a value of "0" for F_ELEV and T_ELEV.

** In U.S. data, the ELEV values in the JC table are not valid. See below.

Grade Separated Crossing - U.S.

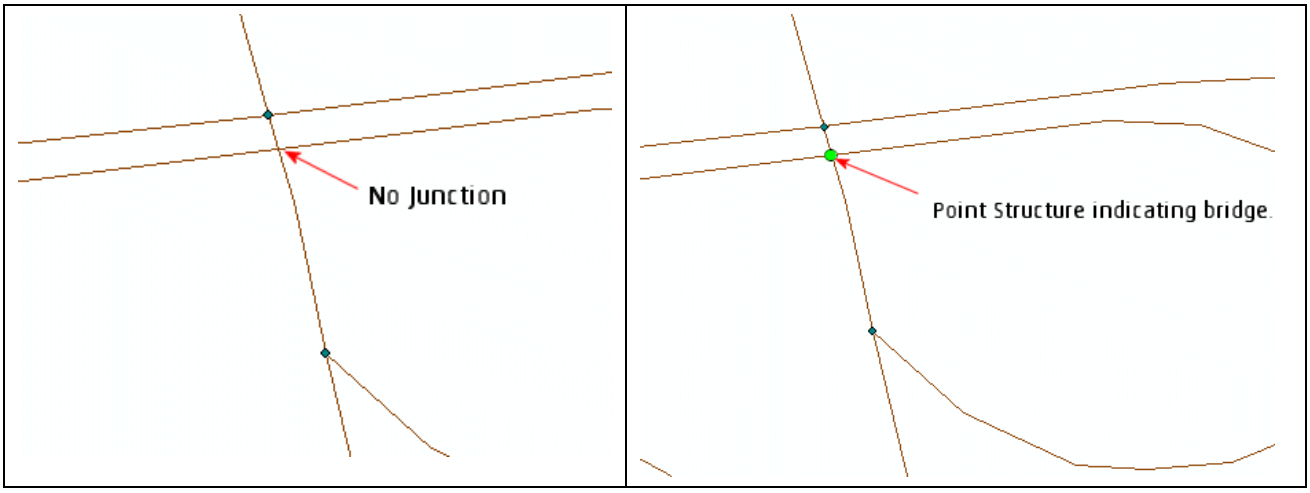
Note:

When two Transportation Elements cross, a Junction is always created that is independent of the relative level difference (at grade or separate grade). The connectivity between the Elements can be checked by their "From" and "To" Junction Elevation (F_LEV and T_LEV fields in the NW layer), with a possible range from –9 to +9.

A Grade Separate Crossing is not available as an explicit Relationship in the North American data.

Structure at Grade Separate Crossing Without a Junction: Relationships

If the crossing is at different levels and there is no reason for a Junction at the crossing, the Grade Separate Crossing Relationship is defined by the Structure situated on the Crossing and the two Transportation Elements.



Structures

At the location of a grade separate crossing, a Structure is present to model the height difference between the different Elements crossing each other. A Structure is defined by two elements: a Bridge, Tunnel or Aqueduct, and another Element that is an overpass or underpass. A Structure is modeled in the database by a point, a line or an area. See **Structures (Brunnels)** earlier in this user guide for Shapefile layer identification for each structure type. The Elements that form part of a Structure can be:

- Road Element;
- Ferry Elements;
- Rail Elements;
- Waterways;
- Junctions; and
- Address Area Boundary Elements.

A Relationship between every Element forming part of the Structure is established to show the relative level that each Element has, above or below. These Relationships are included in the SE Structure Index table. Every Element is linked via an ID to its geometrical Structure in the PS or LS layer. Every Element has an internal sequential number within the Structure. Every Relation between two Elements also has a number that occurs twice logically, once for every Element record.

NOTE:
No Grade Separate Crossing level differences are defined for Area Structures (AS). The level differences are related to the Line Structures.

The Feature Element Type defines which kinds of Elements are involved in a Structure: Transportation Element (Road Element, Ferry Element, Address Area Boundary Element); a Railway Element; or a Water Area/Center Line. In some cases, (for example, a Railway Crossing), a Junction takes part in the Relations defined within the Structure.

Routing with MultiNet® Shapefile

Routing finds the best path (e.g., shortest, lowest cost) from one Junction in the Transportation Network to another Junction.

Grade Separated Crossings are handled differently in the European and North American databases. In North America, Grade Separated Crossings are always represented by a Level 1 Junction. This is not always the case in the European Database because Road Elements may cross each other at different levels without needing to have a Junction at that location (see **Grade Separate Crossing - U.S**. earlier in this user guide). Therefore, routing algorithms using North American MultiNet® data have to take the relative elevation into account in order to know which Transportation Elements are connected and which Transportation Elements overpass other Transportation Elements. In Europe, the level information of the Structure Transportation Elements is available in the NW table (F_ELEV, T_ELEV) in case there is a Junction on a Grade Separate Crossing.

Several Transportation Element Attributes are useful for assigning weight in routing calculations, depending on what kind of routing options are important.

ROUTING OPTION	RELEVANT ATTRIBUTES	FILE IDENTIFIER	DESCRIPTION OF ROUTING OPTION
Shortest Route	Feature Length (METERS)	NW	Shortest routes are based on distance only.
Fastest Route	Average Speed Limit (KPH) See **Average Speeds and Speed Restrictions** below	NW	Fastest Route calculations are adjusted for optimal routing, realistic travel times and guidance toward a higher Transportation Network level without discarding Elements with a high connectivity function (having a high Functional Road Class).
	Travel Time (MINUTES)	NW	
	Network Class (NETCLASS); (NETBCLASS); (NET2CLASS)	NW	
	Speed Restriction Type (SPEEDTYP) See **Average Speeds and Speed Restrictions** below	SR	Speed Restrictions can be the maximum speed, recommended speed or lane dependent.
Conditional Route	Form of Way (FOW)	NW	Conditional routes are created to avoid unwanted situations and conditions while travelling, including: • Road types (FOW1, Motorway
	Freeway (FREEWAY)	NW	
	Road Condition (RDCOND)	NW	
	Toll Road (TOLLRD)	NW	
	Back Road (BACKRD)	NW	
	Stubble (STUBBLE)	NW	

	Charge to be paid (CHARGE)	NW	FOW14, Pedestrian Zone); • Bad roads (RDCOND); • Expensive roads (TOLLRD); • Roads not totally captured and not conforming to TomTom® specifications, or roads not suited for motorized traffic (BACKRD), (STUBBLE). **NOTE:** A Back Road is a rural road not optimal for travel. • A road charge needs to be paid in order to use the roads (CHARGE). This differs from a toll as it is a one-time payment during a specified time span.

Average Speeds and Speed Restrictions

The KPH field in the Shapefile Network file (NW) represents the average speed over the entire distance of a road. This calculation is based on the Functional Road Class (FRC), Form of Way (FOW) and whether the Road Elements travel through Built Up Areas (BUAs).

The SPEED field in the Shapefile Speed Restriction file (SR) represents either the maximum, recommended or lane-dependent speed for a single Road Element. The speed type is identified in the SPEEDTYP field.

Note that a particular Road Element can be flagged in the NW file with an average speed that may be higher than the SR maximum speed value.

The VERIFIED field in the Shapefile Speed Restriction file (SR) indicates whether the speed values were verified by reliable sources or were calculated (Not Verified).

Restrictions and Maneuvers

Restrictions and Maneuvers are limitations to take into consideration when calculating a route.

See the Maneuvers and Restrictions section of the **Shapefile & Oslfile Data Model** in the Appendix section.

Restrictions

A Restriction limits access to part or all of a Transportation Element.

RESTRICTION TYPE	TABLE	ATTRIBUTE	COMMENTS
Digital direction of a Transportation Element	NW/RS	Direction of traffic flow (ONEWAY)/(RESTRTYP = DF)	Direction depends on the relative positions of the F_JNCTID and T_JNCTID of an Element.
Access to the F_JNCTID and T_JNCTID	NW/RS	Blocked passage at start or end of junction (F_BP; T_BP)/(RESTRTYP = BP)	A physical obstruction to prevent vehicle access (e.g., to a Campground, School).
		Private Road (PRIVATERD)	Road not open to public motorized vehicles.
		Construction Status (CONSTATUS)/(RESTRTYP = 6Z)	Road closed for construction/maintenance .
Time restriction	TD	Time Domain (TIMEDOM)	Closed for a measurable amount of time.
Vehicle type	RS	Vehicle type restriction (VT)	The type of vehicle restricted.
Special Restrictions	RS	RESTRTYP = SR	Special restrictions include roads accessible by employees only, residents only, authorized personnel only, etc.

Maneuvers and Routing

A Maneuver represents a mandatory, preferred or prohibited access of a Transportation Element, in relation to another Transportation Element.

See **Maneuvers (MN)** earlier in this user guide for descriptions.

The Elements that comprise a Maneuver Relationship are listed in the **Maneuver Path Index table (MP)**. Each Element has a Sequential Number (SEQNR) as listed in the following table:

SEQNR	FEATURE	FUNCTION	RELATES TO
1	Transportation Element (Road or Ferry Element)	Element travelled on before arriving at a traffic sign indicating a maneuver.	ID in the NW table
2	Junction	Location of a traffic sign, where the maneuver actually begins. This is also the central reference point or anchor point to build a Maneuver Path (identified by its own ID).	JNCTID in the MN table; F_JNCT / T_JNCT in the NW table
3	Transportation Element	Element that is routed to, and for which the maneuver is valid coming from the first Element.	ID in the NW table
4	Transportation Element	Element for which the maneuver is valid, coming from the preceding Element (e.g., 3).	ID in the NW table

Partition-Crossing Maneuvers

Partition-crossing Maneuvers are Maneuvers where the Junctions are lying on a partition border. The Elements that are present within a partition are included in a Maneuver Relationship. The Sequential Number (SEQNR) Attribute contains the exact position that an Element occupies in a Maneuver Relationship chain. The Elements of the Maneuver located in the adjacent partition are represented by a Dummy Feature (and as such a Dummy ID: the neighboring feature's ID).

NOTE: All Maneuver parts lying on a partition border and all Maneuver Dummy Features are listed in the Conversion Records stored in the CN table.

Signage Information

Signpost information is useful for directional and destination information. Transportation Elements that lead to a destination indicated by a signpost can be linked.

Route Numbers also play an important role in routing.

Traffic Signs allow for messages such as lane-dependent speed restrictions, or warnings for traffic jams.

Signposts

Signpost information, near a road, contains a directional component and a destination component.

- Directional information includes the Relationship between the Road Element ("from where") that leads to the intersection the signpost refers to, and the first Road Element ("to where") leading from the intersection to the destination. A signpost can indicate a direction by a pointing shape of the signpost or by arrows.
- Destination information can include text, route number, exit number and a pictogram.

Direction and destination information are present in MultiNet® Shapefile in different tables. The different signpost-related tables are linked by means of a Signpost ID. See also the Signpost Information section of the **Shapefile and Oslfile Data Model** at the end of this user guide.

SP (Signpost Path Index) Table

The SP table describes the path of a Signpost. The first Transportation Element is the start of the path; the second Element is the Junction of the Traffic Sign location; and the last Element is the end of the path.

SG (Signpost) Table

The SG table includes the Junction Attribute.

SI (Signpost Information) Table

The SI table includes the text and pictogram descriptions. If a signpost has multiple textual descriptions (for example, when the same destination is described in two languages), or multiple pictograms (for example, Railway Station with Parking Facility on the same signpost), then the records are repeated in the SI table for each textual description or pictogram, and ordered by a Textual Context Sequential Number (SEQNR).

When a textual description has more than one pictogram or destination, the pictograms or destinations are listed as they occur on the signpost with respect to the text: the signpost is treated as an information matrix. The SI table includes the DESTSEQ (Sequence in the Destination Set) field to determine the line in this matrix. If Route Numbers are listed on the signpost in one line, the sequence within the line is determined in the RNPART field (Route Number Part).

Both text and pictograms are stored in the TXTCONT field of the SI table.

EXAMPLE: "Waterloo Station // 13 // 11" indicates that a sign has, reading left to right, the name of the station, then a Railway Station pictogram, then a Parking Facility pictogram. "13 // Waterloo Station // 11" indicates that the Railway Station pictogram is to the left of the station name on the signpost.

The SI table also indicates the Type of connection information that the signpost represents (CONTYP field).

The AMBIG field indicates whether the destination information is ambiguous or clear.

Route Numbers

Route numbers are defined according to national or international standards that vary from country to country. A Transportation Element can belong to more than one system, and thus have more than one route number.

Route Numbers that appear on route shields are stored in the RN table's SHIELDNUM field. The route type is stored in the RTETYP field of the RN table. See **Route Number Types** earlier in this user guide.

Some route numbers indicate which direction they lead to. This is stored in the Route Directional field (RTEDIR). Together with this directional, the Directional Validity Direction (relative to the digitizing direction) is stored in the RTEDIRVD field.

The hierarchy of the route numbers for a particular country is stored in the PRIORITY field.

NOTE:
The NW table also has a ROUTENUM field: this stores only the primary route numbers, i.e., the Route Numbers with the highest priority (according to the standards of a particular country).

NOTE:
Certain route numbers indicate that a road is part of a tourist route. Road Elements that are part of such a route have an entry in the TO (Tourist Roads) table.

Traffic Signs

Traffic Signs are a type of signpost that can hold different types of information. This can range from lane-dependent speed restrictions at certain periods (e.g., during rush hour, construction work) to warnings such as "Tunnel/Mountain Pass Closed" or "Traffic information on FM107.6."

In MultiNet® Shapefile format, traffic sign information is stored in two tables: TS and TT:

- Traffic sign features are stored with their own geometry in the TS table.
- The relation with the Transportation Element it belongs to, the direction in which it is valid and the location on that Transportation Element are stored in the TT Table.

See also the Traffic Sign section of the **Shapefile and Oslfile Data Model** at the end of this user guide.

TMCs

The Traffic Message Channel (TMC) is a system of collecting, coding and broadcasting traffic-related information. Traffic announcements are transmitted as a coded message by a Radio Data System (RDS). The coding of the information is assembled according to a uniform global standard and is independent of language. The message is always in the same format:

- there is an incident caused by something;
- on a specific road;
- in a specific direction;
- and between two locations.

The TMC system process generally follows these steps:

- The traffic information is collected by the Traffic Information Center (TIC) and sent to the Data Service Provider.
- The Data Service Provider checks the quality of the information and generates the coded messages. The coding of the information is done according to a uniform global standard. These messages are language independent.
- The Data Service Provider sends the coded messages to the Broadcaster for transmission to the receiver as an RDS signal.

TMC Location Database

The TMC Location Database is the basic source for coding where a traffic event is located. This database contains an official list of point, line and area TMC locations. A Point Location (event) is connected by means of Line Locations (roads connected as paths) within an Area Location. These Databases are subject to regular changes; therefore, MultiNet® Shapefile stores a reference to the TMC source table and the TMC table's version in the attributes TMCTAB and TMCLSTVER in the TP table (TMC Path).

Although TMC Location Databases list Point locations, Line locations and Area locations, TomTom® only captures Point Locations.

TMC Locations in MultiNet® Data

A TMC Point Location is linked logically to a Junction, an Intermediate Point or another Landmark Point (e.g., Freeway Intersection). Therefore, TMC Point Locations are not always Level 1 point features.

To link a Point Location with its database representation, TomTom introduced the TMC Locations.

A TMC Location is related to one Point Location in the TMC location database and refers to objects along or at the Road Network.

TMC Location Structure

Each TMC Location has a TMC Location Reference Code (according to the ALERT C protocol). This code is composed as follows (ABBCCCCC):

- A = EBU (European Broadcasting Union) Country Code (hexadecimal);
- BB = the number of the Location Database that is used;
- CCCCC = Location Code (0-filled if fewer than five digits) in the Location Database.

TMC Location Structure in MultiNet® Shapefile Data

TMC Location References in the TomTom® MultiNet® database are stored in two different ways:

- As a Complex Feature (Feature Code 9020). These are stored in the TL table's TMCLOCREF field, which stores the TMC Location Reference Code (ABBCCCCC) as defined above. The Transportation Elements and Junctions composing this Complex Feature are indexed in the TC table.
- As a Level 1 "RD" attribute of a Road or Ferry Element. This attribute can be retrieved from the **RD** table's **RDSTMC** field. This field stores the TMC Location Reference Code as "ABCCDEEEEE."
- Where:
  - A = Direction of Road Element (from start Junction to end Junction) compared with the TMC chain direction:
    - **+** = in positive direction and external to the TMC point location;
    - - = in negative direction and external to the TMC point location;
  - B = EBU (European Broadcasting Union) Country Code;
  - CC = TMC Location Code;
  - D = TMC Direction of the Chain;
    - **+** = in positive direction and external to the TMC point location;
    - **-** = in negative direction and external to the TMC point location;
    - **P** = in positive direction and internal to the TMC point location;
    - **N** = in negative direction and internal to the TMC point location.
  - EEEEE = TMC Point Location Code (found in the official TMC location Databases).

Example code **TMC Location Reference Code** in the Shapefile RD table:

ID	RDSTMC	TMCPATHID
15280000693470	**+817-45896**	**15280801601246**

TMC Paths

A TMC Path is defined by the chain of TMC Locations using the positive or negative offset in one direction of the traffic flow. A TMC Path:

- starts where a TMC Location does not refer to a previous TMC Location (no negative offset in the Location table);
- ends where a TMC Location does not refer to a next TMC Location (no positive offset in the Location table).

TMC Paths in MultiNet® Shapefile Data

TMC Paths are stored in the Shapefile TP table.

Example of the TMC Path data in the TP table:

ID	FEATTYP	TMCINFO	TMCTAB	TMCLSTVER
15280801601246	9021	45880/45904/-	**817**	**9.1**

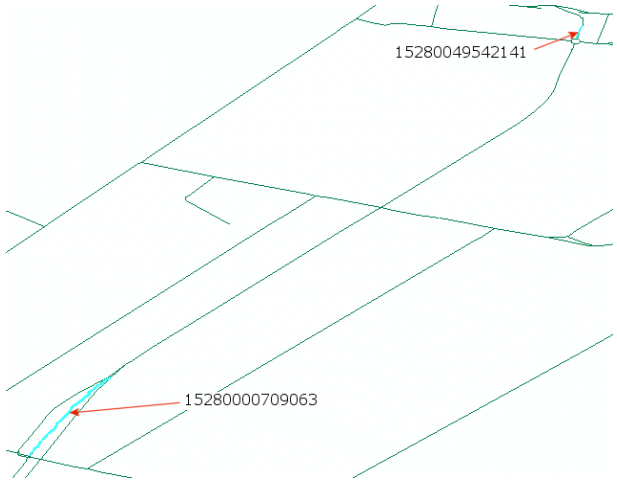
- Note that the ID in this table represents the referenced TMC Path ID in the above example.
- TMCINFO data identifies the start TMC Location code (45880), end TMC Location code (45904), and the path direction (from end to start (-)).
- The TMC location table is **817**; the table version is **9.1**.

Linking the TMC Path to the Network Geometry

The TMC Path Index table (TG) links the TMC path to the transportation element IDs located in the Network (NW) geometry. The transportation element IDs in the TG table are in the TRPELID fields.

Example of the TMC Path Index data in the TG table:

ID	SEQNR	TRPELID	TRPELTYP
15280801601246	1	**15280049542141**	4110
15280801601246	2	15280049542149	4110
15280801601246	3	15280049542148	4110
15280801601246	4	15280049542144	4110
15280801601246	5	15280002596101	4110
15280801601246	6	15280002596133	4110
15280801601246	7	15280002596135	4110
15280801601246	8	15280002796808	4110
15280801601246	9	15280000709077	4110
15280801601246	10	**15280000709063**	4110

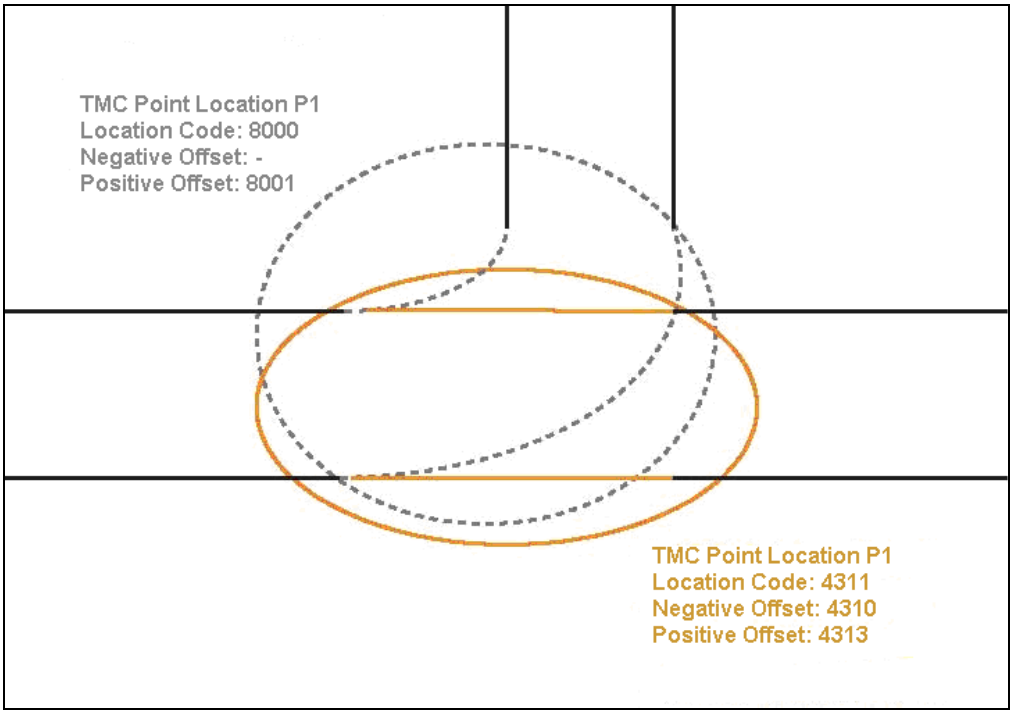


Location of the 1st and 10th Transportation Elements in the 15280801601246 TMC Pat

Two TMC Location Codes in One Area

More than one TMC Location can refer to the same real-world object. In such a case the object is part of different Line Locations.

The following drawing illustrates two TMC location codes located at the same geographical latitude/longitude point. The 8000 Location Code is at the end of a TMC path that began on the vertical roadway. The 4311 Location Code is in a TMC path that runs on the horizontal roadway. The previous Location code in the path is 4310 and the next Location code in the path is 4313.



Note that codes used in the above example are for demonstration purposes only and may not reflect actual codes in your geographic area.

Summary of TMC Location and Path Information in MultiNet® Shapefile Data

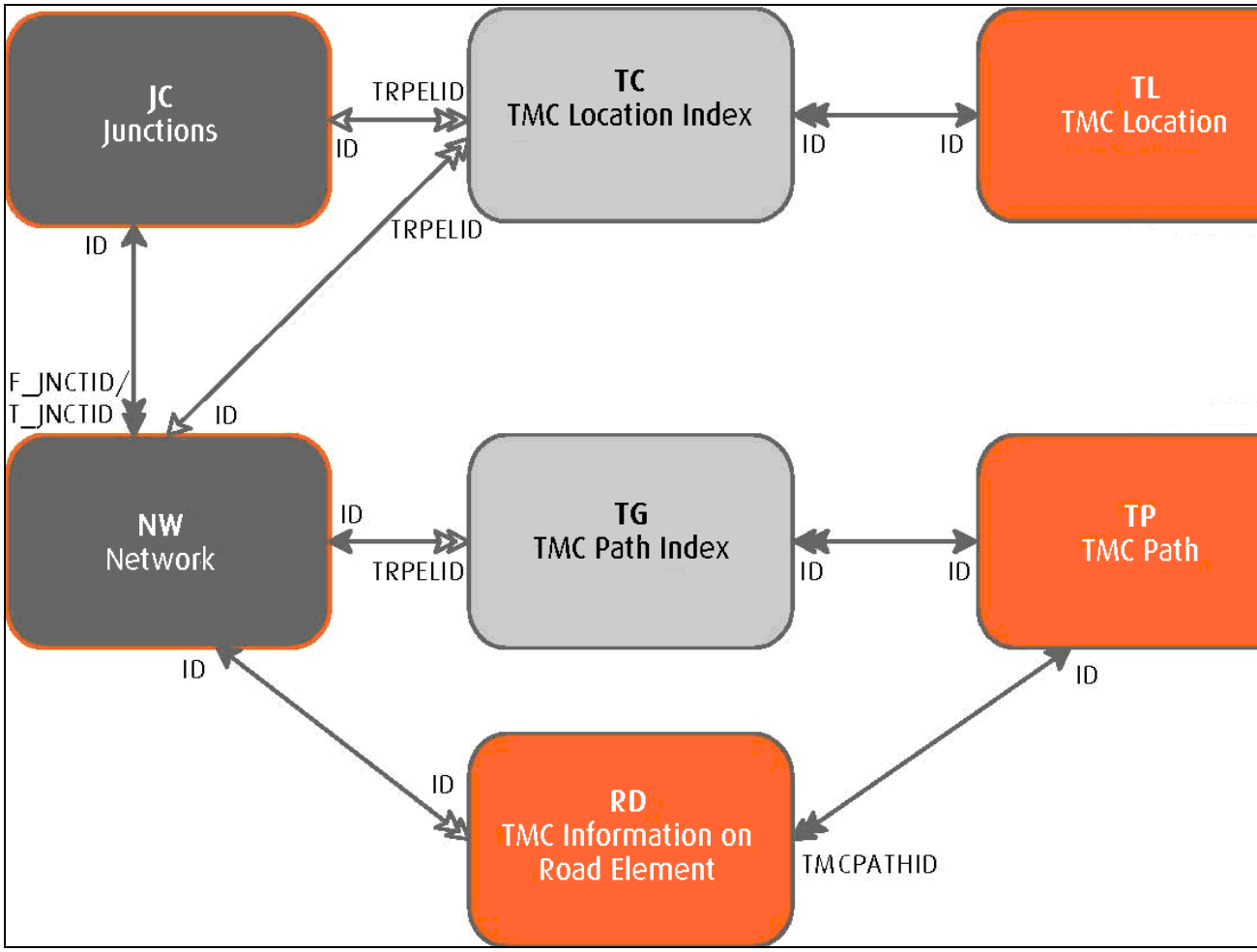
TMC Location information and TMC Path information are present in different tables in MultiNet® Shapefile.

