C. Killet Software Ing.-GbR, Postbox 400225, 47896 Kempen, Germany - Internet http://www.killetsoft.de - Email killet@killetsoft.de
Phone +49 (0)2152 961127 - Fax +49 (0)2152 961128

Data base tables "Geo Data International Houses"

Description

House Coordinates or also called Geo Coded Building Addresses are meaning the connection between the postal addresses of buildings or building complexes and their accurate positions in the coordinate system. The house coordinates are the basis for applications, which are developed to assign buildings or building complexes as exact as possible positions in the form of coordinates. By Geo Coding buildings or building complexes become cartographically representable.

Quality of the Geo Data

The geo data offered here are in very precise quality and are present in several coordinate and reference systems. The geo data are specifically for your order purchased from the current data release of well-known international manufacturers e.g. such as NAVTEQ, Tele Atlas or INFAS. The geo data then are supplemented, unified and, where appropriate, adapted to your needs by KilletSoft. The geo data therefore are always up to date and are subject to constant quality control by the manufacturer.

The house-exact geo data are used in many mobile navigation systems. The accuracy refers to individual buildings or building complexes. House number suffixes and house number ranges are not dissolved, since the local proximity of a building complex can be represented regularly by an individual numeric house number.

Detailed information, hints to the use of the geo references and the formulas for distance calculation can be found in the provided data specification.

Conversion to the necessary data format

As a standard the database tables are present in the file format CSV (Comma Separated Values). The used character set is UTF8. This format is used often and in most cases you can import the data directly into your own system.

The freeware program CONVERT, downloadable from the site **http://www.killetsoft.de/p_cona_e.htm**, converts the available database tables into other data formats and character sets with the necessary sortings and selections. With the program for example CSV data can be converted into the SDF format (Simple Document Format) or into the dBase format. For the use of the data on different platforms it is possible to select between the character sets ASCII, ANSI, UTF8 and UniCode. Thus the import of the data in any database management system or file system will be possible.

For the import in MySQL or SQL data bases the necessary "CREATE TABLE" script can be generated. Further the selection of the data on data fields and data records is possible. In addition the data can be sorted on base of the data fields. Data from several files can be joined to a common file.

Please contact us, if you need the data in another format, sort sequence or in another coordinate system.

Coordinate systems and Reference systems

The geo references of all objects are contained in the tables as geographic coordinates in degree and degree/minute/second notation and as UTM coordinates.

The UTM coordinates are globally present in 60 meridian strips with a width of 6 degree each. In order to be able to accomplish country-wide and even countries spreading distance calculations between the coordinates, the UTM coordinates with the suffix "_CENT" are converted country-wide to a uniform, national central meridian strip. The UTM coordinates with the suffix "_NAT" are present with the strip number of their natural meridian strip.

All Geoographical coordinates and the UTM coordinates of the countries not belonging to Europe are present as the reference system "WGS84 (worldwide, GPS), geocentric, WGS84". The reference system WGS84 is standardized the in the year 1984 world-wide as "World Geodetic System" on the also named WGS84 ellipsoid. It is used for navigation tasks with the American satellite navigation system GPS (Global Positioning System).

The UTM coordinates of the European countries are present as the reference system "ETRS89 (Europe), geocentric, GRS80". ETRS89 is the reference system uniform for all European countries. GRS80 is the ellipsoid used for the mapping of the coordinates. ETRS89 is a geocentric (on the earth center referred) reference system, which is almost identical to the reference system WGS84.

Because WGS84 deviates only very slightly within millimeter range from the ETRS89, the direct unification of the here used coordinates with GPS data and modern maps is possible.

Distance calculation with right-angled and metric coordinates

Because UTM coordinates are converted to a uniform meridian strip, distances between two points can be calculated by the simple execution of the Pythagoras theorem. That has the advantage in relation to the computation with geographical coordinates (see below) that it is substantially simpler and much faster. The result is the distance between the points in meters.

Formula for the distance calculation with UTM coordinates:

```
difEast      = abs(UTM_E_CENT_1 - UTM_E_CENT_2)
difNorth     = abs(UTM_N_CENT_1 - UTM_N_CENT_2)
distance     = sqrt(difEast * difEast + difNorth * difNorth)
  with
UTM_E_CENT_1:  Easting of the first coordinate
UTM_N_CENT_1:  Northing of the first coordinate
UTM_E_CENT_2:  Easting of the second coordinate
UTM_N_CENT_2:  Northing of the second coordinate
abs():         Absolute value
sqrt():        Square root
distance:      The result is the distance in meters
```

Distance calculation with geographic coordinates

Geographic coordinates are indicated in longitude and latitude. Usually longitude and latitude are represented in the degree/minute/second notation. For further calculations with the coordinates, the minute and second portions must be converted into parts of a degree. The representation of latitude and longitude in degrees is called the decimal notation. For a distance computation the longitude and latitude of the first point (Lon1, Lat1) and the longitude and latitude of the second point (Lon2, Lat2) are needed. If the longitude has a minus sign, the point is situated west of the Greenwich meridian, otherwise east of it. If the latitude has a minus sign, the point is on the southern earth hemisphere, otherwise on the northern earth hemisphere.