TC (TMC Location Index) and TG (TMC Path Index) Tables

The Index tables include a list of all Transportation Elements belonging to the same TMC Location or Path. A TMC Location also can include Junctions.

TL (TMC Location) and TP (TMC Path) Tables

The TL and TP Tables contain a link to the actual location references in the specific TMC database of some country. The bounding TMC Location References of a Path, in the TP Table, are in the TL Table.



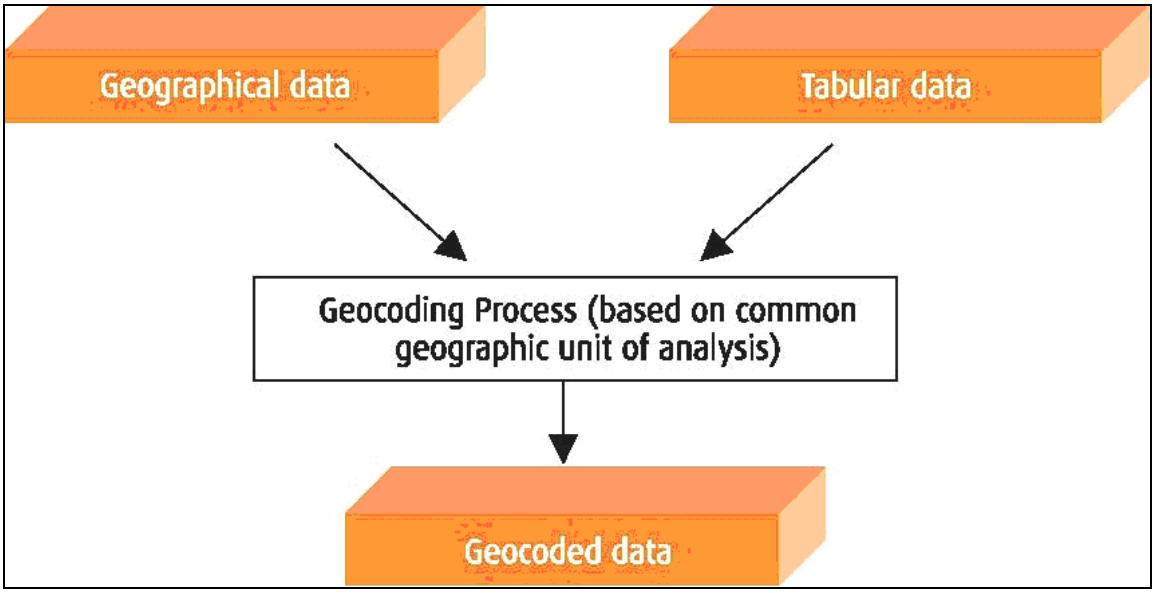
See additional descriptions of all TMC files beginning with **TMC Information Along Road Elements (RD)** in the Shapefile Format section of this user guide.

Geocoding - Overview

Geocoding is the cross-referencing between geographic spatial data (features with coordinates relative to a standard reference system) and non-geographic data (such as addresses and postal codes).

Geocoding brings geographic data and tabular data together based on a common geographic unit of analysis. A geographic unit of analysis refers to the spatial characteristic within the data that is necessary to locate the data on a map. Such units include addresses (street level) and postal codes (postal district level). This spatial characteristic is common to the geographic data and the non-geographic tabular data. The tabular data also can contain extra, non-geographic information: e.g., telephone numbers, fax numbers, e-mail and website information.

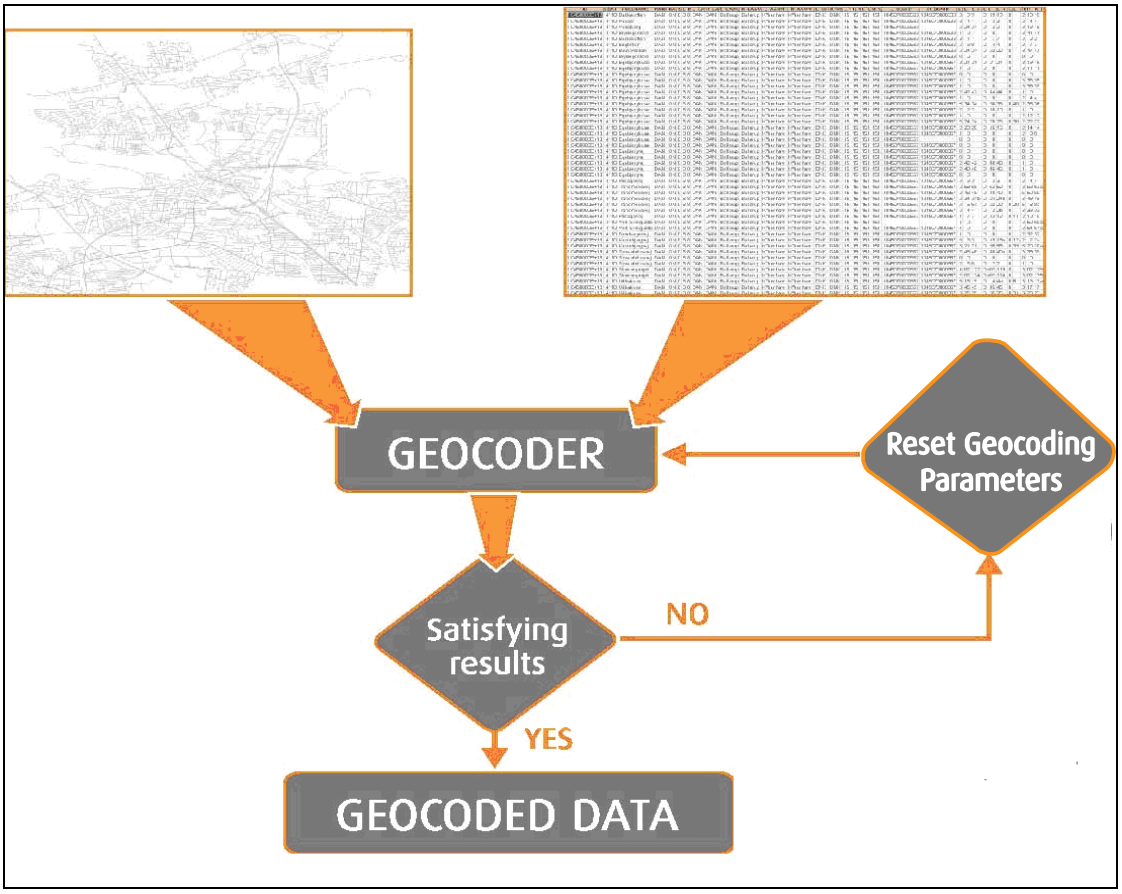
The following diagram shows an overview of the geocoding process.



How to Geocode

There are five basic steps in the geocoding process:

1. Preparing files for geocoding;
2. Standardizing geocoding parameters for the geocoder;
3. Geocoding;
4. Reviewing the results;
5. Resetting geocoding parameter specifications and re-geocoding if results are not satisfactory.



Preparing Files for Geocoding

The first step in the geocoding process involves the sometimes extensive preprocessing of both tabular address data and geographical data in order to maximize the match rates.

The tabular data should be parsed into individual fields that have a clear function in the address data (e.g., postal codes, street names and house numbers). The parsing can include adding abbreviations of address elements to match the reference data.

For the geographical data from the reference database, an address style is defined and the fields are assigned according to that style.

EXAMPLE: If the address style is "U.S. Streets" of the form "house number street name," then assign a column "STREET" from the reference database to the address style component "street name" and a column "HNR" to the component "house number." To speed up the process of finding the address from the tabular data in the reference data, build geocoding indexes.

The key to successful geocoding of the reference data is to include all reference data that is to be assigned to the geocoded addresses. For example, the geocoding tool provided with the ESRI® ArcView® package expects the user to define the address style of the reference data and specify the address field of the tabular data.

Standardizing Geocoding Parameters

The successful matching of the geographic units from each source, reference data and tabular data, can be fine-tuned through the specification of several parameters of both tabular data and reference data. Whether a match is successful depends on the needs of an end user. Accuracy, product costs, maintenance costs, utility and compatibility are some of the factors that determine whether a match is considered successful. Many times, information is geocoded against a street reference layer.

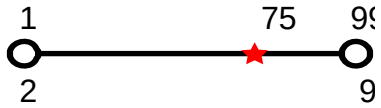
The configuration of the parameters—e.g., address style, offset distance—depends on the GIS or geocoding software. The objective is to obtain the optimal geocode match rate.

Geocoding

The geocoding process, which is performed by GIS or geocoding software, involves the placement of the tabular data in relation to the reference geographic layer. When the reference layer is a Street layer, the geocoded point is "interpolated."

Address interpolation refers to a calculated address value assigned by evenly distributing an address range along a street element. Address values at nodes are thus based on percentage of length along the chain.

Range-based geocoding locates addresses by interpolation within the address ranges.



Address "75" Located Within Address Range by Geocoded Address Interpolation

Reviewing the Results

Most GIS or geocoding software generate a geocoding outcome that indicates the success of the geocoding process. It is now up to the user to interpret these results and to decide whether or not these results are acceptable. Possible geocoding problems generally occur because of missing or incorrect address ranges or missing/incorrect street information in the geodatabase or in the address lists.

Resetting Geocoding Parameters

If the geocoding results are unsatisfactory, then the user may want to try other parameter settings; for example, lowering the spelling sensitivity. With these new settings the geocoding process is repeated.

Geocoding with MultiNet® Shapefile

The MultiNet® Shapefile Geocode Layer (GC table) contains all address information necessary for geocoding on different levels, from house number to country level, by containing Administrative Name Attributes or by referring to a Feature Identifier in another table.

The most extensive address information content is located at the street level. The GC table has its own geometry objects, which are the extracted roads and address areas from the Network layer (NW table).

On higher levels, address information is present as an Attribute and also by referring to themes such as Postal Districts, Other Named Areas, Built-up Areas, Centers of Settlement and Administrative Areas. A direct reference to a Street and a higher-level Administrative Area of any type is thereby made.

NOTE:
All name information needed to geocode to an address is contained as an attribute in the Geocode Layer (GC). See table below.

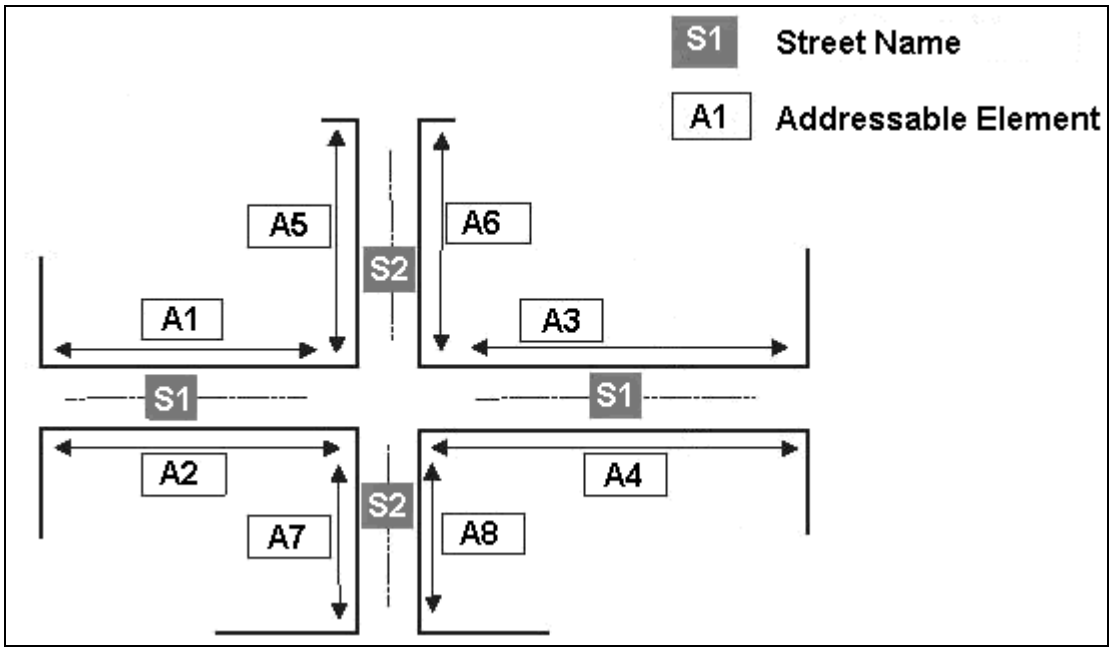
GC ATTRIBUTE	ATTRIBUTE DESCRIPTION
NAMEPREFIX	Prefix portion of the FULLNAME, often the street type (e.g., Carettera, Rue)
NAMESUFFIX	Suffix portion of the FULLNAME, often the street type (e.g., Street, Ave, Blvd)
PREDIR	Prefix Directional field for North(N), South (S), East (E), West (W)
FULLNAME	Full Street Name
NAME	The main body portion of the full street name (e.g., "Sirai" component of "Strada Statale Sirai")
SUFDIR	Suffix Directional field for North(N), South (S), East (E), West (W)
L_APNAME	Administrative Place Name (City) on Left side of Street
R_APNAME	Administrative Place Name (City) on Right side of Street
L_PC	Postal Code Left
R_PC	Postal Code Right
L_AXON	Administrative Area Left
R_AXON	Administrative Area Right
L_F_ADD (Optional)	Left from address number
L_T_ADD (Optional)	Left to address number
R_F_ADD (Optional)	Right from address number
R_T_ADD (Optional)	Right to address number

House Number and Street Level Geocoding

The TomTom® road network is represented by three different network levels: STNW, ICNW and MRNW. See **Road Networks** earlier in this user guide for more details. The MRNW network is not suitable for good geocoding results.

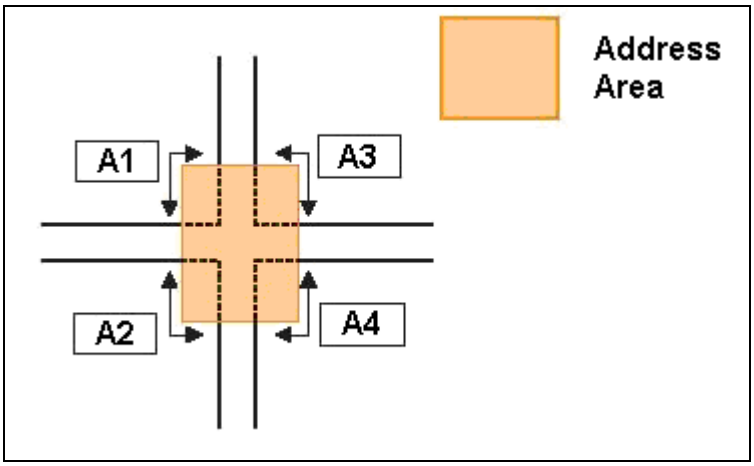
A House Number is attached to an Addressable Element in the following ways:

1. At the side of a Road Element between two intersections that has the same Street Name, Postal Code and Place Name. See figure below.



In the above graphic, A1 is an Addressable Element because it forms a unit that runs from the left-most Intersection to the Intersection of S1 with S2. That Addressable Element unit has street name S1. Street name S2 also applies to A2, A3 and A4: they belong to Street Name S1. Addressable Elements A5, A6, A7 and A8 belong to S2.

2. At the side of the Boundary of an Address Area that is not intersected by other roads and that has the same Street Name, Postal Code and Place Name.



In the above graphic, A1 forms a continuous part of the Address Area, going from the west road to the north road. Here, the House Number Information is stored only at one side (the outside) of the Address Area Boundary Element.

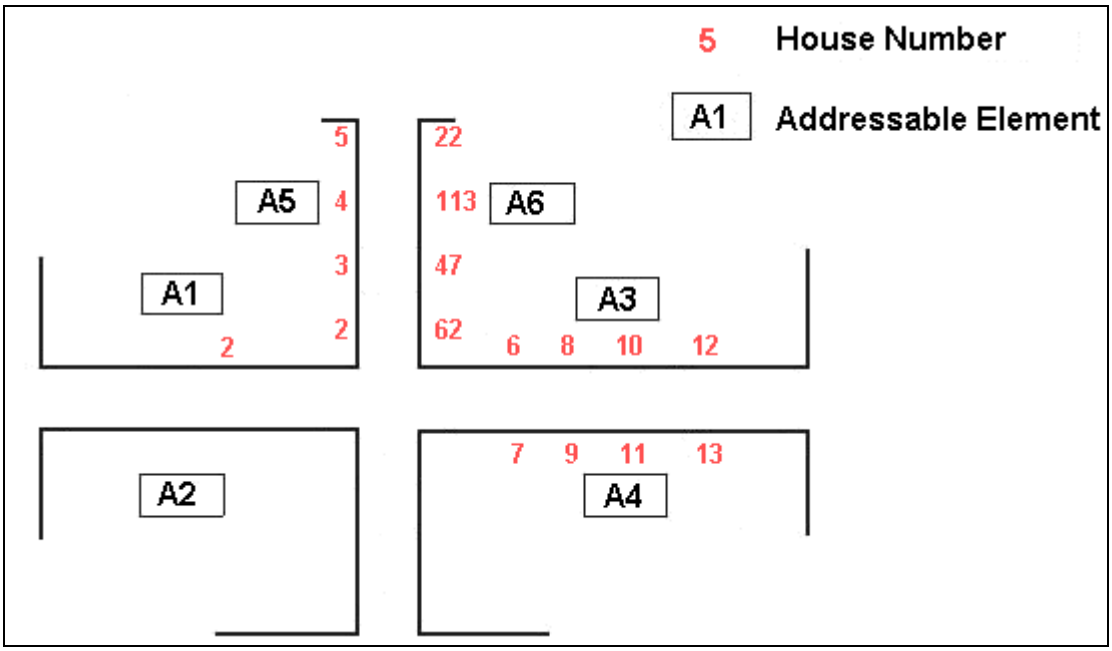
House Number Ranges

House number information in the TomTom® mother database is stored as a range (see graphic of **address range interpolation** above). A House Number Range is a set of house numbers related to each side and the extremities of a particular Addressable Element. Addressable Elements correspond in most cases to Transportation Elements in MultiNet® Shapefile.

In most cases, the representation of the first and last house number, together with the left and right house number structure (L_STRUCT and R_STRUCT in the GC table) associated with the Addressable Element, is sufficient to locate an address.

NOTE:
Because of the non-linearity of some street addressing, the lowest or highest house number of an Addressable Element does not necessarily make it the first or last house number of that Addressable Element. Intermediate house numbers are sometimes needed to clearly assign an address to an Addressable Element. Intermediate numbers are stored in the IH (Intermediate House Numbers) table. In the GC table, those house number ranges having Intermediate House Numbers are flagged in the R_INTM field.

Below are some examples of addressing schemes and how they are handled in MultiNet® Shapefile.

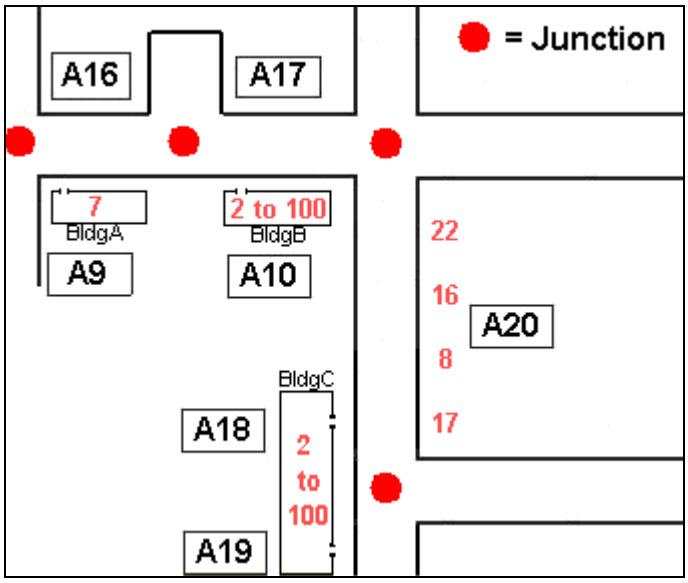


The table below describes the house numbers in the above drawing and how they are represented in the GC table.

ADDRESSABLE ELEMENT	HOUSE NUMBER STRUCTURE	ATTRIBUTE CODE IN GC TABLE R_STRUCT OR L_STRUCT	NOTES
A1	Even	**2**	Only one even house number.
A2	No house number	**1**	A2 Road Element has no house numbers at all.
A3	Even	**2**	Only even house numbers in ascending or descending order.
A4	Odd	**3**	Only odd house numbers in ascending or descending order.
A5	Mixed	**4**	Even and odd house numbers in ascending or descending order.
A6	Irregular	**5**	Even and/or odd house numbers in no particular order.

Address Information: Special Cases

Addresses with Apartment Blocks



- In the figure above, Apartment block BldgA has one entrance and has only one house number assigned. In this case, the house number is assigned to addressable element A9.
- Apartment block BldgB also has only one entrance, but all house numbers residing in this apartment block are even numbers 2 to 100. All of these house numbers are assigned to addressable element A17, since A17 contains even numbers for the street.
- Apartment block BldgC also has only even house numbers. This block, however, has two entrances. The first entrance is located at addressable element A18. In the GC table, this entrance gives access to house numbers 2 to 34. Those numbers are stored in the address Attributes to the right side of the street. This street's left house numbers (assigned to addressable element A20) are irregularly structured.

NOTE:
If an apartment building has house numbers, but the addressable element in the GC layer's R_STRUCT or L_STRUCT value is 0 (no structure), addresses is not assigned to the Road Element.

Streets with Two Street Names

If a street has two street names, but only one official street name and one alternate street name, the full house number range is assigned to both the official street name and alternate street name. The street names are applicable to both sides of the streets.

If a street has two official street names and each of the street names belongs to only one side of the street, and thus to only one Addressable Element, the record for the Transportation Element is repeated, one time for each "Side of Line (SOL)," which for the first record is set "1 (Left)," and for the second "2 (Right)."

Dead-End Streets

On a dead-end street, house numbers may not be well ordered, especially at the end of the street. House numbers are allocated to the most appropriate Addressable Element.

Alpha-Numeric House Numbers

If a house number is alpha-numeric (e.g., 4a) this number appears as "4" in the GC table's left or right first house number attribute field (L_F_ADD or R_F_ADD). This house number is called the "Base House Number." The complete information "4b" is stored in a separate Left (or Right) First Full House Number field (L_F_F_ADD or R_F_F_ADD).

Address IDs and Official Street Codes

The GC table fields L_ADDRID and R_ADDRID store stable, definitive TomTom® IDs that are used for joining information with a Transportation Element or a group of Transportation Elements belonging to the same street (a unit with the same Street Name). When a match is made between an Address ID and a geocoded Feature, the match can be translated into a Relation of the Feature with the Transportation Element or the street it belongs to.

Official Street Codes are used by authorities in some countries for identifying a street. Official Street Codes are stored in the SC (Official Street Codes) table.

Geocoding on Lower Levels of Accuracy

The GC layer also allows for geocoding on lower levels of accuracy.