Representation of the longitude and latitude of a coordinate in the degree/minute/second notation (Data fields **LON_GEO** and **LAT_GEO**).

```
| Two to three digit degree portion of the coordinate (d)
|  | Two digit minute portion of the coordinate (m)
|  | | Two digit second portion of the coordinate (s)
|  | |  | Decimal portion of one second(s)
dddmmss.ss
with
d:         Degree portion of longitude or latitude
m:         Minute portion of longitude or latitude
s:         Second portion with decimals of longitude or latitude
```

Conversion of the lengths and widths of the two coordinates into the decimal notation. This is not necessary if Geographic coordinates in degree notation are used directly (data fields **LON_DEC** and **LAT_DEC**).

```
Lon1d = d + (m / 60) + (s / 3600)
Lat1d = d + (m / 60) + (s / 3600)
Lon2d = d + (m / 60) + (s / 3600)
Lat2d = d + (m / 60) + (s / 3600)
with
Lon1d:    Decimal longitude of the first point
Lat1d:    Decimal latitude of the first point
Lon1d:    Decimal longitude of the second point
Lat1d:    Decimal latitude of the second point
```

For further computation the longitude and latitude are converted into radians. The unit of the radian is [rad].

```
Lon1r = Lon1d * PI / 180
Lat1r = Lat1d * PI / 180
Lon2r = Lon2d * PI / 180
Lat2r = Lat2d * PI / 180
with
Lon1r:    Radian of the longitude of the first point
Lat1r:    Radian of the latitude of the first point
Lon1r:    Radian of the longitude of the second point
Lat1r:    Radian of the latitude of the second point
PI:       Circle constant Pi (3,14...)
```

Now the longitudes and latitudes of the two coordinates are so far prepared that they can be inserted into the formula for the distance computation.

```
distance = r * acos[sin(Lat1r) * sin(Lat2r)
           + cos(Lat1r) * cos(Lat2r) * cos(Lon2r - Lon1r)]
with
sin():    Sinus function
cos():    Cosinus function
acos():   Arcus Cosinus function
r:        Earth equatorial radius = 6378137 meter
distance: The result is the distance in meters
```

Field widths and data types

Field	**Max-Width**	**Typ**	**Description**
ISO3_CODE	3	C	Unique ID of the country (ISO 3166 ALPHA-3)
LANG_CODE	3	C	Unique ID for the Language used in the data record
STREET	40	C	Designation of the road
STR_NO	4	N	House number of a building or building complex
STR_SIDE	1	N	Street side of the building or building complex
POST_CODE	6	C	Postal zip code
TOWN	40	C	Designation of the town / city
QUARTER	40	C	Designation of the town quarter (optional)
MUNIC_CODE	8	C	Administration ID (municipality key)
ADMIN1	40	C	Name of the 1st administr. unit (e.g. federal state)
ADMIN2	40	C	Name for the 2nd adm. unit (e.g. province)
ADMIN3	40	C	Name of the 3rd admin. unit (e.g. county / district)
LON_DEC	10	N	Geographic longitude in degree notation (WGS84)
LAT_DEC	9	N	Geographic latitude in degree notation (WGS84)
LON_GEO	10	N	Geographic longitude in degree/minute/second notation (WGS84)
LAT_GEO	9	N	Geographic latitude in degree/minute/second notation (WGS84)
UTM_E_NAT	8	N	UTM easting (ETRS89) on the natural meridian strip
UTM_N_NAT	8	N	UTM northing (ETRS89) on the natural meridian strip
UTM_E_CENT	8	N	UTM easting (ETRS89) on an uniform meridian strip
UTM_N_CENT	8	N	UTM northing (ETRS89) on an uniform meridian strip
UTM_STRIP	2	N	UTM strip number of the uniform meridian strip

Data field ISO3_CODE

Unique ID for the country / the state, on whose territory the data in the file are contained. The ID corresponds to the international country code in ISO 3166 ALPHA-3 standard.

Data field LANG_CODE

Unique ID for the language used in the data record. In some countries several languages are in use. The language ID differentiates multilingual descriptions for the same street, town etc.

Data field STREET

Designation of the street / road, where the building / building complex is placed. If in a town / municipality several times the same road designation occurs, the streets are differentiated with the entries in the fields POST_CODE and QUARTER.

Data field STR_NO

House number of a building or building complex.

Data field STR_SIDE

This flag reprents the street side of the building or building complex.