Note:

The GC layer contains numerous attributes referring to Built-up Areas, Postal Districts and Administrative Area levels. These references are stored in the Transportation Element Belonging to Area (TA) table in the field ARETYP.

NOTE:
It is not necessary to use the GC table for geocoding on other levels. Using the GC table limits the amount of matches to roads that are included in the GC table (Named Roads). Using the NW table enables geocoding on other levels of all roads.

Administrative Area Information

Information on the lowest Administrative Order at both sides of the Road Element appears in the the following fields: L_LAXORD and R_LAXORD (left and right Lowest Administrative Area Order); L_LAXONLC and R_LAXONLC (left and right Lowest Administrative Area Official Name Language Code); L_LAXON and R_LAXON (left and right Lowest Administrative Area Official Name).

The second-lowest Administrative Area information is included in the Attributes L_AXON and R_AXON (left and right second-lowest Area Official Name).

For the European database, the Administrative Area Codes of Administrative Order 0 and 8 levels are present as L_ORDER00, R_ORDER00, L_ORDER08 and R_ORDER08.

Note:

The GC tables in the U.S. MultiNet® Shapefile product store the Administrative Area Codes of Administrative Orders 0 (Country) and 1 (State) in the fields L_ORDER00, R_ORDER00, L_ORDER01 and R_ORDER01.

The relationship for all Road Elements—named and unnamed—and the Administrative Area in which they are located is stored in the Transportation Element Belonging to Area (TA) table.

Built-Up Area Information

The Road Element that a Built-up Area belongs to is represented in the Transportation Element Belonging to Area (TA) table. The ARETYP attribute has the value 3110.

Postal Code Information

Postal Districts are areas that are defined as units for postal services. These areas are defined by national postal organizations. Postal Districts are referred to in the GC table in the Postal Codes L_PC and R_PC (left and right Postal Code) fields.

Postal Codes apply to a certain area. In the U.S., for example, this area is a block. For the U.S., the ZIP+4 Code is an extension to the Postal Code ZIP Code and provides additional street-level postal information. It is captured in the Attributes L_PCEXT and R_PCEXT (left and right Postal Code [ZIP+4]) fields.

Administrative Places Information

An Administrative Place corresponds to a non-hierarchical Administrative unit. These units cannot be categorized in the Administrative Order levels (0-9). They are referred to in the Transportation Element Belonging to Area (TA) table by the ARETYP codes 1165 to 1199. For Road Elements on the Administrative Place boundary, the Side of Line is stored in the attribute SOL.

Geocoding on Other Levels

Other Named Areas (for example, Census Districts or Index Areas) are not categorized as Administrative Areas or Administrative Places. Still, it is possible to perform a geocoding operation on these areas, which are captured in the Other Named Areas (OA) layers. The link to the Street Network can be established through the Transportation Element Belonging to Area (TA) table.

Note:

The last field in the GC table, RECTYP, indicates the source of any additional Features specific for the U.S. Besides the TomTom® MultiNet® (U.S.) database geometry, various levels of ZIP Codes are part of the Geocoding Layer. The RECTYP value indicates the varying degree of detail of the Features that influence the geocoding scores.

Geocoding is attempted for every range in the USPS ZIP+4 files. An address range that exists in USPS records but for which the geocoding fails is called an "unmapped range." An unmapped range generally occurs in these cases:

- The street is listed in USPS ZIP+4 records but not in other sources.
- The street name is inconsistent among sources.
- The street address range has changed.
- The street address range starts with a non-numeric character.

For each unmapped address range, a line segment is constructed at the center of the ZIP+4 area and the center of the ZIP Code vicinity for ZIP+2 and above. Then a value (see table below) is assigned in the RECTYP field to represent the level of successful match, from a 9-digit to a 3-digit ZIP Code.

VALUE	DESCRIPTION
A	ZIP+4 (9-digit)
B	ZIP+2 (7-digit)
C	ZIP Code (5-digit)
D	SCF (3-digit ZIP Code prefix)
G	TomTom®-defined

Index Areas in MultiNet® Shapefile / Oslfile

See **Index Areas** earlier in this user guide for a general description of Index Areas.

An Index Area is stored as a simple area feature in the product. The capturing on the database level is composed either out of an Index Area Component (Simple Area Feature) or by 1 or more other area features (Complex Area Feature).

In the case of a complex feature, the components can be any of the following area types:

- Administrative Area;
- Administrative Place;
- Built-Up Area;
- Postal District; or
- Census District.

Index Areas are stored as polygons in the **OA6** table (Other Named Areas - Index Areas). All Index Orders are stored in one table. The OA6 table has the Official Name, Alternative Name and Index Order as attributes.

EXAMPLE: A partial listing of the fields in the OA6 table:

ID	FEATTYP	NAME	INDORDER
22826160054351	9200	Central Park	9
22826160165082	9200	Chadderton	8
22826160054365	9200	Chaigley	9

In MultiNet® Shapefile and Oslfile formats, the following Relationships are used to build and associate indexes:

RELATIONSHIP	SHAPEFILE TABLE
Place Within Place	**PP**
Administrative Area Replaced by Index Area	**AI**
Road Element in Named Area	**TA**
Ferry Connection in Named Area	**TA**
Address Area Boundary Element	**TA**
Address Area Boundary Element in Named Area	**TA**
Service in Named Area	**SA**
Built-Up Area in Named Area	**BA**
Center Point of Feature Belonging to Feature	**SA**

Place Within Place Relationship for Index Areas in Shapefile

In Shapefile, the Place Within Place Relationship is present between Administrative Places and Administrative Areas, and between Index Areas of different hierarchy levels.

EXAMPLE: All fields in the PP table:

ID	FEATTYP	PLTYP	PLID	BELPLTYP	BELPLID
10560100002001	2400	9200	10561600000036	9200	1056160000003
10560100002002	2400	9200	10561600000040	9200	1056160000003
10560100002003	2400	9200	10561600000042	9200	1056160000003
10560100002004	2400	9200	10561600000037	9200	1056160000003

In the above example, the place type Index Area (PLTYP=9200) with its identifier PLID belongs to another Index Area (BELTYP=9200) with its identifier BELPLID. The Place within Place Class is 3 = "address significant."

Administrative Area Replaced by Index Area in Shapefile

The Shapefile AI table stores all Area identifiers of a certain Area feature type that can be replaced by an Area of a different Area feature type. This can be Administrative Area replaced by Index Area or Index Area replaced by Index Area.

For the "Area replaced by Index Area" Relationship where it concerns an Administrative Area in the AREID field, the INAREID and ARETYP are not filled in. Also, if an Order 8 Administrative Area has multiple Index Areas that cover its surface, there is no possibility to choose one of those Index Areas as the second part of the "Area Replaced by Index Area" Relationship. The relationship only indicates that the Order 8 Administrative Area can be left out of the Index.

EXAMPLE: All fields in the AI table:

AREID	FEATTYP	INAREID	ARETYP
25826165004563	1120		
258261630006667	1118		
258261630087456	1119		

How to Use Index Areas for Index Building - examples

The examples below show how TomTom applies Index Areas to use for index building in certain geographic areas. The examples are meant to show how some of the same procedures and principals may be applied to other geographic areas depending on a country's Administrative structure.

Example: Scheveningen in the Netherlands

"Den Haag" is an Order 8 Administrative Area. It contains an area called "Scheveningen" that is known by the public, but has no Administrative reference.

The Area of Scheveningen is captured by TomTom as an Order 9 Index Area. This results in additional "Order 9" information that can be added to other Administrative Order 9 Areas.

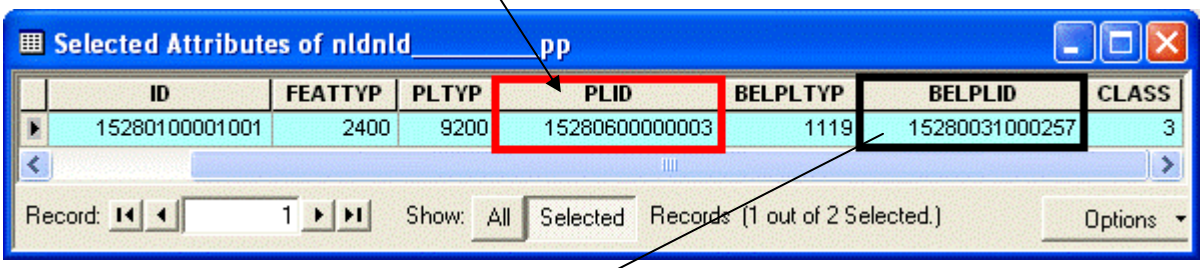
There is no "Area replaced by Index Area" Relationship, but there is a "Place within Place" Relationships that can be used.

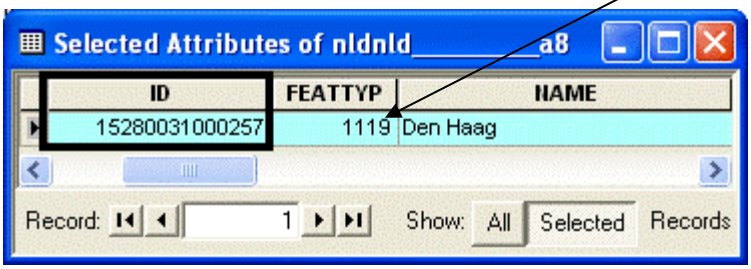
Scheveningen Located in Den Haag

Index Building for the Netherlands

1. Start with the lowest Index Area Order (highest Index Area Order number - e.g., Index Order 9).

2. Use "Place within Place" to find the Administrative Area Order 8 (in this case "Den Haag")

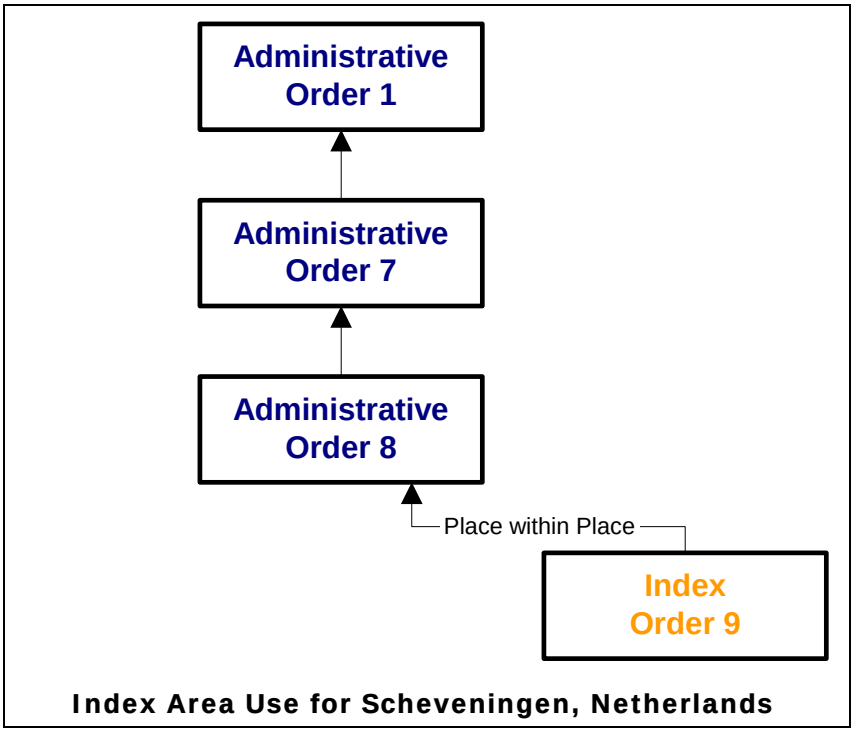




3. Use the hierarchical structure to go down from Admin Order 8 to find the other Administrative Order 9 Areas.

Result: The Index has all Administrative Areas and the additional Index Area Order 9 called "Scheveningen."

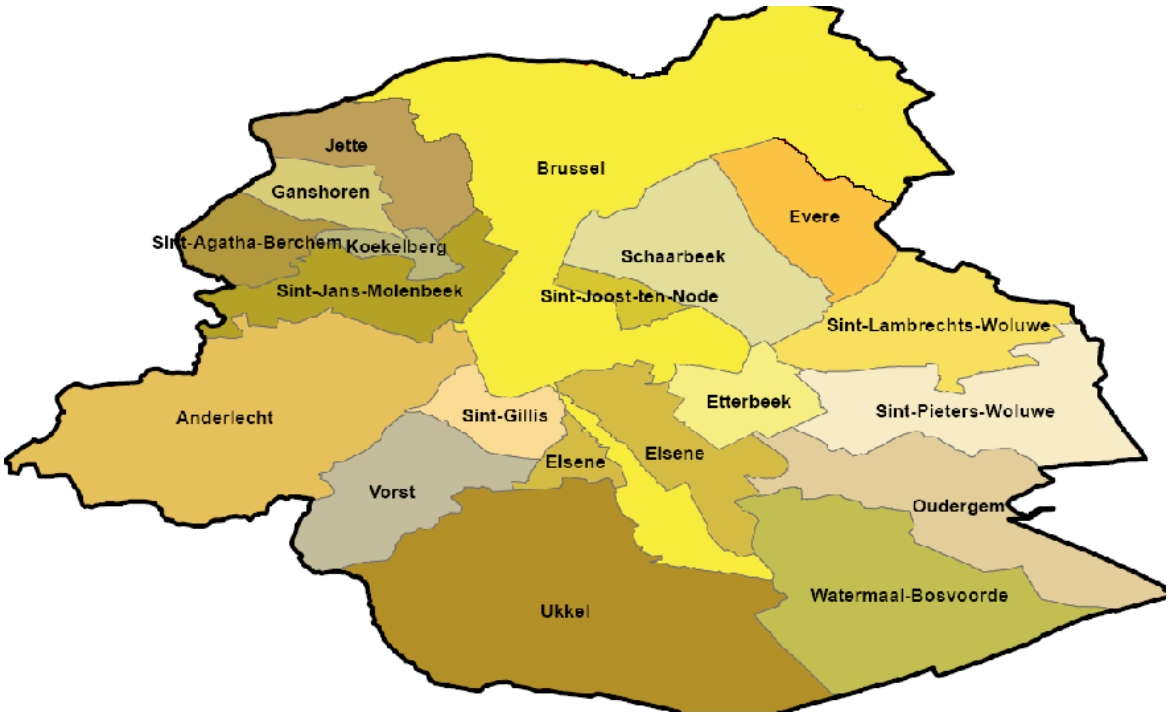
The hierarchy model is shown on the following page.



Index Area Use for Scheveningen, Netherlands

Example: Brussels in Belgium

Brussels exists as a capital region: Administrative Area Order 1. It also exists as an Administrative Area Order 8. This Order 8 does not correspond to the public perception of Brussels. The Administrative Area Order 1 "Brussels" consists of 19 Order 8 Administrative Areas of which Brussels Administrative Area Order 8 is one.

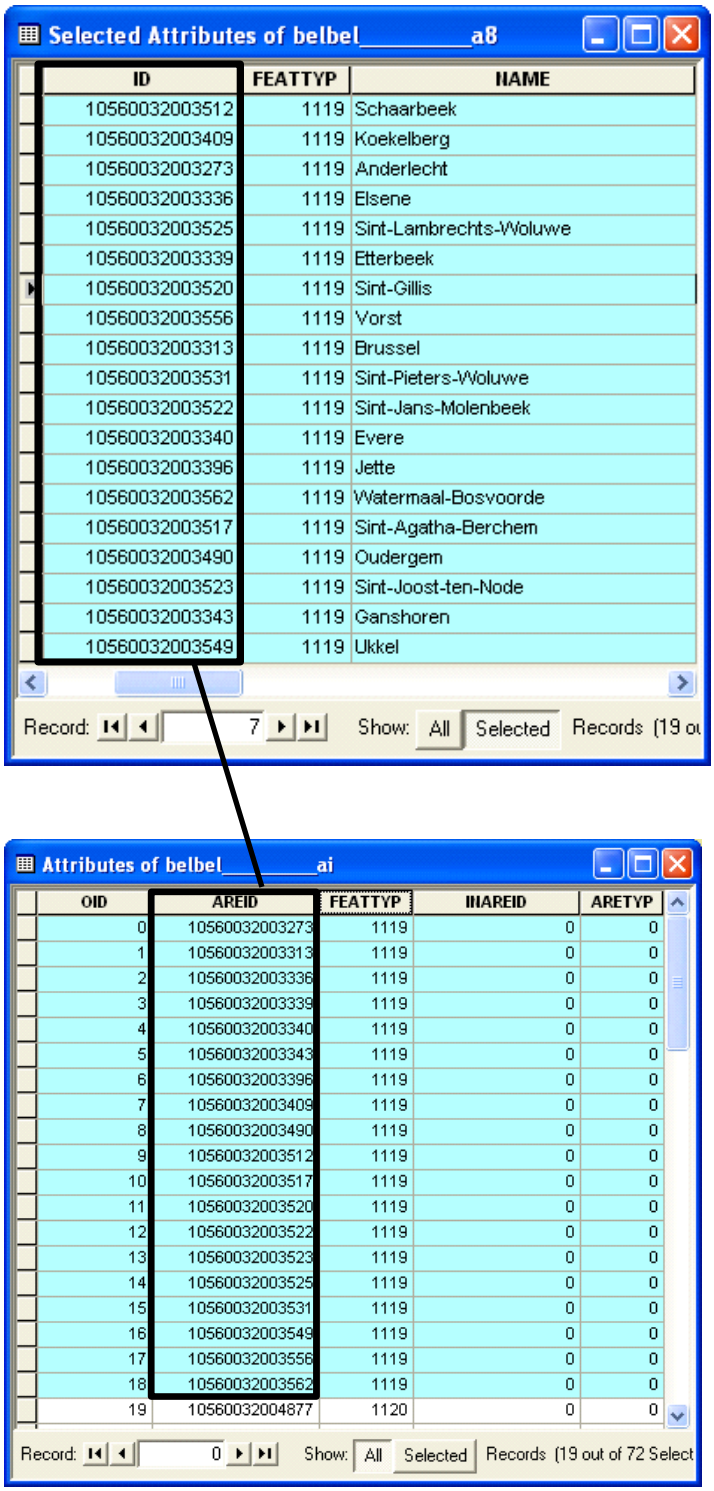


Perimiter of Entire Area is Brussel as Administrative Area Order 1
Within Order 1 are Administrative Area Order 8s including
Brussel Administrative Area Order 8

The other 19 Order 8 Administrative Areas are also considered by the public as being "Brussels". Therefore, an Order 8 Index Area "Brussels" must be created to cover the 19 other Administrative Order 8 areas.

Index Building for Brussels

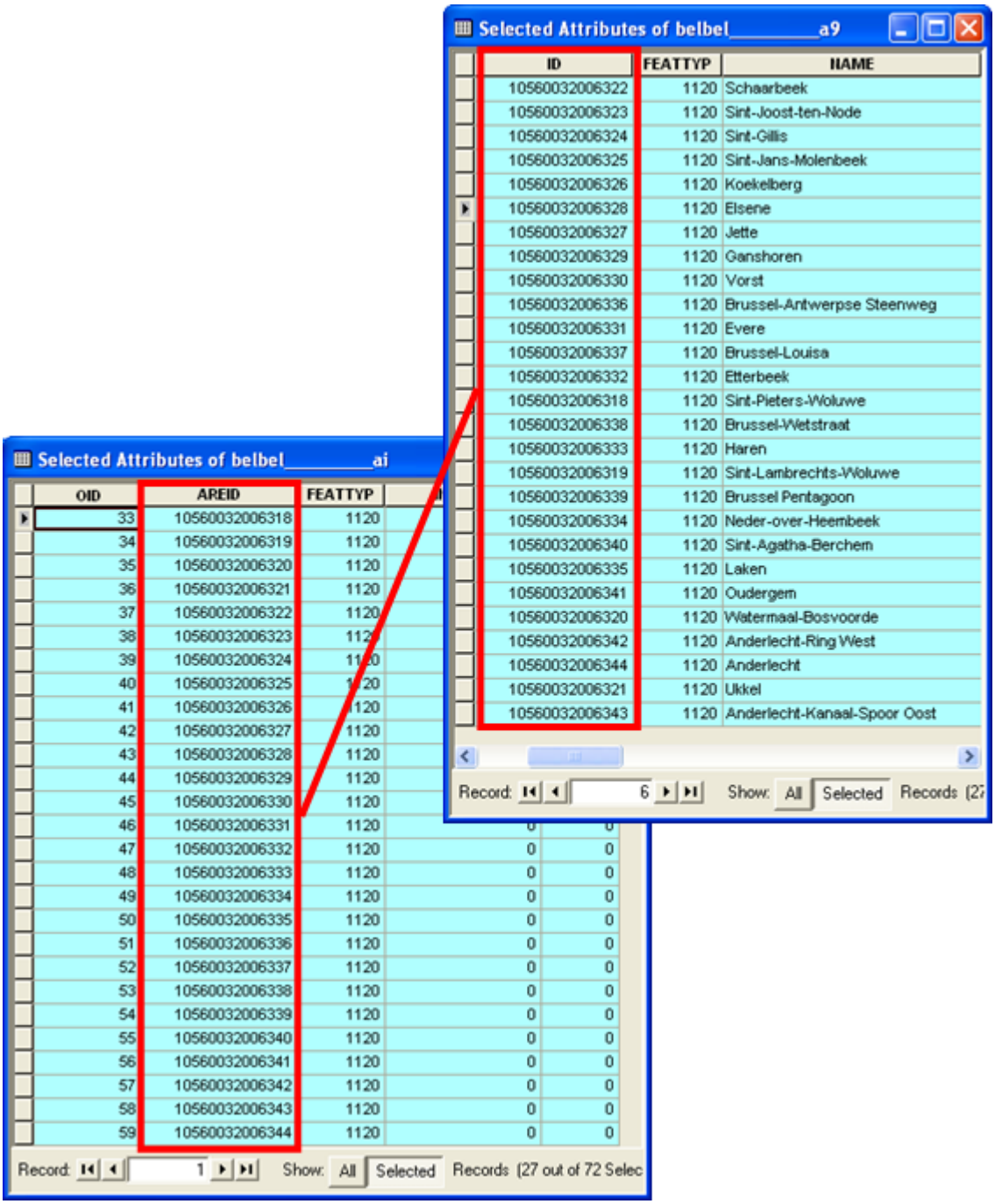
1. Create an Index Area Order 8 "Brussels" that contains all the Administrative Order 8 Areas now contained in Administrative Area Order 1 "Brussels"
    - Select the 19 Administrative Area Order 8s (a8) and match them to the Adminstrative Area Order 8s that are in the Area Replaced by Index Area file (ai). See the following page.



ID	FEATTYP	NAME
10560032003512	1119	Schaarbeek
10560032003409	1119	Koekelberg
10560032003273	1119	Anderlecht
10560032003336	1119	Elsene
10560032003525	1119	Sint-Lambrechts-Woluwe
10560032003339	1119	Etterbeek
10560032003520	1119	Sint-Gillis
10560032003556	1119	Vorst
10560032003313	1119	Brussel
10560032003531	1119	Sint-Pieters-Woluwe
10560032003522	1119	Sint-Jans-Molenbeek
10560032003340	1119	Evere
10560032003396	1119	Jette
10560032003562	1119	Watermaal-Bosvoorde
10560032003517	1119	Sint-Agatha-Berchem
10560032003490	1119	Oudergem
10560032003523	1119	Sint-Joost-ten-Node
10560032003343	1119	Ganshoren
10560032003549	1119	Ukkel

OID	AREID	FEATTYP	INAREID	ARETYP
0	10560032003273	1119	0	0
1	10560032003313	1119	0	0
2	10560032003336	1119	0	0
3	10560032003339	1119	0	0
4	10560032003340	1119	0	0
5	10560032003343	1119	0	0
6	10560032003396	1119	0	0
7	10560032003409	1119	0	0
8	10560032003490	1119	0	0
9	10560032003512	1119	0	0
10	10560032003517	1119	0	0
11	10560032003520	1119	0	0
12	10560032003522	1119	0	0
13	10560032003523	1119	0	0
14	10560032003525	1119	0	0
15	10560032003531	1119	0	0
16	10560032003549	1119	0	0
17	10560032003556	1119	0	0
18	10560032003562	1119	0	0
19	10560032004877	1120	0	0

2. Add the Administrative Order 9s to the Area Replaced by Index Area (ai) file to make it an Index Area Order 9. The ai file now contains the previous Administrative Order 8 areas (feature 1119) and the exisiting Administrative Order 9 areas (feature 1120).



Selected Attributes of belbel_____a9

ID	FEATTYP	NAME
10560032006322	1120	Schaarbeek
10560032006323	1120	Sint-Joost-ten-Node
10560032006324	1120	Sint-Gillis
10560032006325	1120	Sint-Jans-Molenbeek
10560032006326	1120	Koekelberg
10560032006328	1120	Elsene
10560032006327	1120	Jette
10560032006329	1120	Ganshoren
10560032006330	1120	Vorst
10560032006336	1120	Brussel-Antwerpse Steenweg
10560032006331	1120	Evere
10560032006337	1120	Brussel-Louisa
10560032006332	1120	Etterbeek
10560032006318	1120	Sint-Pieters-Woluwe
10560032006338	1120	Brussel-Wetstraat
10560032006333	1120	Haren
10560032006319	1120	Sint-Lambrechts-Woluwe
10560032006339	1120	Brussel Pentagoon
10560032006334	1120	Neder-over-Heembeek
10560032006340	1120	Sint-Agatha-Berchem
10560032006335	1120	Laken
10560032006341	1120	Oudergem
10560032006320	1120	Watermaal-Bosvoorde
10560032006342	1120	Anderlecht-Ring West
10560032006344	1120	Anderlecht
10560032006321	1120	Ukkel
10560032006343	1120	Anderlecht-Kanaal-Spoor Oost

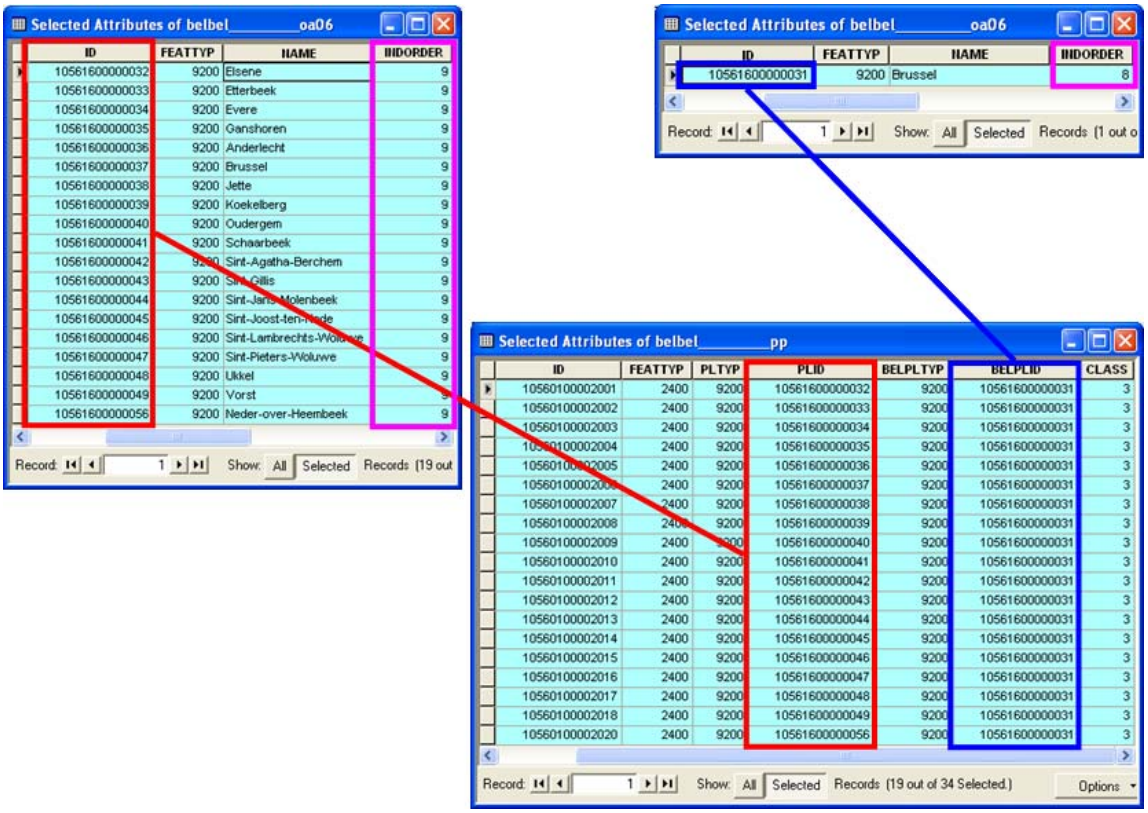
Record: 6 Show: All Selected Records (27

Selected Attributes of belbel_____ai

OID	AREID	FEATTYP		
33	10560032006318	1120		
34	10560032006319	1120		
35	10560032006320	1120		
36	10560032006321	1120		
37	10560032006322	1120		
38	10560032006323	1120		
39	10560032006324	1120		
40	10560032006325	1120		
41	10560032006326	1120		
42	10560032006327	1120		
43	10560032006328	1120		
44	10560032006329	1120		
45	10560032006330	1120		
46	10560032006331	1120	0	0
47	10560032006332	1120	0	0
48	10560032006333	1120	0	0
49	10560032006334	1120	0	0
50	10560032006335	1120	0	0
51	10560032006336	1120	0	0
52	10560032006337	1120	0	0
53	10560032006338	1120	0	0
54	10560032006339	1120	0	0
55	10560032006340	1120	0	0
56	10560032006341	1120	0	0
57	10560032006342	1120	0	0
58	10560032006343	1120	0	0
59	10560032006344	1120	0	0

Record: 1 Show: All Selected Records (27 out of 72 Selec

3. Use the "Place within Place" relation to relate the previous 19 Administrative Order 8 Areas (now Index Order 9 Area) to the Index Order 8 Area, "Brussel."

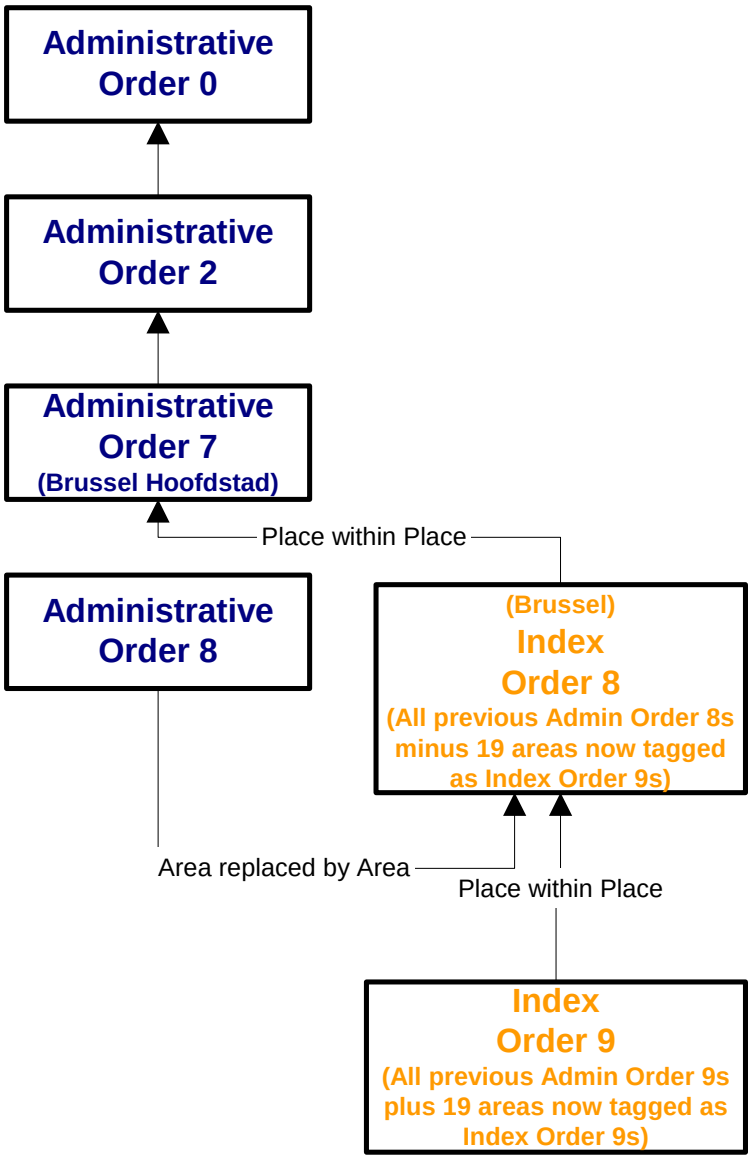


4. Use the "Place within Place" relation to build the Index Areas hierarchy.

The above actions now relate Index Order 8 Area , "Brussel," to Administrative Order 7 Area, "Brussel Hoofdstad."

5. Use the "Area replaced by Index Area" relation to remove the unwanted Administrative Order 8 Areas from the Index Order 8 list.

The hierarchy model is shown on the following page.



Index Area Use for Brussels, Belgium

Special Use of Relationships in Top Down Indexing - U.K.

For the United Kingdom, every Administrative Order 7, 8 and 9 has a relationship "Area replaced by Index Area". Performing the above described top-down Index building, the Index first has all Administrative Areas together with all Index Areas. The "Area replaced by Index Area" Relationship allows exclusion of all Administrative Areas Order 7, 8 and 9.

Displaying Land Cover and Land Use Areas

When designing for map displays, engineers need to determine a practical order of how features overlay so that relevant features are not hidden by other Land Cover or Land Use areas. TomTom® recommends the following guidelines:

- Land Use features can always overlap with any other feature (including Land Cover features).
- Land Cover features never overlap with other Land Cover or Water areas.
- It is best to draw Water on top of any other feature.

If there are islands or other Land Cover features inside Water, then there is a gap in the water at those locations and there should be no overlap.

The following table lists a recommended order for displaying Land Cover and Land Use features.

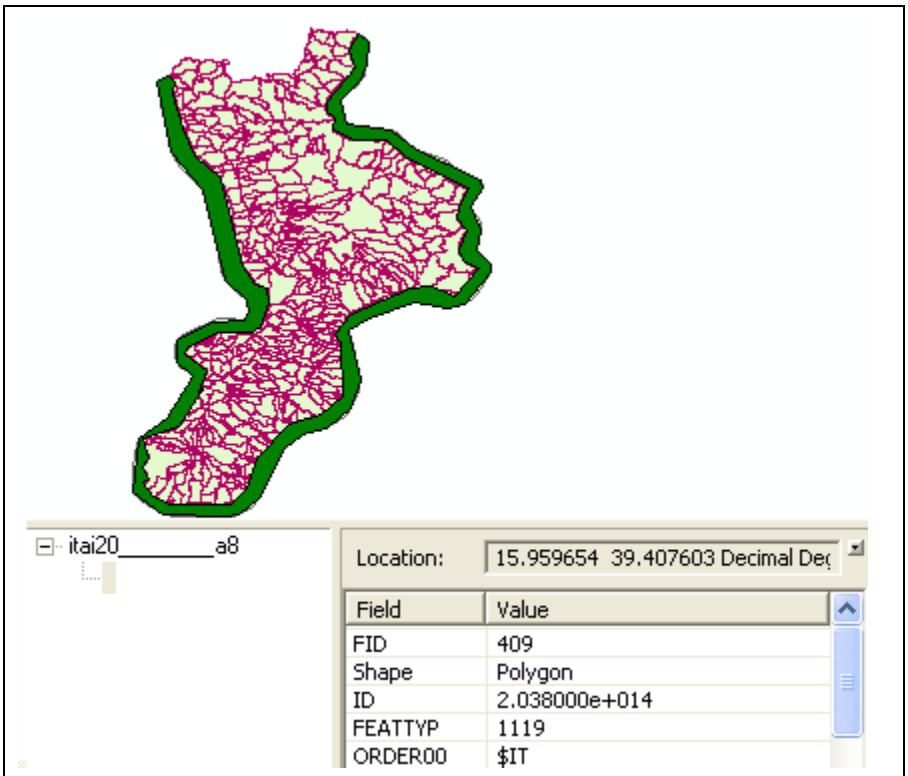
ORDER	FEATURE CODE	FEATURE NAME	FEATURE TYPE
1	7110	Building	Land Use
2	9776	Airport Runway	Land Use
3	9732	Airport Ground	Land Use
4	9790	Shopping Ground	Land Use
5	9789	Military Ground	Land Use
6	9788	Cemetery	Land Use
7	9768	Stadium	Land Use
8	9780	Institution	Land Use
9	9771	University	Land Use
10	9756	Parking Area	Land Use
11	9744	Golf Course	Land Use
12	9733	Amusement Park Ground	Land Use
13	9748	Hospital Ground	Land Use
14	9720	Industrial Harbor Area	Land Use
15	9715	Industrial Area	Land Use
16	9353	Company Ground	Land Use
17	7180	Island	Land Cover
18	7170	Park	Land Use
19	9710	Beach, Dune and Plain Sand	Land Cover
20	7120	Forest (Woodland)	Land Cover
21	9725	Moor & Heatherland	Land Cover
22	9787	Other Land Use	Land Use

See also **Land Cover and Land Use** earlier in this user guide.

Administrative Boundaries and Shorelines

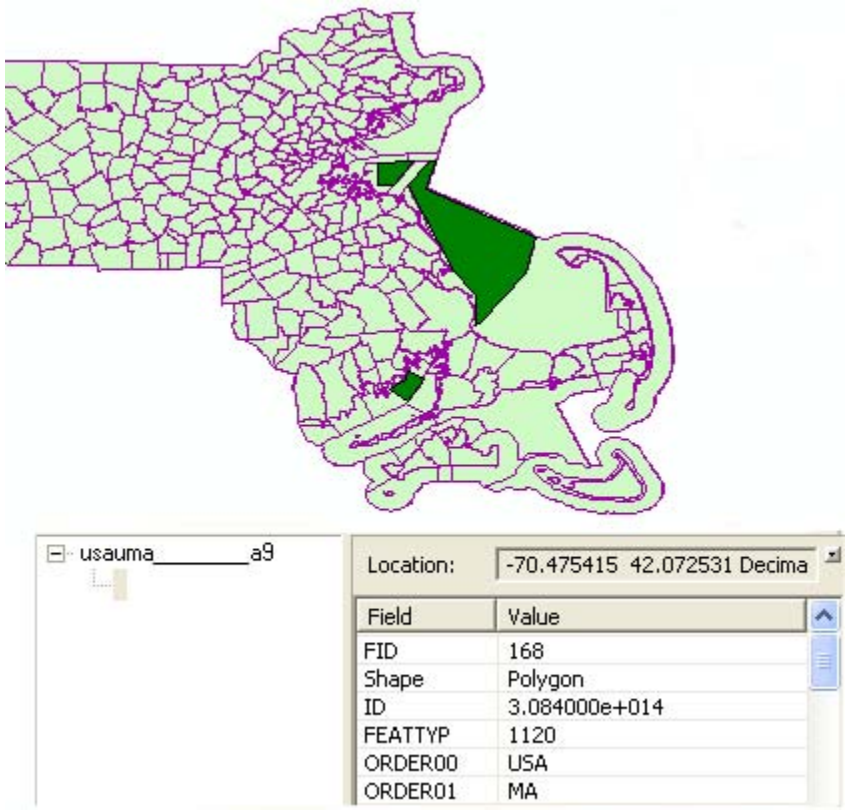
Depending on geography, definitions of water boundary coastal strips are treated differently because of different rules for defining the legal ownership of coastal waters from country to country. Consequently, these areas are presented differently for some countries in the TomTom database.

For example, in Italy and some other European countries, a separate "dummy" Administrative layer is provided and identified in the shapefile layer with a "**$**" in the ORDER00 field name. In Italy, this is **$IT** (rather than **ITA**) to distinguish it from other actual Administrative A8 areas. It displays as the legal coastal water border for the country.



"Dummy" Administrative Area Highlighted in Italy

In North America and in some other countries, a dummy Administrative Area boundary does not exist. Coastal waters are a part of the Adminstrative Area boundaries of these countries. **See the figure** on the following page.



No Dummy Adminstrative Areas in North America

(Massachusettes, U.S. Shown)

In order to display or select physical coastal boundaries in countries where a dummy Administrative Area is not provided, TomTom suggests using the Border Line layer (**BL**) and keying on **ADMBNDTYP = 10** (Coastal Border).`

BL Layer Displayed with ADMBNDTYP = 10 Selected

Note: ADMBNDDC = 1 will also indicate Administrative Area Boundaries that are in the sea or ocean.

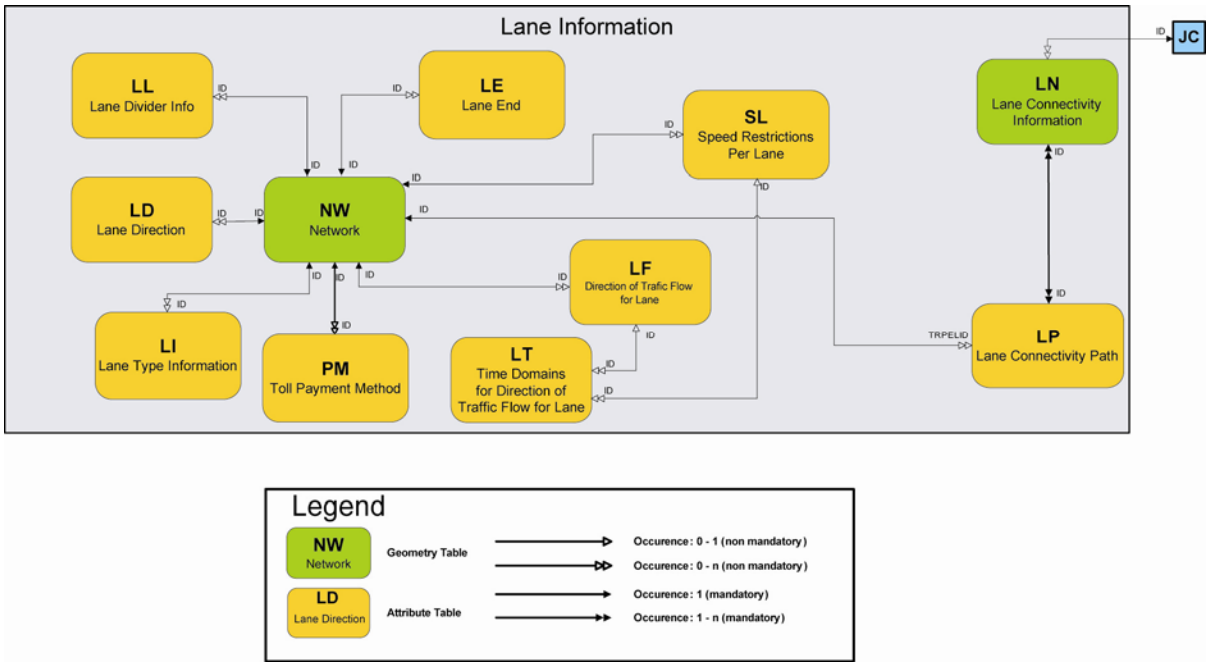
How to Use Lane Information

Lanes are generally present in MultiNet® data when there are instances of lane crossing.

Lane use is important both for display and for routing. Lane representation can give more accurate routing instructions (e.g., "go in the left lane and then turn left") and also demonstrate possibile real traffic situations (e.g., lane crossing with several lanes can be represented with an image).

To learn about the capturing rules for lanes and lane attribution please see the MultiNet® Data Specification and MultiNet® Data Model documents.

This section demonstrates the use of lanes with MultiNet® Shapefile data.



Files Involved with Lane Information

Definitions

Follow the links below for definitions of each file involved in lane information. All Shapefile file definitions are found in the Data Content - Shapefile and Oslfile section of this user guide.

NW; **LN**; **LL**; **LD**; **LE**; **LI**; **LT**; **LF**; **SL**; **LP**, **PM**.

The use of all the Shapefile tables related to lane information are not necessary to understand the basics of lane use information.

Basics of Lane Use Information

1. The first table to check when dealing with lanes is the **NW** table.

NW Data Example:

ID	LANES
108400000197899	4

Explanation:

The LANES field tells you if and how many lanes are present on a road element.

2. The **LL** table gives information on what type of road divider line is used to separate the lanes (e.g., Interrupted Line with Long Lines, Double Solid Line).

LL Data Example:

ID	SEQNR	DIVIDERTYP	VALIDITY
108400000197899	1	2	R010

Explanation:

In order to use this information:

- Search the road element ID in the ID field and then the sequence number (in the SEQNR field) to see if there could be more than one line for the record.
- See the DIVIDERTYP field which describes what kind of divider line is present. For example, a value of "2" indicates that the line is a Double Solid Line. For a list of all possible values, see the MultiNet® Shapefile format specifications document.
- Finally, the VALIDITY field identifies which lane the line is present in. For example, value "R010" means that, reading right to left, the second lane is the lane that the information is valid for. Line direction is defined according to the map digitalization, so it must be checked using the start junction (F_JNCTID) and end junction (T_JNCTID) IDs in the **NW** table.

3. The **LD** table gives information about the type of arrows (indicating lane direction that the arrows point to) that are on the lane.

LD Data Example:

ID	SEQNR	DIRECTION	VALIDITY
108400000197899	1	3	R010

Explanation:

In order to use this information:

- Search the road element ID in the ID field, and then the field sequence number (in the SEQNR field) to see if there could be more than one line for that record.
- See the DIRECTION field to find what kind of arrow is present on the road surface. See the LD table in the MultiNet® Shapefile Format Specification document for a complete list of numeric values.
    - The DIRECTION numeric values can be combined to best represent how the arrows look. For example, "1" = straight, and "2" = slight right. The sum of the two would make a value of "3" = there is an arrow depicting straight and an arrow depicting a slight right. See the photo below for an example.

Aerial Photo Copyright © Google

Example of the DIRECTION field = "3" in the LD Table

4. The **LN** and **LP** tables give information when connectivity between lanes is necessary. This occurs when there is a change of lane when crossing road elements (e.g., you are in lane 2 on the first road element, and end up in lane 1 of the second road element after the crossing).

Connectivity is present only when there is a change of lane and only when this happens in the real world, not when the change of lane is due to opposite digitalization direction.

In order to use the information, start from the **LN** table which is related to junctions (nodes).

LN Data Example:

N1	FEATTYP	FROMTO	JNCTID
108400100201661	9860	1/1	108400200101251
108400100201661	9860	1/2	108400200101251
108400100201661	9860	2/3	108400200101251

Explanation:

The LN table tells you:

- at the junction ID (JNCTID), a lane connection is present;
- the feature type (FEATTYP) is Relationship 9860 = Lane Connectivity;
- which lanes are involved from the values in the FROMTO field. For example, a value 1/2 means that you are on lane 1 in the starting road element and you end up in lane 2 in the destination road element (lane 1 and 2 are always defined according to digitalization direction starting from the right)

5. Once you have the connectivity ID and the lanes involved, you can now search for the same ID in the **LP** table to tell you which road elements are involved.

LP Data Example:

ID	SEQNR	TRPELID	TRPELTYP
108400100201661	1	108400000369141	4110
108400100201661	2	108400000062923	4110

Explanation:

The first sequence number (SEQNR field) is the starting road element and the second is the destination road element. The IDs of starting and destination IDs are in the TRPELID field.

Note
Only the starting and destination road elements are present, not any road elements that may lie in between.

6. Table **LF** gives you information on the traffic direction allowed for each lane.

LF Data Example:

ID	SEQNR	DFLANE	VT	VALIDITY
108400000369141	1	3	0	R11

Explanation:

- The sequence number (in the SEQNR field) indicates if there is more than one line for the record.
- The DFLANE field indicates the direction of traffic flow for the lane. In this example, "3" = Closed in the Negative Direction.
- VT indicates vehicle type. In this example, "0" = All vehicles.