Digit 1:	L	left street side
	R	right street side

Data field POST_CODE

Postal Zip Code of the postal area, in which the building / building complex is placed. If in a town a street designation is several times present, the address is differentiated with the entries in the fields POST_CODE and QUARTER.

Data field TOWN

Designation of the town / municipality in which the building / building complex is located.

Data field QUARTER

Designation of a town / municipality quarter in which the building / building complex is located. If the data field contains the designation "Center", the building is in the main quarter of the town. If in a town a street designation is several times present, the address is differentiated with the entries in the fields POST_CODE and QUARTER.

Data field MUNIC_CODE

Country dependend Administration ID (municipality key).

Data field ADMIN1

Name of the administrative unit standing most highly in the hierarchical structure of the country (e.g. federal state)

Data field ADMIN2

Name of the administrative unit standing at 2nd place in the hierarchical structure of the country (e.g. province)

Data field ADMIN3

Name of the administrative unit standing at 3rd place in the hierarchical structure of the country (e.g. county / district)

Data field LON_DEC

Geographic longitude (WGS84) of the building / building complex in degree notation.

The degree notation is also called the decimal notation. The minute and second portion of the coordinate are converted into a decimal fraction of a degree and are placed behind the comma.

As geodetic reference system "WGS84 (worldwide, GPS), geocentric, WGS84" is used. Please read the section "Coordinate and Reference Systems" for resuming information.

Geographical coordinates in degree notation are particularly suitable well for searches with Google Earth. Here is as an example an Internet URL with coordinates from the "Geo Data International Houses", which can represent the location of Killet Software Ing.-GbR point-exactly:
http://maps.google.com/maps?t=k&ll=51.397363,6.450883&spn=0.002,0.002
The first value behind the identifier "ll" (lat / lon) is the geographical latitude, then the geographical longitude follows. The shown URL can be inserted directly into the address field of the browser to represent a map cutout on the screen.

```
Digit 1:          Sign for coordinates to the west of Greenwich
Digits 2 to 10:  Geographic longitude in degree
```

Data field LAT_DEC

Geographic latitude (WGS84) of the building / building complex in degree notation.

See information of the data field LON_DEC.

```
Digit 1:          Sign for coordinates of the southern hemisphere
Digits 2 to 9:   Geographic latitude in degree
```

Data field LON_GEO

Geographic longitude (WGS84) of the building / building complex in degree/minute/second notation.

The degree/minute/second notation is also called the gradual notation. The degree, minutes and seconds of the geographical longitude and latitude are represented as two digits each before the comma. The decimal part of one second is placed behind the comma.

As geodetic reference system the WGS84 datum on the WGS84 ellipsoid is used. Please read the section "Coordinate and Reference Systems" for resuming information.

```
Digit 1:          Sign for coordinates to the west of Greenwich
Digits 2 to 4:   Degree portion of the geographic longitude
Digits 5 and 6:  Minute portion of the geographic longitude
Digits 7 and 8:  Second portion of the geographic longitude
Digits 9 and 10: Decimal fraction of a second
```

Data field LAT_GEO

Geographic latitude (WGS84) of the building / building complex in degree/minute/second notation.

See information of the data field LON_GEO.

```
Digit 1:          Sign for coordinates of the southern hemisphere
Digits 2 and 3:  Degree portion of the geographic latitude
Digits 4 and 5:  Minute portion of the geographic latitude
Digits 6 and 7:  Second portion of the geographic latitude
Digits 8 and 9:  Decimal fraction of a second
```

Data field UTM_E_NAT

UTM easting (ETRS89) of the building / building complex on the natural meridian strip.

Please read the section "Coordinate and Reference Systems" for resuming information.

```
Digits 1 and 2:  UTM meridian strip  number of the natural meridian
```

Digits 3 to 8: UTM easting in meter

Data field UTM_N_NAT

UTM northing (ETRS89) of the building / building complex on the natural meridian strip.

Please read the section "Coordinate and Reference Systems" for resuming information.

Digit 1: Sign for coordinates of the southern hemisphere
Digits 2 to 8: UTM northing in meters

Data field UTM_E_CENT

UTM easting (ETRS89) of the building / building complex on an uniform meridian strip.

Please read the section "Coordinate and Reference Systems" for resuming information.

Digits 1 and 2: UTM meridian strip number of the uniform meridian
Digits 3 to 8: UTM easting in meters on the meridian strip

Data field UTM_N_CENT

UTM northing (ETRS89) of the building / building complex on an uniform meridian strip.

Please read the section "Coordinate and Reference Systems" for resuming information.

Digit 1: Sign for coordinates of the southern hemisphere
Digits 2 to 8: UTM northing in meters

Data field UTM_STRIP

Strip number of the uniform UTM coordinates of the data fields UTM_E_CENT and UTM_N_CENT.

Digits 1 and 2: UTM strip number of the uniform meridian