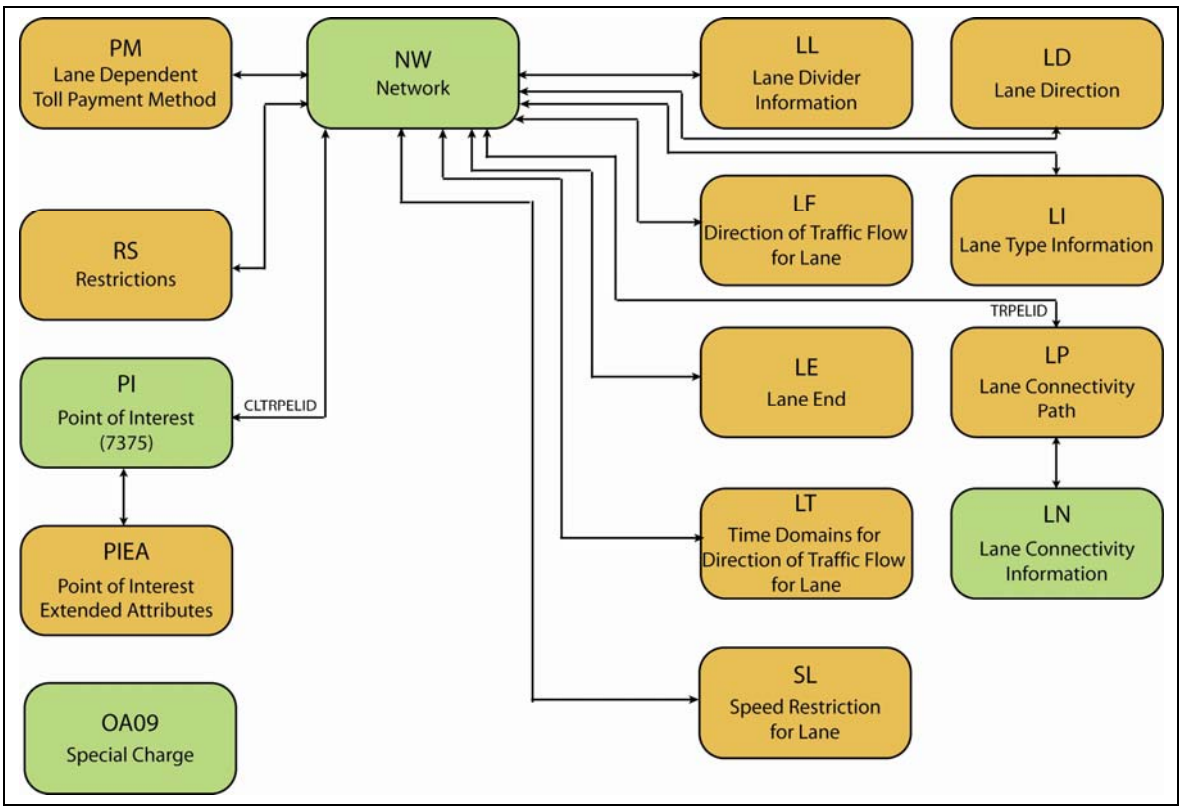
VALIDITY indicates the valid lanes for this information. As in the VALIDITY fields of the other Lane files, lanes are read from right to left.

How to Use Toll Information

All relevant information for tolls can be found in the MultiNet Shapefiles in the figure below.

- Links to the NW file are all via ID to ID fields except where indicated.
- Files that also have geometry are in green; files that are tables only are in orange.
- Most of the lane information files that are of more indirect importance to toll information are grouped to the right.

OA09 (special charge) is used for display purposes only.



Definitions

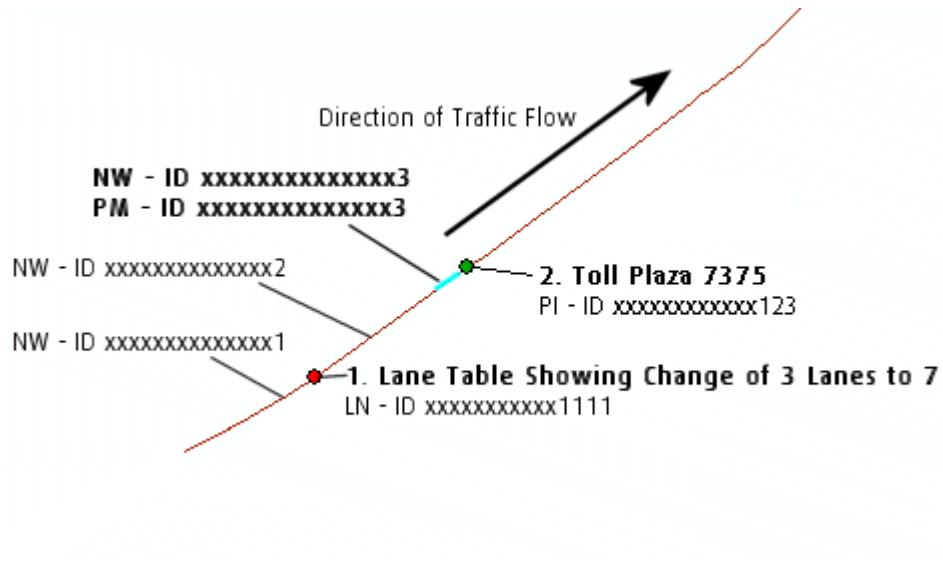
Follow the links below for definitions of each file involved in lane and toll information. All Shapefile file definitions are found in the Data Content - Shapefile and Oslfile section of this user guide.

NW; **LN**; **LL**; **LD**; **LE**; **LI**; **LT**; **LF**; **SL LP**, **PM**, **RS**, **PI**, **PIEA**, **OA09**.

The use of all the Shapefile tables related to toll information is not necessary to understand the basics of lane change locations, toll location, and toll information.

Data View

A generic Shapefile view of a highway or motorway containing network, lane, toll location, toll information and toll payment method is shown below.



Sample Data With Sample Toll and Lane Information

See **Graphic Rendering** of this example.

Lane Table Showing Change of 3 Lanes to 7

The LN table indicates that in the Lane Connectivity Relationship (9860), lane 1 breaks out into lanes 1, 2 and 3 (1/1, 1/2, 1/3); lane 2 becomes lane 4 (2/4); and lane 3 breaks out to lanes 5, 6, and 7 (3/5, 3/6, 3/7) at this point.

LN Connectivity Information Table

ID	FEATTYP	FROMTO	JNCTID
xxxxxxxxxxx1111	9860	1/1	yyyyyyyyyyyyyyy
xxxxxxxxxxx1111	9860	1/2	yyyyyyyyyyyyyyy
xxxxxxxxxxx1111	9860	1/3	yyyyyyyyyyyyyyy
xxxxxxxxxxx1111	9860	2/4	yyyyyyyyyyyyyyy
xxxxxxxxxxx1111	9860	3/5	yyyyyyyyyyyyyyy
xxxxxxxxxxx1111	9860	3/6	yyyyyyyyyyyyyyy
xxxxxxxxxxx1111	9860	3/7	yyyyyyyyyyyyyyy

Note: JNCTID indicates Junction where the LN point is located

The LP table links the LN "FROMTO" lane assignments to the transportation elements in sequence.

LP Lane Connectivity Path Table:

ID	SEQNR	TRPELID	TRPELTY
xxxxxxxxxxx1111	1	xxxxxxxxxxxxxx1	4110
xxxxxxxxxxx1111	2	xxxxxxxxxxxxxx2	4110

The LL table indicates the type of lane dividers that are on a road element.

- If the divider types differ per lane, there will be additional SEQNR numbers per ID.
- The divider type (DIVIDERTYP) on road element xxxxxxxxxxxxxx2 is "single solid line" (3).
- The divider type on road element xxxxxxxxxxxxxx2 is valid (VALIDITY) for all lanes except the far right lane (R1111110).
- The divider type (DIVIDERTYP) on road element xxxxxxxxxxxxxx3 is "toll booth" (15).
- The divider type on road element xxxxxxxxxxxxxx3 is valid (VALIDITY) for all lanes except the far right lane (R1111110).

LL Lane Divider Information

ID	SEQNR	DIVIDERTYP	VALIDITY
xxxxxxxxxxxxxx2	1	3	R1111110
xxxxxxxxxxxxxx3	1	15	R1111110

Toll Plaza 7375

Note: Only fields relevant to the example are shown in the tables below.

The PI table indicates that this point of interest is a toll plaza (7375). The CLTRPELID field is the link to the closest transportation element ID (xxxxxxxxxxxxxx3).

PI table

ID	FEATTYP	NAME	CLTRPELID
xxxxxxxxxxxx123	7375	Toll Plaza	xxxxxxxxxxxxxx3

The PIEA table indicates the validity direction (7V) is "positive" (2).

PIEA table

ID	FEATTYP	ATTTYP	ATTVALUE
xxxxxxxxxxxx123	7375	7V	2

The NW table is linked to the PI CLTRPELID field.

- The TOLLRD field indicates that the toll is in both directions (B).
- ONEWAY indicates that the road is a oneway in the From-To direction (FT).
- LANES indicates the number of lanes (7) on this road element.

NW table

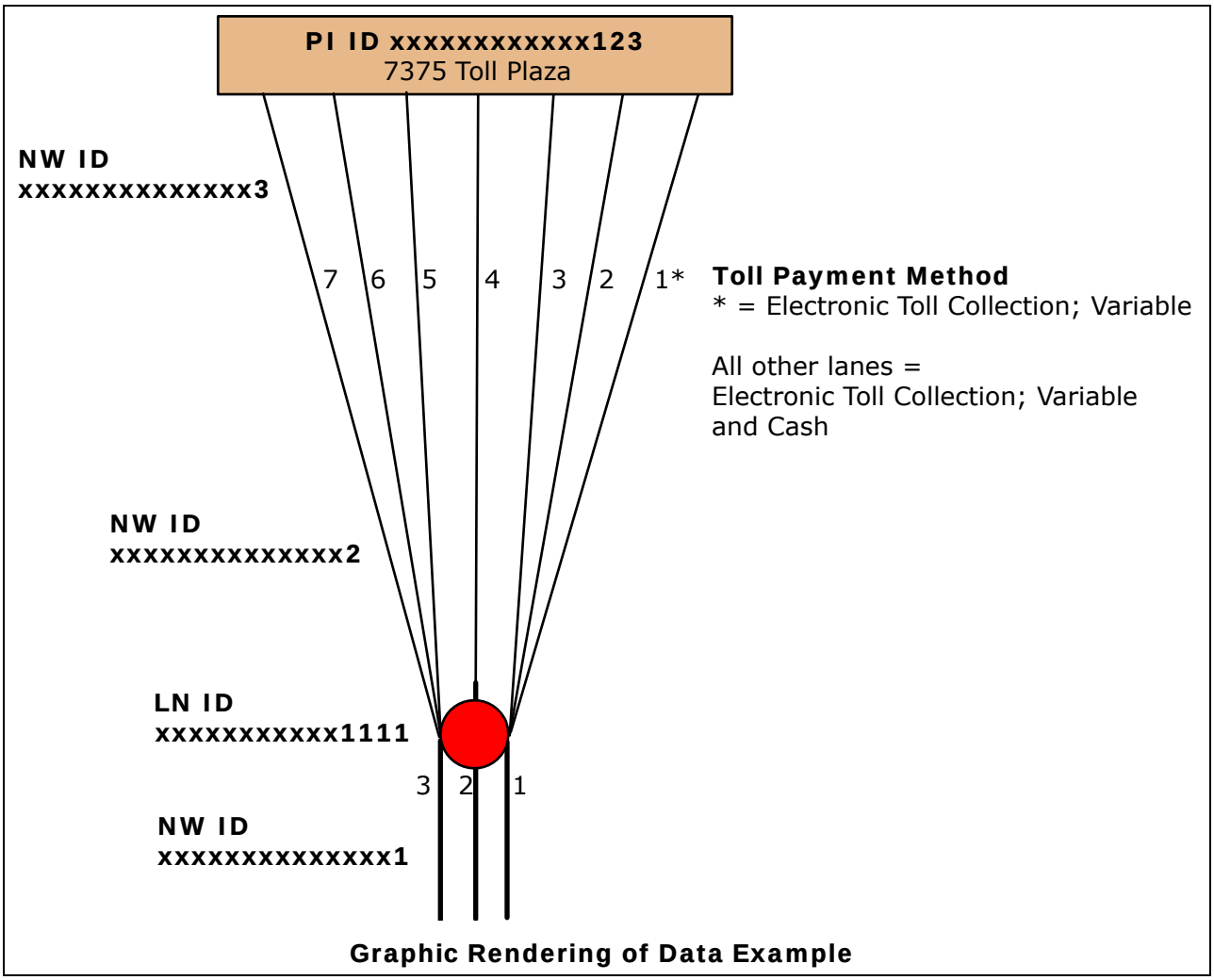
ID	TOLLRD	ONEWAY	LANES
xxxxxxxxxxxxxx3	B	FT	7

The PM table carries the same IDs as the NW table when there is a toll road. The PM table identifies the type of toll payment available for each lane. Payment code is a bitmask in order to make multiple payment identifiers available as a single coded number.

- Payment method (PAYMENT) is variable (64) electronic toll collection (16) (64 +16 = 80) in the far right lane (R0000001).
- Payment method (PAYMENT) is variable (64) electronic toll collection (16) and cash (1) (64 +16+1 = 81) in all lanes but the far right lane (R1111110).

PM table

ID	SEQNR	PAYMENT	VALIDITY
xxxxxxxxxxxxxx3	1	80	R0000001
xxxxxxxxxxxxxx3	2	81	R1111110



Graphic Rendering of Data Example

See **Data Example** of this rendering.

Refer to the **MultiNet Shapefile** and **MultiNet 3.5.1 Data** specifications for detailed information on tables, features and attributes.

Section 8: Data Content - GDF

Product Records - GDF-AS

Unlike Shapefile, Oslfile and GDF-AR formats, GDF-AS-formatted data contains all Features, Attributes and Relationships in a single file of many different records. GDF files may be delivered as an entire Dataset (Country) in one file, or partitioned by "Sections" in single or multiple files. A MultiNet® GDF-AS "Volume" contains one or more Sections. A collection of Volumes is referred to as an "Album."

The hierarchy and order of the GDF-AS records in *.gdf files is generally organized as shown below:

Volume Header Record

Dataset Records

Section Header Records

Layer Header Records

Data Records

Volume Termination Record

See the **Record Organization of GDF-AS Files** in the GDF-AS Format section of this user guide for a complete listing of records displayed as a hierarchy.

List of Records - GDF-AS

The list of records below is ordered as they appear in MultiNet® data. See also **Notes on the Order of Records** in the GDF-AS Format section of this user guide.

See record names under the Record Name column in the table below to find the matching records in the **MultiNet® ASCII Sequential (GDF-AS) Format Specifications** document for the record definitions for each file.

RECORD TYPE	RECORD NAME	RECORD IDENTIFIER
Volume Header Record	Volume Header Record	**01**
Comment Record*	Comment Record	**90***
Dataset Header Record	Dataset Identification Subrecord	**0201**
Dataset Header Record	Dataset Main Title Subrecord	**0202**
Dataset Header Record	Dataset Contents Subrecord	**0206**
Dataset Header Record	Field Definition Record	**03**
Dataset Header Record	Record Definition Record	**04**
Dataset Header Record	Attribute Definition Record	**05**
Dataset Header Record	Feature Definition Record	**07**
Dataset Header Record	Relationship Definition Record	**09**
Dataset Header Record	Administrative Structure Definition Record	**10**
Dataset Header Record	Default Attribute Record	**15**
Dataset Header Record	Attribute Value Definition Record	**18**
Dataset Header Record	Datum & Ellipsoid Record	**61**
Dataset Header Record	Earth Magnetic Field Record	**66**
Section Header Record	Section Identification Subrecord	**1601**
Section Header Record	Section Border Subrecord	**1607**
Layer Header Record	Layer Header Record	**17**
Data Record	Coordinate Record	**23**
Data Record	Node Record	**25**
Data Record	Edge Record	**24**
Data Record	Face Record	**29**
Data Record	Point Feature Record	**51**
Data Record	Line Feature Record	**52**
Data Record	Area Feature Record	**53**
Data Record	Complex Feature Record	**54**
Data Record	Name Record	**41**
Data Record	Segmented Attribute Record	**44**
Data Record	Conversion Record	**46**
Data Record	Relationship Record	**50**
Data Record	Time Domain Record	**45**
Data Record	Object Reference Record	**83**
Volume Termination Record	Volume Termination Record	**99**

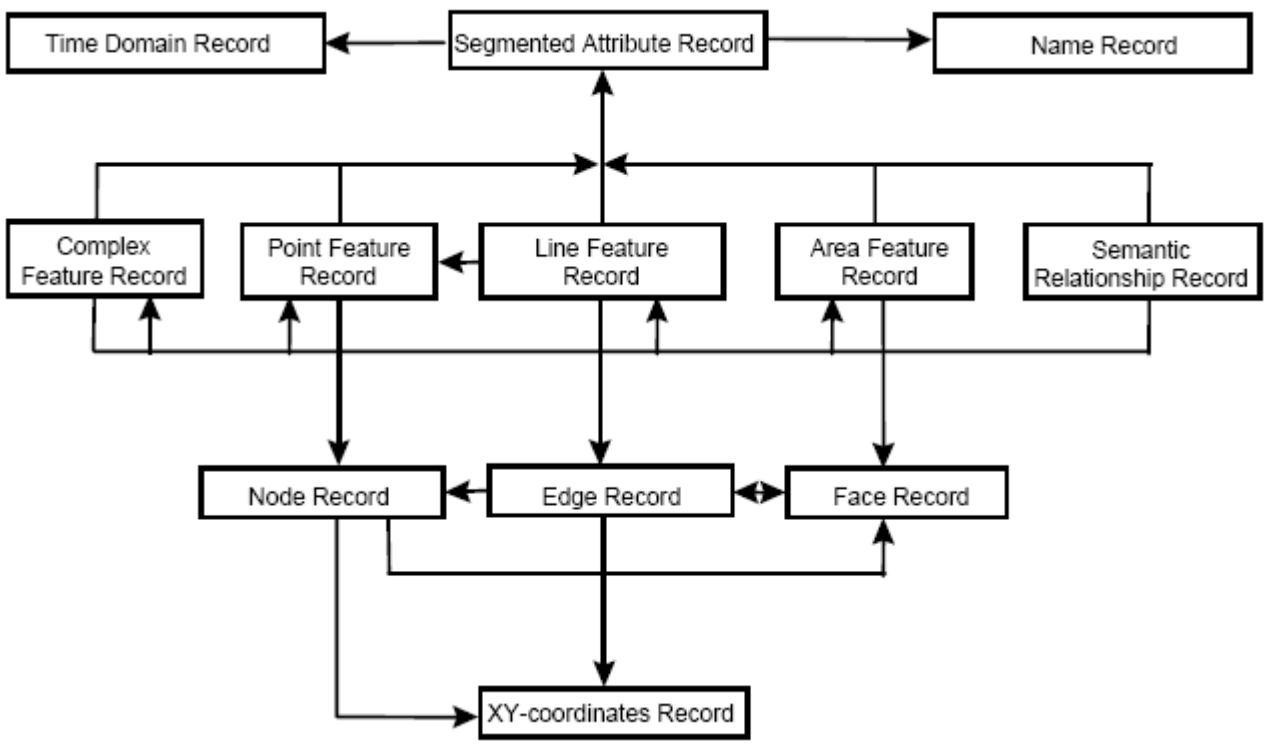
* A Comment Record cannot be inserted between two physical records belonging to one logical record. Comment Records containing free text are allowed to be written anywhere else in the GDF-AS file between the Volume Header Record and the Volume Termination Record.

See also **Notes on Order of Records** in the GDF-AS Format section of this user guide.

Data Model - GDF-AS

Below is the data model for the Data Records in GDF-AS format:

Data Record Relations

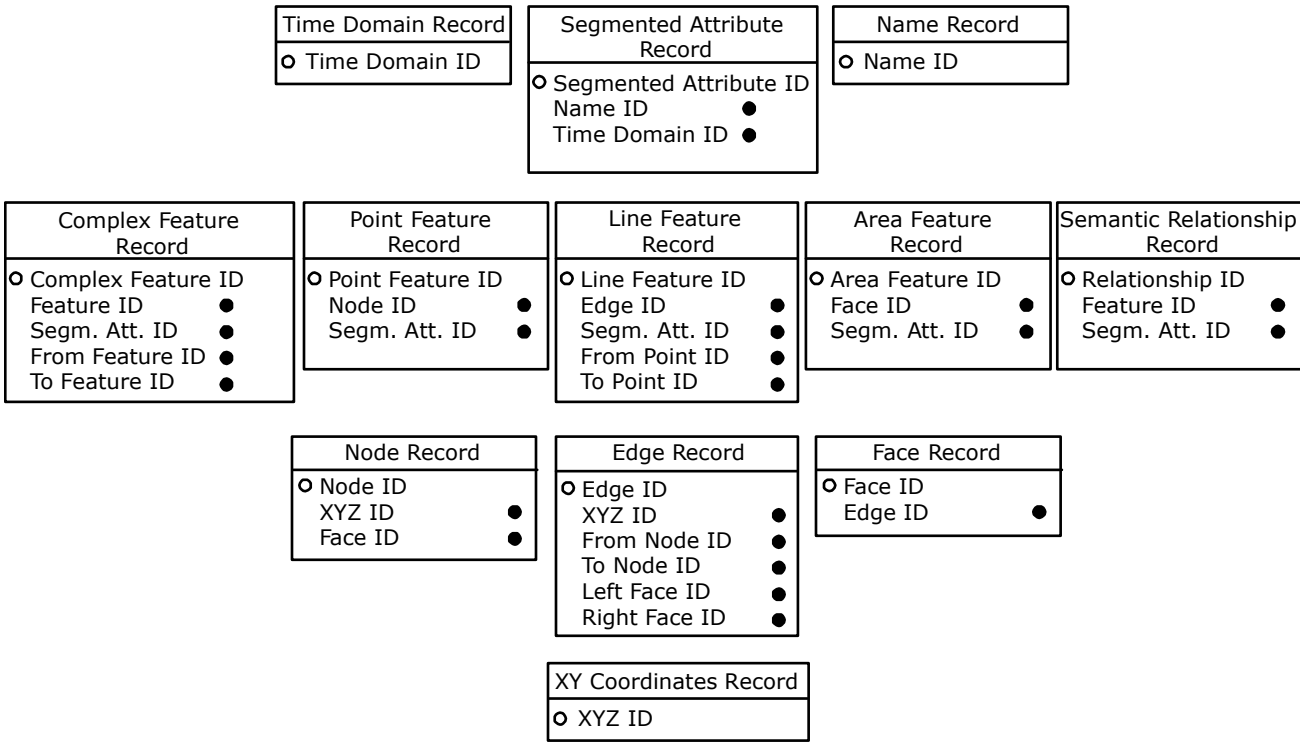


GDF-AS Data Records Model

Data Record Field Pointers - GDF-AS

In the Pointer Fields figure below:

- an open dot ° indicates a field where the identifier is assigned;
- a full black dot ● indicates a field used to refer to another record.



Pointer Fields and Their Role in the Records

Record Definitions - GDF-AS

Volume Header Record (01)

Each volume starts with a Volume Header. This header specifies the Album to which the Volume belongs and it specifies the links to the datasets to which it belongs or that it contains. In MultiNet® GDF-AS, the Volumes are considered independent of each other and therefore always carry an identification of "1."

Dataset Identification Subrecord (0201)

This record marks the beginning of a new Dataset and the end of the previous one. This record contains the supplier dataset ID and also identifies the languages used in the dataset.

Dataset Main Title Subrecord (0202)

This record names the dataset.

Dataset Contents Subrecord (0206)

These records list the Feature themes that may be contained in the dataset.

Field Definition Record (03)

These records identify and define all the record fields that may be contained in the dataset.

Record Definition Record (04)

These records identify all the record types that may be contained in the dataset.

Attribute Definition Record (05)

These records identify all the Attributes that may be contained in the dataset.

Feature Definition Record (07)

These records identify the Feature Types that may be contained in the dataset.

Relationship Definition Record (09)

These records define Relationships that may be contained in the dataset.

Administrative Structure Definition Record (10)

These records name and define the Administrative Type Structures that may be contained in the dataset.

Default Attribute Record (15)

These records identify the default Attribute values for each Attribute type that may be contained in the dataset.

Attribute Value Definition Record (18)

These records define all Attribute values that may be contained in the dataset.

Datum and Ellipsoid Record (61)

This record does not contain any datum or ellipsoid information at this time.

Earth Magnetic Field Record (66)

Constructions that may influence the earth's magnetic field include: bridges, tunnels, power lines, electric railways and tramways. These records identify latitude and longitude coordinates where variations between magnetic north and geographic north have been measured.

Section Identification Subrecord (1601)

This record contains the Section ID and the geographic region that the following records apply to.

In TomTom® MultiNet® GDF products, Sections are defined based on Administrative Areas. Usually Sections are defined based on Municipality Borders. By default one section contains one municipality. The "GEO_AREA" field contains the Municipality Name. Exceptions exist where one section contains multiple municipalities. In that case the "GEO_AREA" field contains the name of one of the contained Municipalities. For all other contained Municipalities the Section Identification Subrecord is repeated for each municipality but stored as a "Comment Record" (90) having the same structure as the Section Identification Record.

Section Border Subrecord (1607)

This record contains the bounding coordinates of the section.

Layer Header Record (17)

The layer header record contains the layer ID within the section and a coded list of features represented in the layer. There are a number of unused fields in this record (always blank).

Example of a Layer Header Record

```
17 1                    111131414243717590929397
```

Field Descriptions

17 = Record identifier

1 = Layer ID

11 = A counter field. The number of times the following two-number theme fields are repeated.

NOTE:
All of the two-number theme fields that follow the counter field (11) are high-level Feature theme codes represented in the GDF 3.0 standard. See the complete list of the GDF Feature Themes below.

GDF THEME CODE	DESCRIPTION
11	Administrative Areas
31	Settlements and Named Areas
41	Roads and Ferries
42	Railways
43	Waterways
50	Public Transport
71	Land Cover and Use
72	Road Furniture
73	Services
75	Brunnels
80	General Purpose Features
90-99	User-Defined Features

The four-number Features found in MulitNet® data are subordinates of the above themes. See the Appendix section of the **MultiNet® 3.5.1 Specification** for a list of four-digit MultiNet® Feature codes.

Coordinates Record (23)

The coordinates record is the root geographic location record that is referenced in the New Node record (25) and Edge Record (24) via the XYZ_ID.

Node Record (25)

Nodes are a Level 0 feature. As such, they are one of the three geometric primitives that lay the foundation for building more complex features. See **Feature Representation - Level 0** earlier in this user guide.

Information in the node record is directly related to Edges (24), Faces (29) and Points (51). Association is via the three IDs contained in this record:

- KNOT_ID (associated with Point records and Edge Record FKNOT_ID and TKNOT_IDs);
- XYZ_ID (associated with Edge records); and
- FACE_ID (associated with Face records).

See also **Data Record Relations** and **Data Record Field Pointers** earlier in this section.

Edge Records (24)

Edges are a Level 0 feature. As such, they are one of the three geometric primitives that lay the foundation for building more complex features. See **Feature Representation - Level 0** earlier in this user guide.

Edge records contain all necessary IDs and information to represent an edge and to connect to any feature that is built from an edge or contains an edge.

See also **Data Record Relations** and **Data Record Field Pointers** earlier in this section.

Face Records (29)

Faces are a Level 0 feature. As such, they are one of the three geometric primitives that lay the foundation for building more complex features. See **Feature Representation - Level 0** earlier in this user guide.

Face records contain all edge records comprising each face. Each edge record identified also contains its digitized orientation in relation to the face. Edges describing the boundary of a face are consecutively ordered in a clockwise orientation for the main polygon of the face. If an edge is digitized in a counterclockwise direction, it is assigned a value of "1" in the Orient field of this record.

See also **Data Record Relations** and **Data Record Field Pointers** earlier in this section.

Point Feature Records (51)

Points are a Level 1 feature. See **Feature Representation - Level 1** earlier in this user guide.

Point records contain the Point ID, the feature code associated with the point, the associated node or knot primitive and reference to segmented attribute IDs, if applicable.

See also **Data Record Relations** and **Data Record Field Pointers** earlier in this section.

Line Feature Records (52)

Lines are a Level 1 feature. See **Feature Representation - Level 1** earlier in this user guide.

Line records contain the Line ID, the feature code associated with the line, the associated edge primitive(s) and relation to their direction and reference to segmented attribute IDs. The bounding points of the line also are identified.

See also **Data Record Relations** and **Data Record Field Pointers** earlier in this section.

Area Feature Records (53)

Areas are a Level 1 feature. See **Feature Representation - Level 1** earlier in this user guide.

Area records contain the Area ID, the feature code associated with the area, the associated face primitive(s) and reference to segmented attribute IDs.

See also **Data Record Relations** and **Data Record Field Pointers** earlier in this section.

Complex Feature Records (54)

Complex features are Level 2 features. See **Feature Representation - Level 2** earlier in this user guide.

Complex feature records contain the Complex Feature ID, the feature code associated with the complex feature, the associated lower level features or other complex features and reference to segmented attribute IDs.

See also **Data Record Relations** and **Data Record Field Pointers** earlier in this section.

Name Records (41)

Name records contain names associated with a feature and a reference to the feature's Segmented Attribute Record(s).

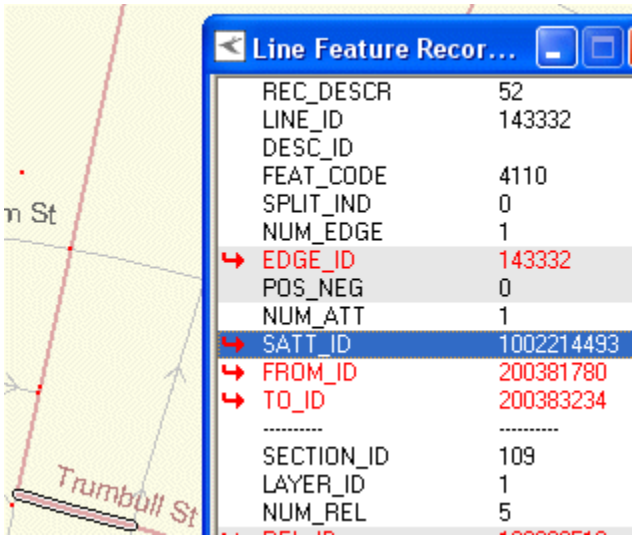
See also **Data Record Relations** earlier in this section.

Segmented Attribute Records (44)

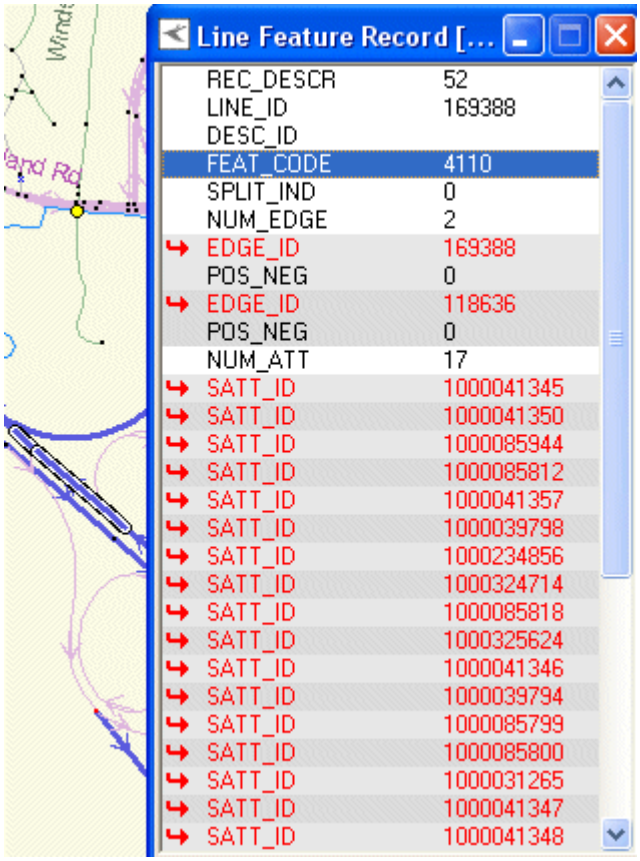
The Segmented Attribute Record contains the attribute codes and values associated with a feature or features. The Segmented Attribute Records are referenced from the following files: Point Features, Line Features, Area Features, Name Records, Relationship Records.

Beginning with MultiNet 3.5.1:

- For each feature, there is an attribute set for each simple attribute per attribute value.
- For each feature that has composite attributes, there is an attribute set for each Main Composite Attribute. The attribute set contains the Main Composite Attribute and its Nested Composite Attributes.



MultiNet Before 3.5.1 – All Attributes Contained in a Single Segmented Attribute Record



MultiNet 3.5.1 – All Attributes Listed Individually

See also **Data Record Relations** and **Data Record Field Pointers** earlier in this section.

Conversion Records (46)

Conversion Records are used as a link between features that lie on a section border or between the parts of a feature that lie in different sections (features that are "split").

A full discussion of Conversion Records and Split Indicators, their representation and use in MultiNet® data, is found in the **Dataset and Section Crossing** portion of this user guide. See also **Conversion Records** later in this user guide for a general overview.

Relationship Records (50)

See **Relationships** earlier in this user guide for a general overview.

Beginning with MultiNet 3.5.1, relationship records show full feature reference (GDF Datasets, GDF Section ID, and GDF Feature ID.

See also the Appendix section of the **MultiNet® 3.5.1 Specification** on this documentation DVD for a list of relationship names and codes.

Time Domain Records (45)

See **Time Domains** earlier in this user guide for a general overview.

See also the Appendix section of the **MultiNet® 3.5.1 Specification** on this documentation DVD for a description of GDF Time Domains.

Object Reference Record (83)

The Object Reference Record is used to link add-on objects directly to the core map. This record is not used for the standalone map.

Comments Record (90)

A Comment Record cannot be inserted between two physical records belonging to one logical record. Comment Records containing free text are allowed to be written anywhere else in the GDF-AS file between the Volume Header Record and the Volume Termination Record.

Volume Termination Record (99)

Volume Termination Records, like Comment Records, contain free text. The Volume Termination Record marks the end of a Volume and indicates with a value of "0" if the

current Volume is the last Volume of the dataset, or by a value of "1" if another Volume follows.

GDF-AR Format Data Content

All Data Content information for GDF-AR format, including file names, file descriptions, attribute descriptions and Data Model are contained in the **MultiNet® GDF ASCII Relational (GDF-AR) Format Specification** document.

Section 9: GDF Formats

Format Specifics - GDF-AS

GDF-AS files can be viewed directly as ASCII files with a simple text editor. All GDF-AS files have a .gdf file extension.

General GDF-AS Record Conventions

- 1st and 2nd positions indicate record type;
- Length of each line = 80;
- If 80th position is = 0, record ends;
- If 80th position is = 1, record continues on next line;
- If 1st and 2nd positions are = 00, record from previous line continues;
- If 1st and 2nd positions are =90, it is a comment line.

Record Organization in GDF-AS Files

The two-digit or four-digit numbers below correspond to the Record Type Codes in the sequence that they appear in GDF-AS data:

Volume

01 = Volume header

Dataset

02 = Data set record

0201 = Dataset ID subrecord

0202 = Dataset main title subrecord

0206 = Dataset contents subrecord

03 = Field definition record

04 = Record definition record

05 = Attribute definition record

07 = Feature definition record

09 = Relationship definition record

10 = Administrative structure definition record

15 = Default attribute record

18 = Attribute value definition record

61 = Datum and ellipsoid record

66 = Earth magnetic field record

Section

1601 = Section identification subrecord

1607 = Section border subrecord

Layer

17 = Layer header record (17 = 0 for first layer of section)

Data Records

23 = Coordinate records

25 = Node records

24 = Edge records

29 = Face records

51 = Point feature records

52 = Line feature records

53 = Area feature records

54 = Complex feature records

41 = Name records

44 = Segmented attribute records

45 = Time domain records

46 = Conversion records

50 = Relationship records

41 = Name records

44 = Segmented attribute records

45 = Time domain records

(90) Section ends, next section starts (1601..1607); next layer starts (17)

Data Records start

23……...

Notes on the Order of Records

The Dataset Header Record indicates the beginning of a dataset. The dataset ends with the next Dataset Header Record or with a Volume Termination Record with a Volume Termination Mark = 0 (last volume in an album).

The Section Header Record immediately follows the Dataset records. Its first appearance indicates the beginning of the first section. The section logically ends at the occurrence of another Section Header Record with a different Section ID or with a Volume Termination Record having a Volume Termination Mark = 0 (last volume of an album). If a section logically continues on the next volume, the corresponding Section Header Record has to be repeated.

The Layer Header Record immediately follows the Section Header Record. This record indicates the beginning of a new layer. A layer ends at the occurrence of another Layer Header Record. The last layer of a section ends with either a Conversion Record, a Semantic Relationship Record, a Section Header Record, a Volume Termination Record or a Data Set Header Record.

The Data Records immediately follow the Layer Header Record. The data records belonging to the last layer in a section are followed by zero or more Relationship Records possibly accompanied with one or more Comment Records. These Records do not belong to one particular layer, because they may contain information that refers to features that belong to different layers.

Comment Records are allowed to be written anywhere in the file between the Volume Header Record and the Volume Termination Record. A Comment Record cannot be inserted between two physical records belonging to one logical record.

Record Layouts - GDF-AS

See the **MultiNet® ASCII Sequential Format Specifications** document on this documentation DVD for all record layouts.

GDF-AR Format

All GDF-AR Format information, including file names, file descriptions, attribute descriptions, data model and record layouts for each GDF-AR file are contained in the **MultiNet® GDF ASCII Relational (GDF-AR) Format Specification** document.

Section 10: How to Use MultiNet® GDF

Index Areas in MultiNet® GDF

See **Index Areas** earlier in this user guide for a general description of Index Areas.

An Index Area is stored as a simple area feature in the product. The capturing on the database level is composed either out of an Index Area Component (Simple Area Feature) or by 1 or more other area features (Complex Area Feature).

In case of a complex feature the components can be any of the following area types:

- Administrative Area;
- Administrative Place;
- Built-Up Area;
- Postal District; or
- Census District.

Relationships for Index Areas in MultiNet® GDF

In MultiNet® GDF formats, the following Relationships are applicable to Index Areas:

RELATIONSHIP	RELATIONSHIP CODE
Place Within Place	2400
Administrative Area Replaced by Index Area	9204
Road Element in Named Area	1003
Ferry Connection in Named Area	1013
Address Area in Named Area	9201
Enclosed Traffic Area in Named Area	9202
Service in Named Area	1014
Built-Up Area in Named Area	9203
Center Point of Feature Belonging to Feature	1029

Relationships 9204, 1003, 1013, 9201, 9202, 1014 and 9203 describe the presence of features in a Named Area. These are "Feature in Index Area".

Place Within Place Relationship for Index Areas

In the Relationships below, Part 1 of the relationship is the child area, part 2 is the parent area.

Possible Relationship Components for Index Areas:

- Index Area (part 1) within an Index Area (part 2)
- Index Area (part 1) within an Administrative Area (part 2)
- Administrative Area (part 1) within an Index Area (part 2)

Relationship Attributes:

- Place within Place Classification. Value 3: "address significant"

IMPORTANT: This order of relationship parts deviates from the convention, used in many other MultiNet® relationships where the "largest" object is the first part of the relationship, and the "smaller" object is the second part. The actual definition, however, is compliant to the ISO GDF 4.0 standard.

Administrative Area Replaced by Index Area

Relationship Components for Index Areas:

- Administrative Area (part 1) replaced by Index Area (part 2)

IMPORTANT: Part 2 of this relationship has feature category 0 followed by an empty identifier field. This means that the relationship merely indicates that the Administrative Area mentioned in the relationship is not appropriate for Index building and can be left out of the Index. The relationship does not mean that a certain Administrative Area is *replaced* by a specific Index Area.

EXAMPLE: An Order 8 Administrative Area has three different Index Areas that cover its surface. There is no possibility to choose one of those Index Areas as the second part of the Area Replaced by Index Area relationship. The relationship only indicates that the Order 8 Administrative Area can be left out of the Index.

Index Areas As They Appear in MultiNet® GDF-AS Format

An Index Area is represented by a Simple Area feature with feature code 9200. The attributes are Official Name (mandatory) , Alternative Name (not mandatory) and Index Order (mandatory).

The Index Order attribute 9X has values 1 to 10 for Index Order 1 to Index Order 10.

NOTE:
The Index Order is country dependent:
Examples: Belgium has Index Orders 8 and 9; the United Kingdom has Index Orders 7, 8, 9 and 10.

Data Example:

```
53 399958884  92000   4  60000210 60094251 60127826 60127828  11997392795    0
```

Area Feature Record 53 has Area Feature Identifier 399958884, Feature Code 9200 for Index Areas, consisting of 4 faces with face identifiers 60000210, 60094251, 60127826, 60127828 and 1 attributeset with segmented attribute identifier 1997392795.

The above example includes the segmented attribute identifier 1997392795. The Segmented Attribute Record has the following information:

```
441997392795    29X   9    ON   6562                                        0
```

This record lists two attributes: 9X, which is a direct attribute with value 9, indicating Order 9 Index Area; and the indirect attribute ON which points to the name record (record type 41) that has the official name of the Index Area:

```
41     6562                ENGTwo Waters Foot                              0
```

The above record contains the language code (ENG) and the official name (Two Waters Foot).

Section-Crossing Index Areas in MutiNet GDF-AS

EXAMPLE: An Order 8 Index Area is split over two different GDF-sections with section identifiers:25000150 and 25000157.

NOTE:
The entire GDF record information below is not shown in the examples below.

In section 25000157, the Order 8 Index Area has its GDF area feature record as follows:

```
53 399962731            92001       (with 3 faces)
```

This shows the identifier (39996271) with feature code 9200 (Index Area) and split indicator (1). The Split indicator shows that this Index Area is split over different sections.

In section 25000150, the Order 8 Index Area has its GDF area feature record as follows::

```
53 399962731            92001          (with 793 faces)
```

This is the complementary Order 8 Index Area.

An Order 9 Index Area lies completely in Section 25000150. The Order 9 Index Area has its GDF area feature record as follows:

```
53 399958845            92000           (with 19 faces)
```

The split indicator is 0 which shows that the Order 9 Index Area lies completely in one section.

See also, **Dataset and Section Crossing** later in this user guide.

Standard Language in Index Areas and Administrative Areas

Standard Language is a mandatory, unique attribute (VL) of Administrative Areas and Index Areas in GDF formats. For regions with multiple official languages, it corresponds to the language that is recognized by authorities as the official language on the national level. For example:

- Dutch instead of Frisian;
- Spanish instead of Catalan or Valencian.

In some cases, the standard language is chosen from the set of official languages (ON). when official languages are equally important (e.g., in Brussels).

Using Index Areas for Index Building in GDF

In the How to Use MultiNet® Shapefile section of this user guide, please see the subsection "**Using Index Areas for Index Building**", as the examples also apply to GDF.

Linking from MultiNet® GDF to MultiNet® Shapefile

Linking these two product formats can be useful:

- if customers receive both formats and use GDF for product development and Shapefile for product visualization and analysis;
- if developers want the ability to take advantage of Shapefile features not found in GDF (e.g., Administrative Area geometry is available for Shapefile but not for GDF).

The principal components involved with linking from GDF to Shapefile are:

- the country dataset IDs;
- the technical dataset IDs and;
- the feature IDs.

These components are handled differently in GDF and Shapefile, and there are also differences between European and North American data formats.

European Dataset IDs

In Europe, the technical datasets are based on Administrative Areas. The term "sections" is used to define one or more Administrative Areas. A country can have many datasets or sections (e.g., Germany has 14 datasets [D51, D52, D53...]) or a single dataset can cover an entire country (e.g., Luxembourg has one dataset [LUX]).

Shapefile

In Shapefile format, the country ID, the technical dataset or section ID, and the feature ID are all identified in a single ID field.

Example:

Feature ID **32111001** in dataset D**64**, in Germany (**276**) is identified in the 15-Number ID in the Shapefile Geocode (GC) file "ID" field and appears as:

64276003**2111001**.

GDF

In GDF-AS format:

- the country dataset is identified in record 0201 (Dataset ID subrecord).
- the section dataset is identified in record 1601 (Section Identification subrecord).
- the feature ID for a line is identified in record **52** (Line feature record).

Example:

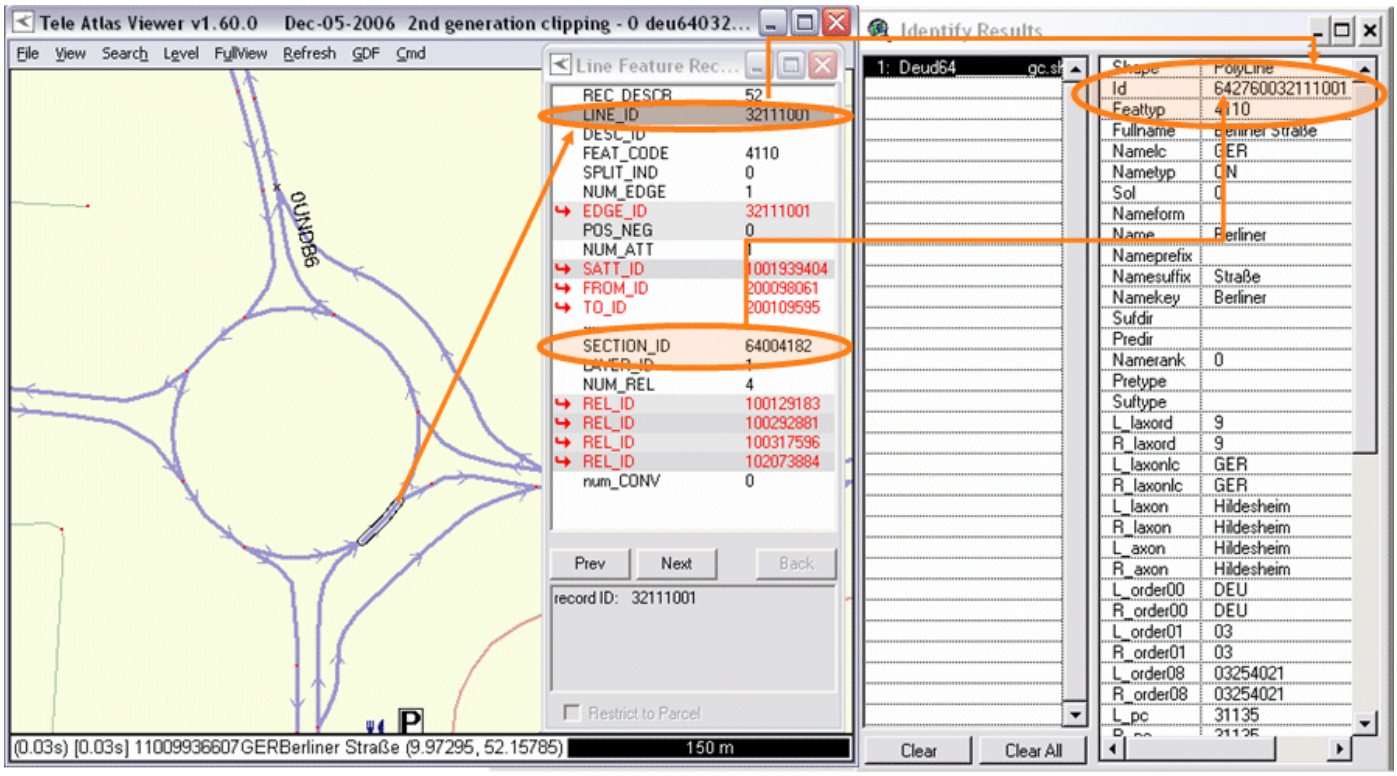
The same line ID identified in the **Shapefile example** above, **64276003211100 1,** would be found in the following GDF-AS records:

```
0201                 2760409131411DANDUTENGFINFREGERITANORPORSPASWE 1DEU

1601  6400147052001470

52  32111001      93100          1 497778949 0     0 510041191 510041197
```

The example below shows IDs in GDF using the GDF Viewer compared with a Shapefile Geocode layer (GC) ID.



Example of Linking GDF IDs to Shapefile IDs using the GDF Viewer (on the left) and a Shapefile Viewing Tool (on the right) for European data

North American Datasets

In the North America dataset, the country code and dataset code are combined into a five-digit code. The country codes are based on the ISO designation.

Shapefile

In North America Shapefile format:

- the first two digits of the five-digit dataset code identify a state (U.S., Brazil) or a province (Canada);
- the next three digits of the five-digit dataset code identify a country.

Example:

Feature ID **300919304** in dataset Massachusettes (**30**), in the U.S. (**840**) is identified in the 15-Number ID in the Shapefile Geocode (GC) file "ID" field and appears as:

30840**0300919304**.

GDF

In GDF-AS format:

- the country dataset is identified in record 0201 (Dataset ID subrecord).
- the section dataset is identified in record 0201 (Dataset ID subrecord).
- the feature ID for a line is identified in record **52** (Line feature record).

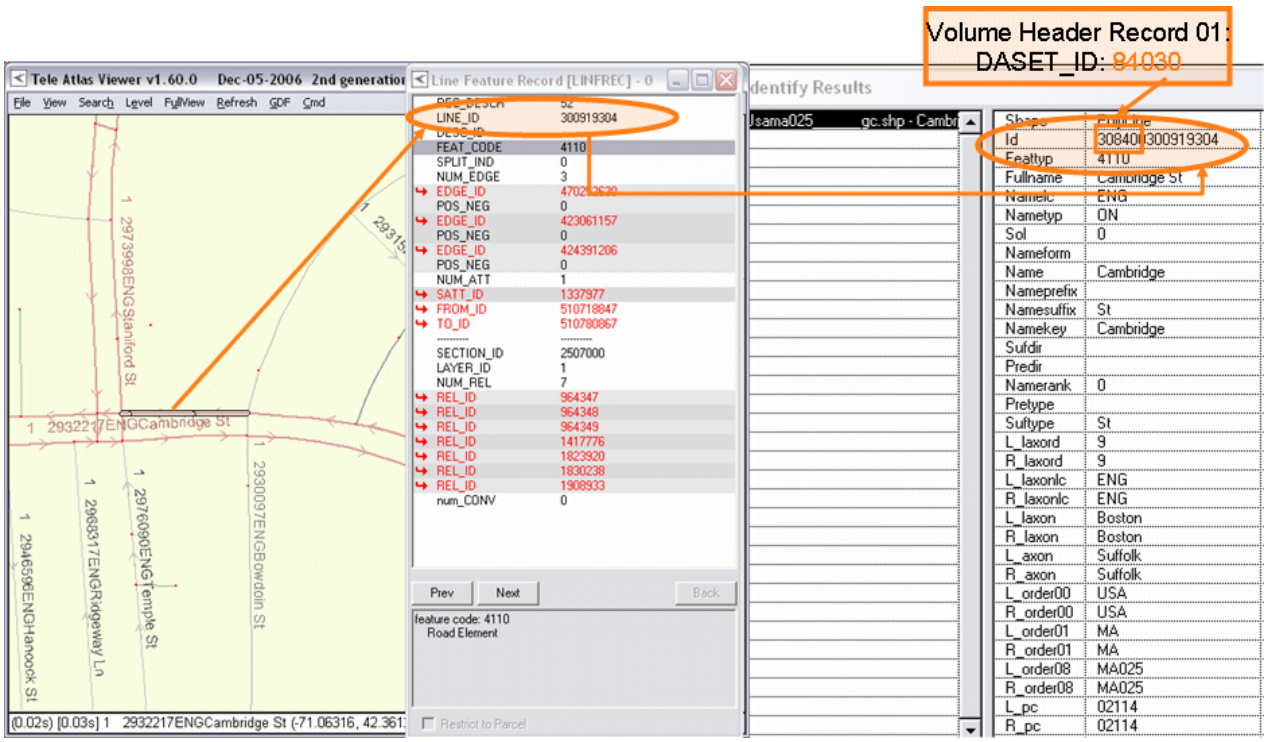
Example:

The same line ID identified in the **Shapefile example** above, **30**840**0300919304,** would be found in the following GDF-AS records:

```
0201                    84030  022207 1ENG 1USA

52 300919304      41100          1 497778949 0     0 510041191 510041197
```

The example on the following page shows IDs in GDF using the GDF Viewer compared with a Shapefile Geocode layer (GC) ID.



Example of Linking GDF IDs to Shapefile IDs using the GDF Viewer (on the left) and a Shapefile Viewing Tool (on the right) for North American data

Dataset and Section Crossing

Data features can cross or lay on a dataset or dataset section border. When this happens, MultiNet® indicates these conditions through Relationships, split indicators, and conversion records.

Definitions

Dataset Section

A dataset is broken down into sections for easier data processing. Sections are based on Administrative Areas. In most countries, sections are Order 8 Administrative Areas, but there are some countries that are sectioned by Order 9 Administrative Areas (e.g., U.S., China).

Relationships

Relationships were defined earlier in this user guide. See **Relationships**.

Conversion Records

For features that are section-crossing (GDF-AS) or technical dataset-crossing (GDF-AR, Shapefile), conversion records are created to provide a relation between the local and the foreign feature ID.

Conversion records are delivered as either separate records (GDF-AS: record 46) or as separate files (GDF-AR: CN1-CN4; Shapefile: CN) to enable dataset crossing linking of Features. They contain the ID of a feature in the current dataset together with the ID of the same feature in the neighboring dataset.

The dataset identifier of the foreign dataset differs from the internal dataset identifier when adjacent sections belong to different countries.

Example: Internal dataset is Spain (country code 724) and the foreign dataset is Portugal (country code 620) then the dataset IDs in each dataset differs.

Example: For technical datasets that belong to one country, the dataset IDs are the same.

The section identifiers of the foreign dataset always differ from the section identifier of the internal dataset.

Some features that the conversion records are available for include the following:

- Road Element – 4110.
- Junction – 4120.
- Ferry Connection – 4130.
- Road - 4140.
- Intersection - 4145.

- Railway Element Junction - 4220.
- Frontier Crossing – 7366.
- Brunnel - 7500.
- Water Element - 4310.

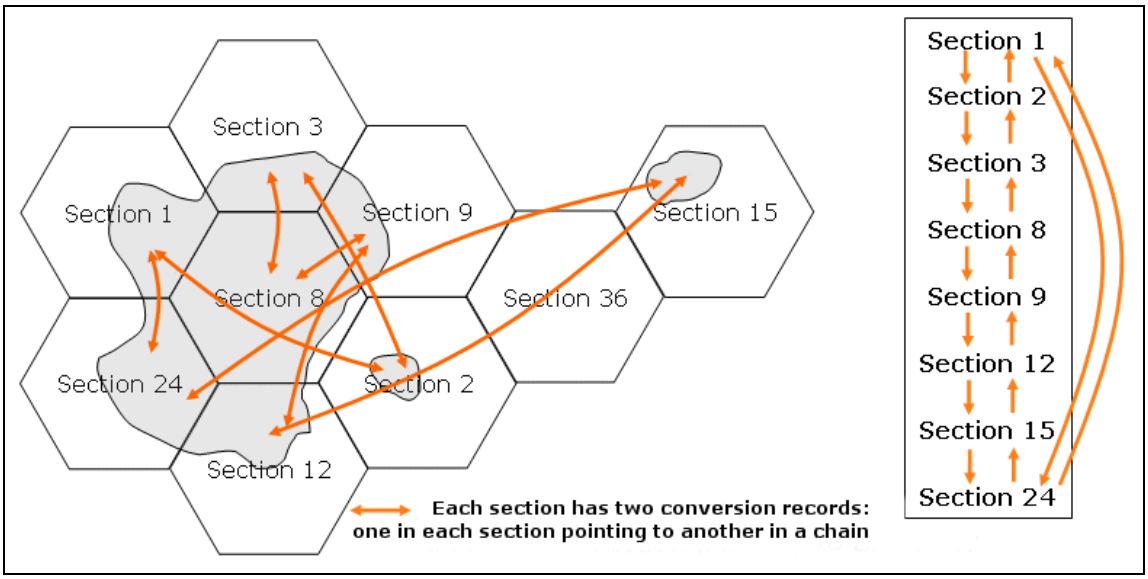
Features with a split indicator of "0" (when lying on a section border) or "1" will automatically generate conversion records.

Exception to the rule:

- An Administrative Area (a feature with split indicator "2") has a conversion record if the feature is not present in a section but referred to by a relationship in that section.

Important Note:

Beginning with the release of MultiNet 3.5.1, all parts of a feature that reside in a number of sections (adjacent and not adjacent) will be linked via conversion records by chaining the IDs of sections, from lowest to highest.



Split Indicators (GDF Format Only)

A "Split Indicator" is a coded value indicating if all composing parts of a feature are present within a section or if some parts are missing. Split indicator values are found in:

- GDF line records (GDF-AS record 52; GDF-AR .LIN file);
- GDF area records (GDF-AS record 53; GDF-AR .ARE file); and
- GDF complex feature records (GDF-AS record 54; GDF-AR .CMP file).

Split indicator values are:

- 0 = A line, area or complex feature lies completely in one section.

- 1 = A line, area or complex feature is split. When split indicator = 1, conversion records are always present for:
  - lines – toward adjacent components only;
  - areas – toward components in all adjacent sections;
  - complex features - toward components in all adjacent sections.
  - 2 = The feature is split but no conversion records are necessary. The feature has the same feature ID in each section within the same dataset.

Note
An Administrative Area (a feature with split indicator 2) has a conversion record if the feature is not present in a section but referred to by a relationship in that section.

MultiNet® Objects / Features and Dataset Section Crossing

Not all MultiNet® Level 0, Level 1 and Level 2 objects are dataset or section crossing. See the table below.

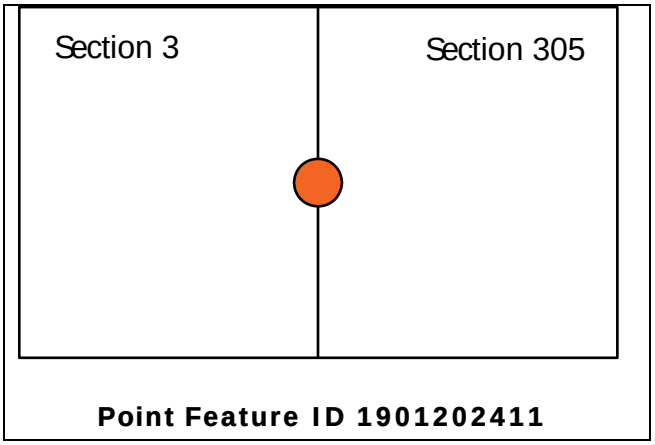
OBJECTS / (LEVEL)	CAN BE SECTION CROSSING	CAN LAY ON A SECTION BORDER	CONVERSION RECORDS	SPLIT INDICATOR / (VALUES)	NOTES
Nodes / (0)	No	Yes	No	No	
Edges / (0)	No	Yes	No	No	
Faces / (0)	No	No	No	No	
Point / (1)	No	Yes*	Yes	No	Conversion recor are generated wl a point feature li on a section border.
Line / (1)	Yes	Yes*	Yes**	Yes / (0, 1)	A road element t lies completely o the section borde has a split indicator of The road elemen described in both sections.
Area / (1)	Yes	No	Yes	Yes / (0, 1)	See Complex Features for Administrative A
Complex Features / (2)	Yes	Yes*	Yes	Yes / (0, 1, 2)	Split indicator = (feature is split) never used for Administrative A However, Administrative A can have Conver Records if a feat in a foreign secti refers to the Administrative A via a Relationshi Split indicator = is only used for complex Administrative A when they are section crossing.

* Features with split indicator = "0" that lie on a section border will generate conversion records.

** Conversion records are only created for line features that lay on a section or dataset border.

Conversion Record Examples

Point Feature on a Section Border



GDF-AS (Section 3, record 46)
46 56 305 11901202411 11901202411

Explanation:

In the GDF-AS conversion record (46), the internal section is Section 3, which is identified in the Section Identification Subrecord (1601) and not shown here. The foreign section is 305, and the feature ID in both section 3 and section 305 is 1901202411.

GDF-AR (CN1)
56 31901202411 1 56 3051901202411

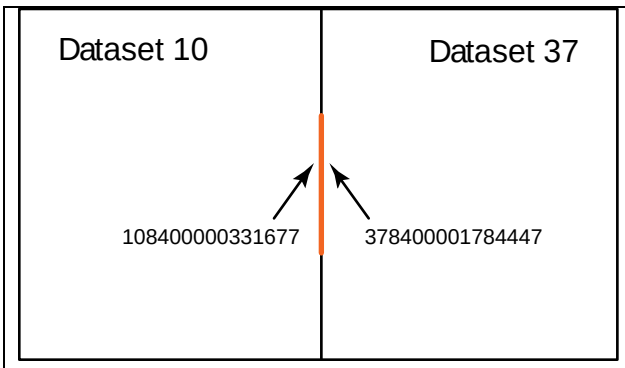
Explanation:

In the GDF-AR conversion record (CN1), the internal section is Section 3 (shown). The foreign section is 305, and the feature ID in both section 3 and section 305 is 1901202411.

Notes:

- Conversion Record: A point feature only generates a conversion record when it lies on a section border.
- Split Indicator: There is never a split indicator for a point feature.
- Relationship Record: Occurs in both Section 3 and Section 305.
- In Shapefile format, Junction IDs on dataset borders have a "10000" prefix. See also Working with Junctions on Dataset Boundaries in Shapefile earlier in this user guide.

Line Feature On a Dataset Border



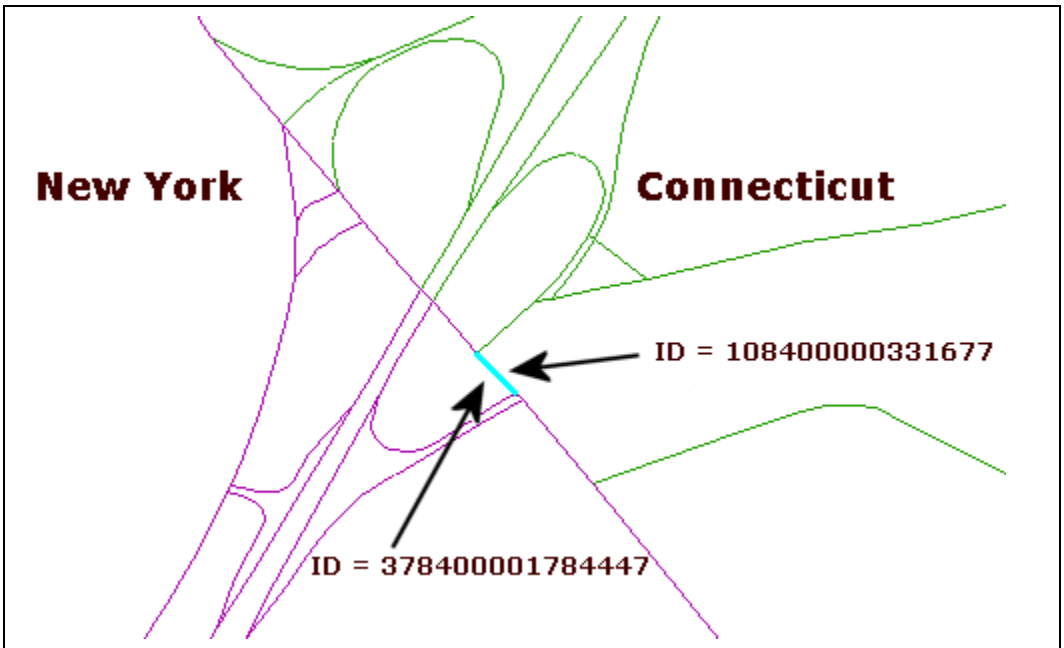
Line Feature 4110 On a Dataset Border

ID	FEATTYP	TABEXT	TOID
10840000033167 7	4110	NW	**37**840000178444 7

Explanation:

In the Shapefile conversion record (CN), the internal (From) dataset is **10** (Connecticut). The foreign dataset is **37** (New York),the country code is 840 for both (United States), the feature type that lays on the section border is a road element (4110) found in the network file (NW).

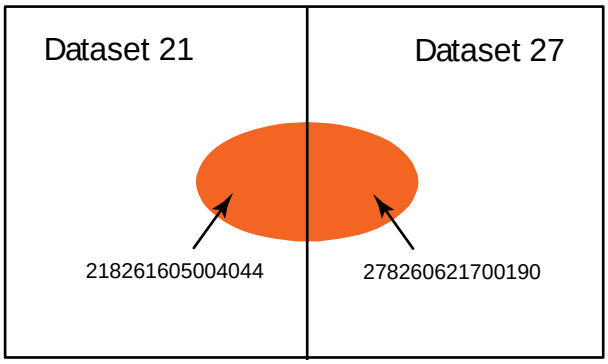
The internal feature ID (From feature) is 108400000331677 and the corresponding feature ID in the foreign feature (To feature) is 378400001784447. See map of the above example below.



Map of the Line Feature on a Dataset Border Example

Area Feature Crossing a Section or Dataset Border

- Conversion records are created when an area feature crosses a section or dataset border (in GDF, split indicator = "1").
- When an Area Feature only touches a section or dataset border but does not cross it, no conversion records are generated (in GDF, split indicator = "0").
- For area features crossing in Technical Datasets, conversion records are generated only for Index Areas & Urban Agglomerations.



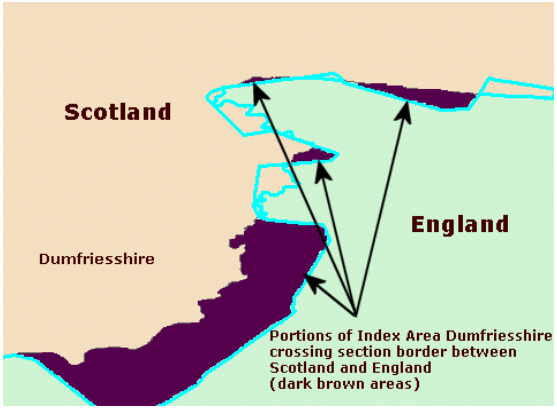
Area Feature 9200 Crossing a Dataset Border

ID	FEATTYP	TABEXT	TOID
21826160500404 4	9200	OA06	27826062170019 0

Explanation:

In the Shapefile conversion record (CN), the internal (From) dataset is **21** (Scotland). The foreign dataset is **27** (England) ,the country code is 826 for both (Great Britain), the feature type that crosses the section border is an Index Area (9200) found in the Other Named Areas file (OA06).

The internal feature ID (From feature) is 218261605004044 and the corresponding feature ID in the foreign feature (To feature) is 278260621700190. The Name field in both tables is Dumfriesshire. See map of the above example below.



Index Area Dumfriesshire (OA06) Crossing Section Borders

Complex Feature Administrative Area Crossing a Section or Dataset Border

Administrative areas have split indicator = "2" when crossing a section border.

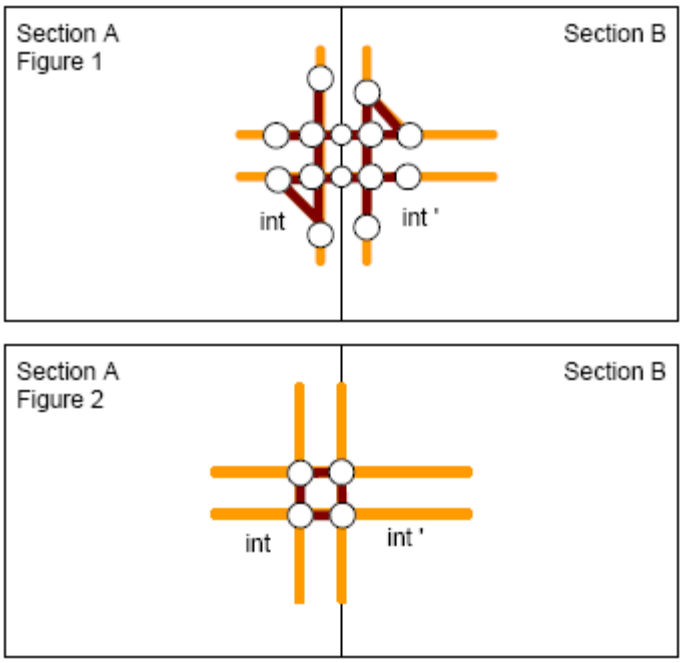
Conversion records are generated for administrative areas with split indicator = "2" when the sections are adjacent or when the administrative area is part of a section crossing relationship.

All Other Complex Features Crossing a Section or Dataset Border

All other complex features (other than complex administrative areas) have either split indicator "0" or "1."

Conversion records and split indicators differ when complex features cross sections within the same technical dataset compared to when they cross different datasets.

In the figures below, an intersection is represented by the brown lines for road elements and the white dots for junctions. The road elements that intersect are represented by the orange lines.



Complex Features Crossing Sections in the Same Technical Dataset

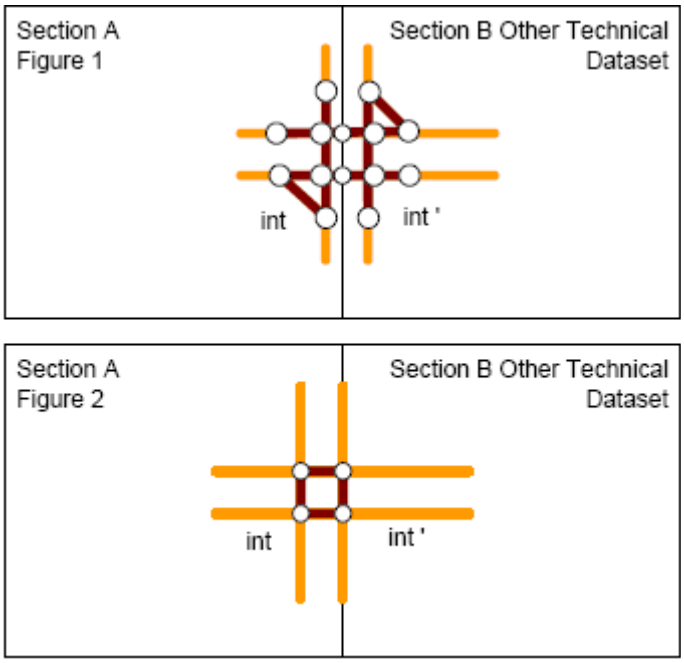
Explanation:

In Figure 1, the complex feature has split indicator = "1" in both sections A and B. The components of the intersection do not lie completely in one section. Conversion records are generated.

In Figure 2, the complex feature has split indicator = "0" for Section A. All components of the intersection lie completely in the section.

In Section B, the complex feature has split indicator = "1." Only the components of the intersection that lie on the border lie in Section B. Conversion records are only generated for Section B.

Conversion record dataset identifiers are identical for both sections.



Complex Features Crossing Sections in Different Technical Datasets

Explanation:

In Figure 1 of the above example, the complex feature has split indicator = "1" in both sections A and B. The components of the intersection do not lie completely in one section. Conversion records are generated.

In Figure 2 of the above example, the complex feature lies completely in Section A but it has Split Indicator = "1" instead of "0." This is because the feature lies on a technical data set border and there is no information if the feature has parts in the other technical dataset. The split indicator here only shows the possibility of components in the other technical data set.

As in the first example, the feature in Section B has Split Indicator = "1."

Conversion records are generated for both features in both sections of the different technical datasets. Conversion record dataset identifiers are different for both sections.

Features in Section Crossing Relationships

In GDF-AS format relationship record 50 and conversion record, the FEAT_CAT field holds the feature definition type. Below are the codes available:

FEATURE CATEGORY	FEATURE CATEGORY CODE
Point	1
Line	2
Area	3
Complex	4

In GDF-AR format, relationship record *.RLP identifies the feature type in the FeatCat field.

List of Relationships

On the following pages, examples of relationships that can cross section borders are explained. Use the links in the table below to find an appropriate or similar example.

CODE	NAME
1001	Road Element in Order 8 Area
1003	Road Element in Named Area
1006	Service in Order 8 Area
1007	Built-Up Area in Order 8 Area
1008	Ferry Connection in Order 8 Area
1010	Enclosed Traffic Area in Order 8 Area
1011	Road Element in Built-Up Area
1013	Ferry Connection in Named Area
1014	Service in Named Area
1016	Service in Built-Up Area
1022	Service Along Road Element
1024	Service at Junction
1026	Service Belonging to Service
1029	Centre Point of Feature Belonging to Feature
2101	Calculated Prohibited Maneuver
2102	Restricted Maneuver
2103	Implicit Turn
2103	Prohibited Maneuver
2104	Priority Maneuver
2128	Signpost Information
2199	Image Maneuver
2400	Place Within Place
9001	Vicinity: Service - City Center
9201	Address Area in Named Area
9202	Enclosed Traffic Area in Named Area
9203	Built-Up Area in Named Area
9501	Road Element in Order 9 Area
9502	Service in Order 9 Area
9503	Order 9 Area in Order 8 Area
9504	Enclosed Traffic Area in Order 9 Area

Relationship Examples

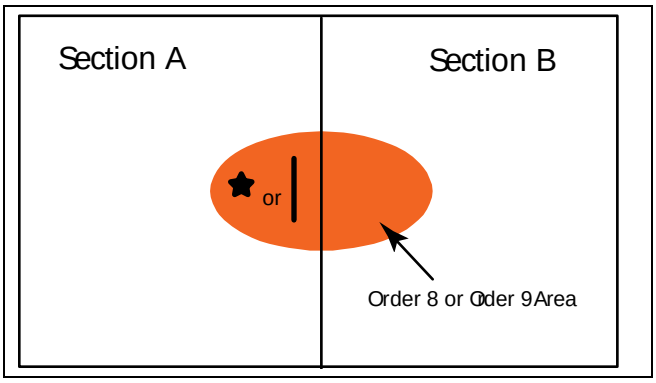
For further examples of Relationships in MultiNet data, contact a TomTom Customer Service representative and request the **Relationship Population in MultiNet 3.5.1** document. This document is not delivered on the standard documentation CD.

Point or Line Feature in Order 8 or Order 9 Area

Relationships:

CODE	RELATIONSHIP
1001	Road Element in Order 8 Area
1006	Service in Order 8 Area
1008	Ferry Connection in Order 8 Area
9501	Road Element in Order 9 Area
9502	Service in Order 9 Area

Example 1: Order 8 or Order 9 Area crosses section border, Feature completely in one section:

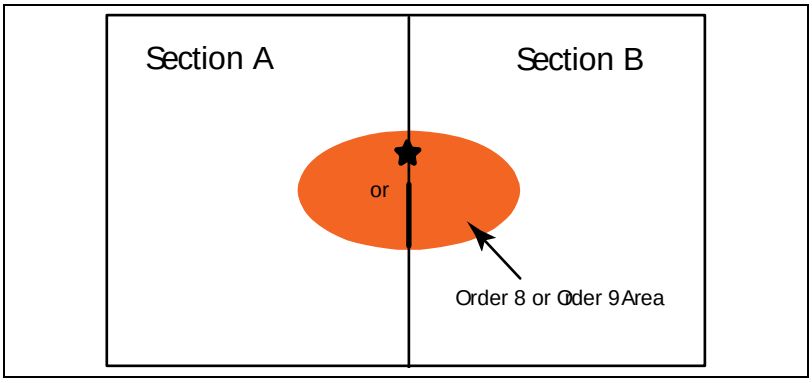


RELATIONSHIP	RELATIONSHIP CODE	SECTION OF RELATIONSHIP	RELATIONSHIP BETWEEN:
Service in Order 8 Area	1006	Section A	Order 8 Area and Service
Service in Order 8 Area	1006	Section B	No relationship
Road Element in Order 9 Area	9501	Section A	Order 9 Area and Road Element
Road Element in Order 9 Area	9501	Section B	No relationship

Explanation:

- In the above relationships, conversion records are created for the administrative area (split indicator "2", adjacent section) because of the relationships. The relationship record is only found in Section B.
- There are no conversion records for the point or line features.

Example 2: Order 8 or Order 9 Area crosses section border, Feature lies on section border:

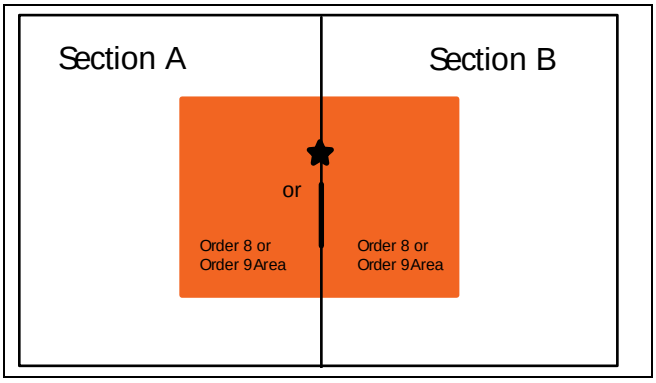


RELATIONSHIP	RELATIONSHIP CODE	SECTION OF RELATIONSHIP	RELATIONSHIP BETWEEN:
Service in Order 8 Area	1006	Section A	Order 8 Area and Servi
Service in Order 8 Area	1006	Section B	Order 8 Area and Servi
Road Element in Order 9 Area	9501	Section A	Order 9 Area and Road Element
Road Element in Order 9 Area	9501	Section B	Order 9 Area and Road Element

Explanation:

- In the above relationships, conversion records are created for the administrative area in each section (split indicator "2", adjacent section) because of the relationships. Relationship record is stored in both Section A and Section B.
- There are no conversion records for the point or line features.

Example 3: Order 8 or Order 9 Areas do not cross section border, Feature lies on section border:



RELATIONSHIP	RELATIONSHIP CODE	SECTION OF RELATIONSHIP	RELATIONSHIP BETWEEN:
Service in Order 8 Area	1006	Section A	Order 8 Area and Service
Service in Order 8 Area	1006	Section B	Order 8 Area and Service
Road Element in Order 9 Area	9501	Section A	Order 9 Area and Road Element
Road Element in Order 9 Area	9501	Section B	Order 9 Area and Road Element

Explanation:

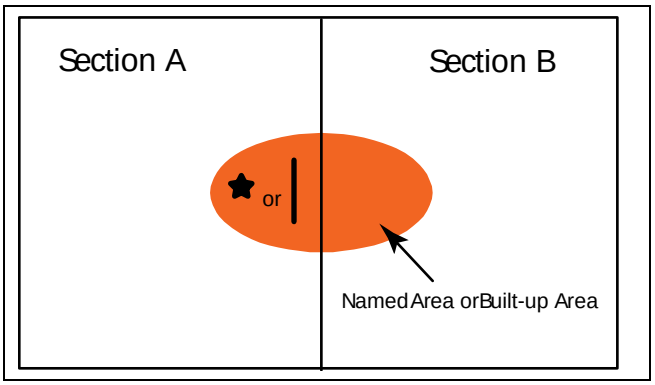
- In the above relationships, conversion records are created for the administrative area in each section (split indicator "2", adjacent section) because of the relationships.

Feature in Named Area or Built-Up Area

Relationships:

CODE	RELATIONSHIP
1003	Road Element in Named Area
1011	Road Element in Built-up Area
1013	Ferry Connection in Named Area
1014	Service in Named Area
1016	Service in Built-up Area

Example 1: Named Area or Built-up Area crosses section border, Feature completely in one section:

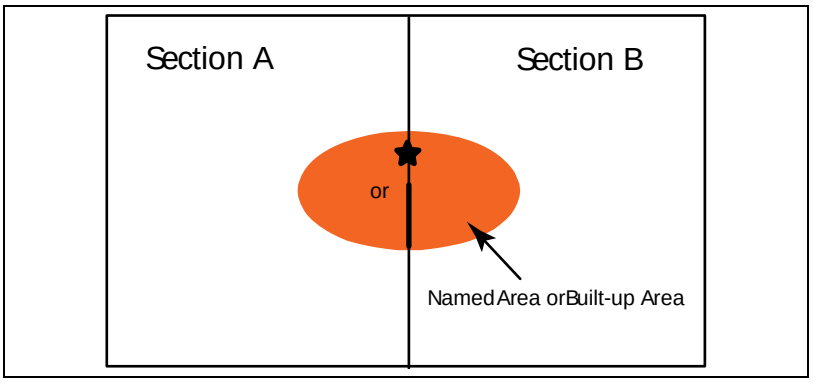


RELATIONSHIP	RELATIONSHIP CODE	SECTION OF RELATIONSHIP	RELATIONSHIP BETWEEN:
Service in Named Area	1014	Section A	Named Area and Service
Service in Named Area	1014	Section B	No relationship
Road Element in Built-up Area	1011	Section A	Built-up Area and Road Element
Road Element in Built-up Area	1011	Section B	No relationship

Explanation:

- In the above relationships, conversion records already exist according to conversion record generation for section crossing area features (split indicator = "1", area is split). Conversion records are not the result of the relationship. Relationship records are in Section A only.
- There are no conversion records for the point or line features.

Example 2: Named Area or Built-up Area crosses section border, Feature lies on section border:

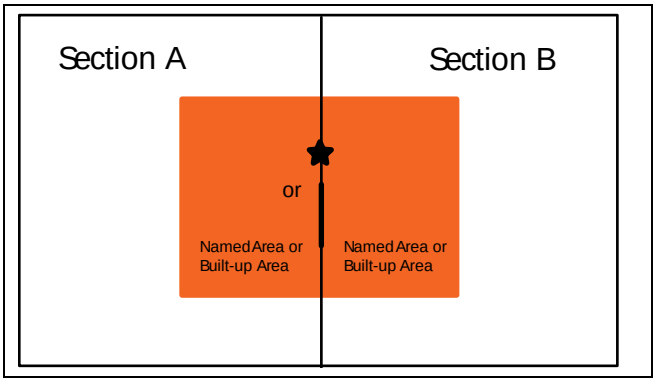


RELATIONSHIP	RELATIONSHIP CODE	SECTION OF RELATIONSHIP	RELATIONSHIP BETWEEN:
Service in Named Area	1014	Section A	Named Area and Service
Service in Named Area	1014	Section B	Named Area and Service
Road Element in Built-up Area	1011	Section A	Built-up Area and Road Element
Road Element in Built-up Area	1011	Section B	Built-up Area and Road Element

Explanation:

- In the above relationships, conversion records already exist according to conversion record generation for section crossing area features (split indicator = "1", area is split). Conversion records are not the result of the relationship. Relationship records are stored in both Section A and Section B.
- There are no conversion records for the point or line features.

Example 3: Named Area or Built-up Area does not cross section border, Feature lies on section border:



RELATIONSHIP	RELATIONSHIP CODE	SECTION OF RELATIONSHIP	RELATIONSHIP BETWEEN:
Service in Named Area	1014	Section A	Named Area and Service
Service in Named Area	1014	Section B	Named Area and Service
Road Element in Built-up Area	1011	Section A	Built-up Area and Road Element
Road Element in Built-up Area	1011	Section B	Built-up Area and Road Element

Explanation:

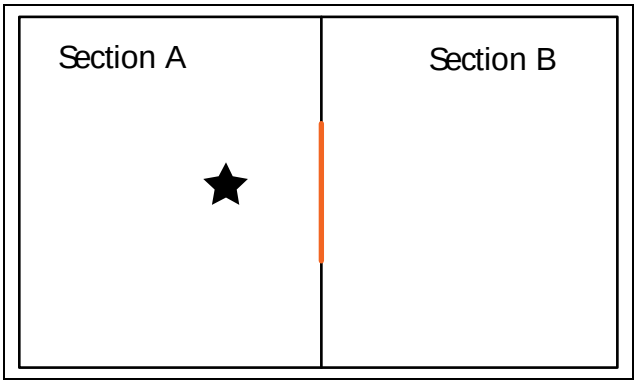
- In the above relationships, conversion records are already created for the areas in each section (split indicator = "1", adjacent section).

Service Along Road Element

Relationship:

CODE	RELATIONSHIP
1022	Service Along Road Element

Example: Service in one section, road element on section border:



RELATIONSHIP	RELATIONSHIP CODE	SECTION OF RELATIONSHIP	RELATIONSHIP BETWEEN:
Service Along Road Element	1022	Section A	Road Element and Service

Explanation:

- In the above relationship, conversion records already exist according to conversion record generation for line features on section borders (split indicator = "1", line is split).
- Relationship record occurs in Section A.

Service at Junction

Relationship:

CODE	RELATIONSHIP
1024	Service at Junction

Explanation:

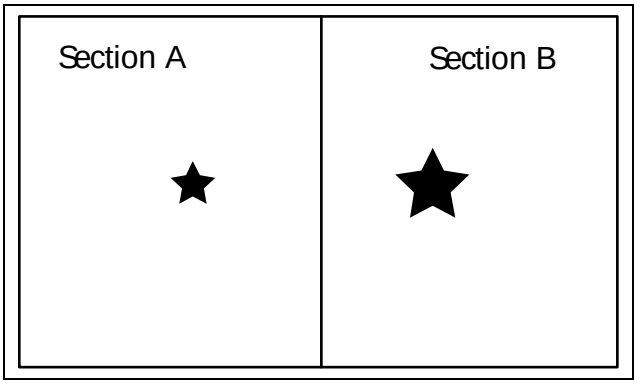
- When a service occurs at a Junction on a Section Border, there are conversion records for both the junction and the service according to conversion record generation for point features.
- There are two relationships, one in each section.

Service Belonging to Service

Relationships:

CODE	RELATIONSHIP
1026	Service Belonging to Service
9001	Vicinity: Service - City Centre

Example 1: Service in one section, other service in another section:

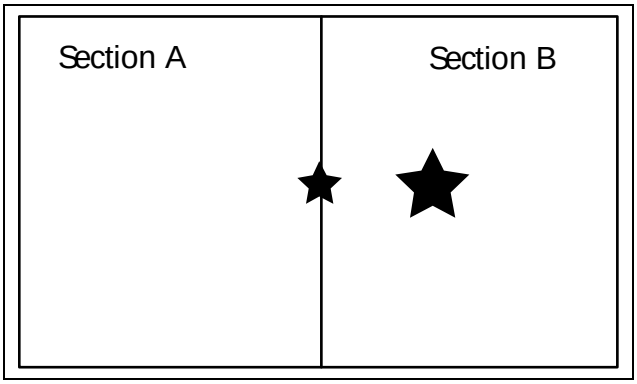


RELATIONSHIP	RELATIONSHIP CODE	SECTION OF RELATIONSHIP	RELATIONSHIP BETWEEN:
Service Belonging to Service	1026	Section A	Service (in Section B) and local Service (in Section A)
Service Belonging to Service	1026	Section B	Service (in Section A) and local Service (in Section B)

Explanation:

- Relationship records (46) are in both Section A and Section B.

Example 2: Service on section border, other service in another section:



RELATIONSHIP	RELATIONSHIP CODE	SECTION OF RELATIONSHIP	RELATIONSHIP BETWEEN:
Service Belonging to Service	1026	Section A	Service (in Section B) and local Service on section border
Service Belonging to Service	1026	Section B	Local Service on section border and local Service (in Section B)

Explanation:

- Relationship record (46) has full-feature reference and is stored in Section B.
- Conversion record is also in Section B.

Centre Point of Feature Belonging to Feature

Relationship:

CODE	RELATIONSHIP
1029	Centre Point of Feature Belonging to Feature

Centre Point of Feature belonging to Feature has 3 possible relationships in MultiNet®:

- Centrepoint of freeway intersection
- Centrepoint of Order 8 Area
- Centrepoint of Index Area.

No conversion records. Relationship record (46) has full-feature reference.

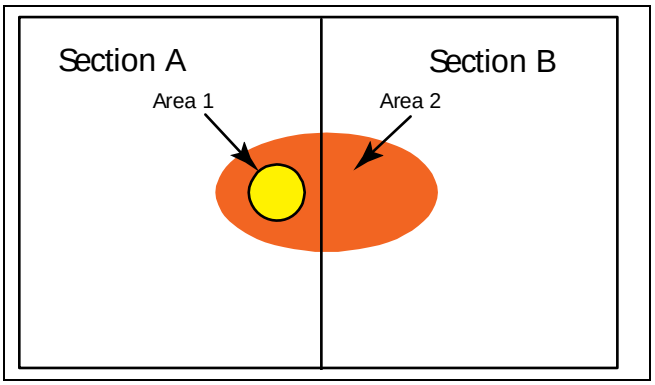
Area Within Area Relationships

Relationships:

CODE	RELATIONSHIP
1007	Built-up Area in Order 8 Area
1010	Enclosed Traffic Area in Order 8 Area
2400	Place Within Place
9503	Order 9 Area in Order 8 Area
9504	Enclosed Traffic Area in Order 9 Area

All non-administrative areas have conversion records because the split indicator = "1." An administrative area has split indicator = "2" and has conversion records, when sections are adjacent. The relationship occurs in the sections where both partners are present.

Example 1:



RELATIONSHIP	RELATIONSHIP CODE	SECTION OF RELATIONSHIP	RELATIONSHIP BETWEEN:
Built-up Area in Order 8 Area	1007	Section A	Built-up Area (Area 1) in Section A and Order 8 Area (Area 2) in Section B
Built-up Area in Order 8 Area	1007	Section B	No relationship

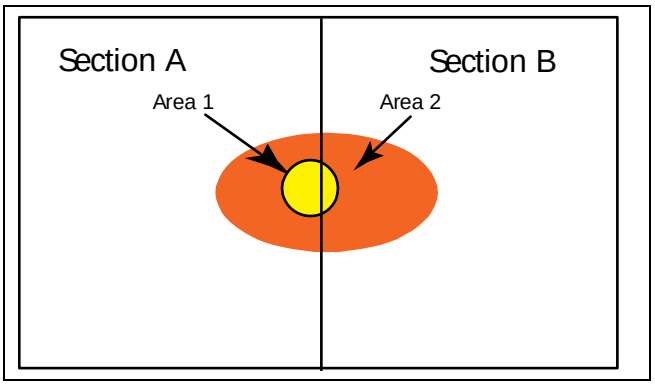
Explanation:

Administrative Order 8 Area has a split indicator of "2."

The following conversion records are created:

- In Section A, conversion record for Area1 and Area2 in Section B;
- In Section B, conversion record because of area crossing section rule. No relationship to Area 1 since Area 1 lies completely in Section A.

Example 2:



RELATIONSHIP	RELATIONSHIP CODE	SECTION OF RELATIONSHIP	RELATIONSHIP BETWEEN:
Built-up Area in Order 8 Area	1007	Section A	Built-up Area (Area 1) in Section A and Order 8 Area (Area 2) in Section B
Built-up Area in Order 8 Area	1007	Section B	Order 8 Area (Area 2) in Section B and Built-up Area (Area 1) in Section A

Explanation:

- The Built-up Area and Order 8 Area are both split across both sections.
- The Administrative Order 8 Area has split indicator = "2" and has conversion records.
- The Built-up Area has split indicator = "1" and has conversion records, according to the rule of conversion records for area features.
- The relationship occurs in both Section A and in Section B.

Area in Named Area Relationships

Relationships:

CODE	RELATIONSHIP
9201	Address Area in Named Area
9202	Enclosed Traffic Area in Named Area
9203	Built-up Area in Named Area

Explanation:

- These are area features that have split indicator = "1" when area crossing. Conversion records are generated accordingly.
- When the area that lies in the other area appears only in one Section, one relationship occurs in that section.
- Two relationships occur (one for each section) when the area that lies in the other area is also section crossing.

Address Area in Named Area occurs for:

- Address Area in Index Area;
- Address Area in Named Area.

TMC Information in GDF

TMC Location Structure in MultiNet® GDF Data

TMC Location References in the TomTom® MultiNet® database is stored as a Level 1 "RD" attribute of a Road or Ferry Element in the form "ABCCDEEEEE."

Where:

- A = Direction of Road Element (from start Junction to end Junction) compared with the TMC chain direction:
  - **+** = in positive direction and external to the TMC point location;
  - **-** = in negative direction and external to the TMC point location;
- B = EBU (European Broadcasting Union) Country Code;
- CC = TMC Location Code;
- D = TMC Direction of the Chain;
  - **+** = in positive direction and external to the TMC point location;
  - **-** = in negative direction and external to the TMC point location;
  - **P** = in positive direction and internal to the TMC point location;
  - **N** = in negative direction and internal to the TMC point location.
- EEEEE = TMC Point Location Code (found in the official TMC location Databases).

The RD attribute is located in the Segmented Attribute Record (44) and indirectly references the values in the Names Record (41).

Example:

441000248055 3**RD** **50260** 6G 3.6 1L 1

00800000048

41 **50260** 0UND**+129-07012**

In the example above:

- **RD** is the attribute, "RDS/TMC Code"
- 50260 is a reference to the Name record where the value is stored
- +129-07012 is the RDS/TMC value.

Location Table Code Version

The Location Table Code version is directly defined in the Segmented Attribute Record (44).

Example:

441000248055 3RD 50260 **6G** **3.6** 1L 1

00800000048

In the example above:

- **6G** is the attribute, "TMC Location Code Version Number"
- 3.6 is the attribute value (indicating version 3.6).

TMC Path Information

The TMC Path information, containing all related features in a TMC path, is located in the Complex Feature record (54). The path ID is referenced from the Segmented Attribute Record (44).

Example:

441000248055 3RD 50260 6G 3.6 **1L** 1

00**800000048**

54 **800000048** **9021**1 **32** **2** 39543 **2** 39544 2 39530 2 1

00 39531 2 39532 2 39444 2 39334 2 39101 2 39100 2 1

00 39491 2 39490 2 39251 2 39533 2 39534 2 39510 2 1

00 39263 2 39457 2 39369 2 39256 2 39279 2 39280 2 1

00 39257 2 39541 2 39542 2 39535 2 39536 2 39416 2 1

00 39088 2 39538 2 39075 2 39539 2 39540

In the example above:

- **1L** is the attribute, "TMC Path ID"
- 800000048 is the attribute value (path ID) whose contents are found in the Complex Feature record (54).
- 9021 is the Feature identifier, "TMC Path."
- 32 indicates how many times the feature code and feature ID repeat
- 2 39543 2 39544 etc., indicates that the feature code that is repeating is of type "2" = Line; and the feature's ID follows.

Artificial Administrative Areas

There are artificial or "dummy" areas in some of the TomTom datasets. A dummy administrative area is an area feature that is captured for GDF compliancy reasons only. It does not refer to any real-world administrative feature.

Artificial Order1-Order9 administrative areas are identified by seven consecutive "9"s followed by a four-digit number.

Example: 99999990001

These IDs may not be unique within a dataset. This situation is currently under investigation at TomTom. A temporary solution for users who need to make these areas unique would be to query records:

- Volume Header Record (01) to obtain the dataset ID;
- Section Identification Subrecord (1601) to obtain the section ID

and associate those IDs with the artificial administrative area.

Section 11: If You Need Help

Correction Policy

Our geographic data files are made as accurately as possible. If you find a problem, please contact us.

All corrections and problems are noted and examined as soon as possible. TomTom® makes every attempt to include any new information in the next product update.

Customer Support

If you have any questions about the files you have purchased, or are having difficulties with them, please call TomTom® Customer Support and have the following information available when you call:

- The product name and version number;
- The product format you received;
- The TomTom® Order Number (on the Packing Slip).

Contact Information

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Phone: 1-603-443-9260; or 1- 888-556-7160 (toll free US and Canada)

Appendix A: - References

Copyright File

The copyright file included with this product (cpyright.txt) contains the following text:

- © 2011 TomTom

Route Number Types

See the **MultiNet® 3.5.1 Specification** document on this documentation DVD for details.

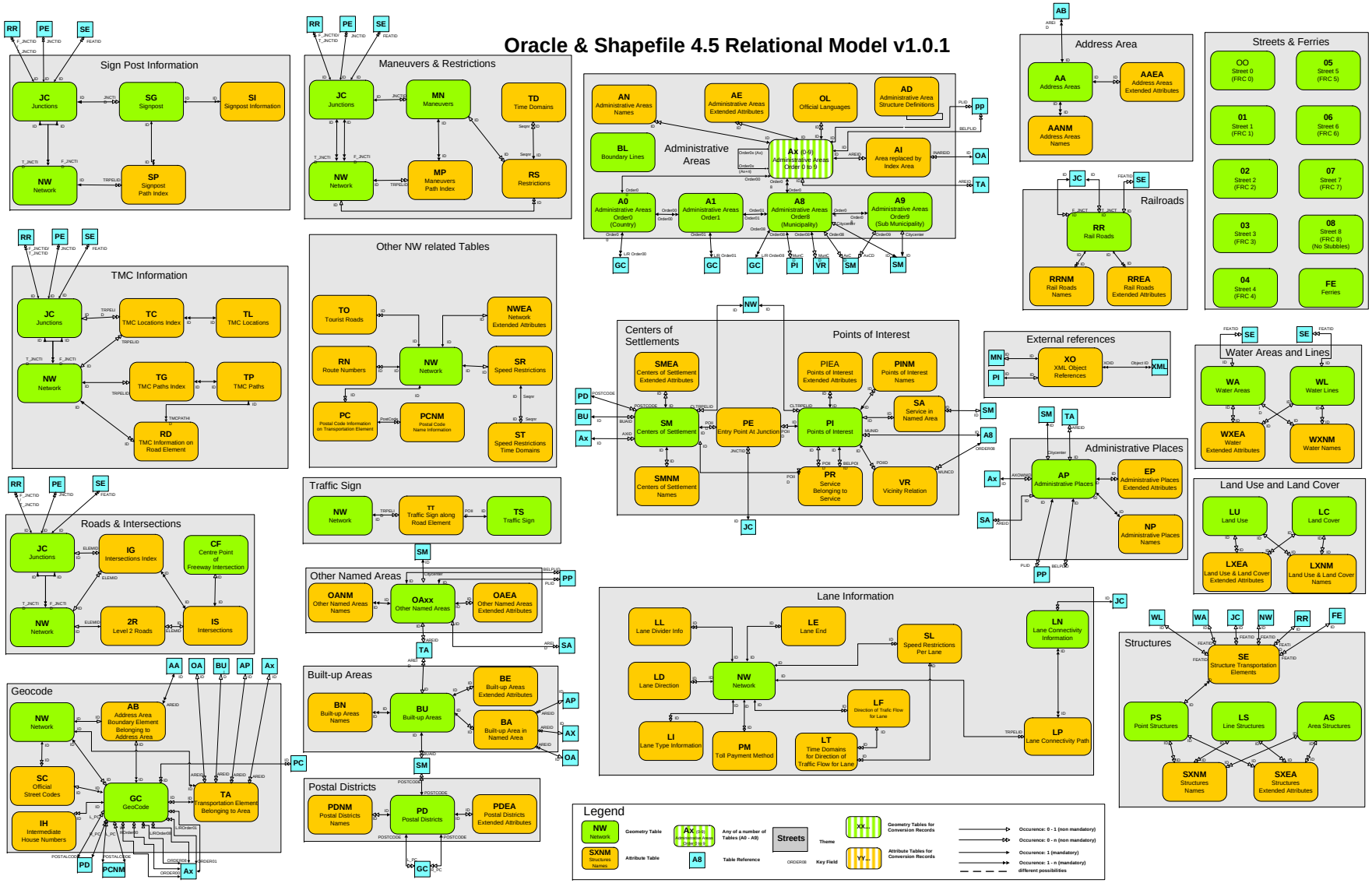
Feature Names and Codes

See the Appendix sections of the **MultiNet® 3.5.1 Specification** document on this documentation DVD for details.

Attribute Names, Codes, and Values

See the Appendix sections of the **MultiNet® 3.5.1 Specification** document on this documentation DVD for details.

Relationship Names and Codes

See the Appendix sections of the **MultiNet® 3.5.1 Specification** document on this documentation DVD for details.

Shapefile & Oslfile Data Model (Increase zoom level to 300% or more)