Geodaten

Datenbeschreibung

EWS 2012

Distance Matrix

for Germany R2012_V1.0

and Europe R2012_V1.1

DDS Digital Data Services GmbH

Stumpfstr. 1 76131 Karlsruhe
Telefon: 0721-9651-400
Telefax: 0721-9651-419
www.ddsgeo.de
service@ddsgeo.de

Dokumentversion 1201
EWS_121_1211_engl.doc

Data Description
EWS – Distance table of streets

Contents

Data Description
EWS – Distance table of streets

1 General

On 01.01.1994 the use of the long distance freight transport tariff (GTF) came to an end. This means that not only the tariffs but also the previously binding basis of distance calculation for invoicing forwarders' services were no longer valid.

A new standard of calculation is provided by PTV AG/DDS GmbH in the form of the distance matrix Entfernungswerk Straße (EWS)). The EWS was developed together with PTV AG, the Bundeszentralgenossenschaft Straßenverkehr (BZG), Dr. Malek Software GmbH and DST Dresden. From 2012, DDS GmbH has been producing the EWS in cooperation with Dr. Malek Software GmbH. Although it does not provide binding information, the EWS is now seen as a general standard in its field. Comfortable computer-supported information systems can be easily created or existing systems and databases can be extended using the simple EWS data structure.

The EWS is available for Germany and Europe and provides the following features:

Calculation of realistic distances for transport between all places in Germany or Europe based on a digitized street network

- Clear and simple handling
- Accurate information for long distance; also suitable for local transport
- Regular updates
- Integration of EWS Germany to EWS Europe is possible

2 The EWS principle

The EWS consists of a place file and a corresponding distance matrix in which the road distances between the places in the place file are stored.
The place file contains the places which exist in the BZG's place file which has been available since July 1993. This file was jointly developed by BZG and PTV AG. An update of the place file is performed once a year.

2.1 Nodes as representatives of the place file

Due to the number of places available, half the distances between places are calculated, rather only those between selected representatives in the place file. These representatives are known as nodes. They are selected based on their population density. In this way economically important areas are refined by more nodes.

The other places (without representatives) are assigned to the nearest node. This assignment is performed on the basis of the shortest distances (= as the crow flies) to the nodes.

The nodes are not always identical in the various matrices, i.e. a region in Germany is covered by many more nodes in the EWS Germany than in the EWS Europe. On a European level all places in a country are always assigned nodes from the same country; an allocation across country borders therefore does not occur. The matrix for Europe is based on up to 10,000 nodes, the German matrix is based on up to 7,300 nodes.

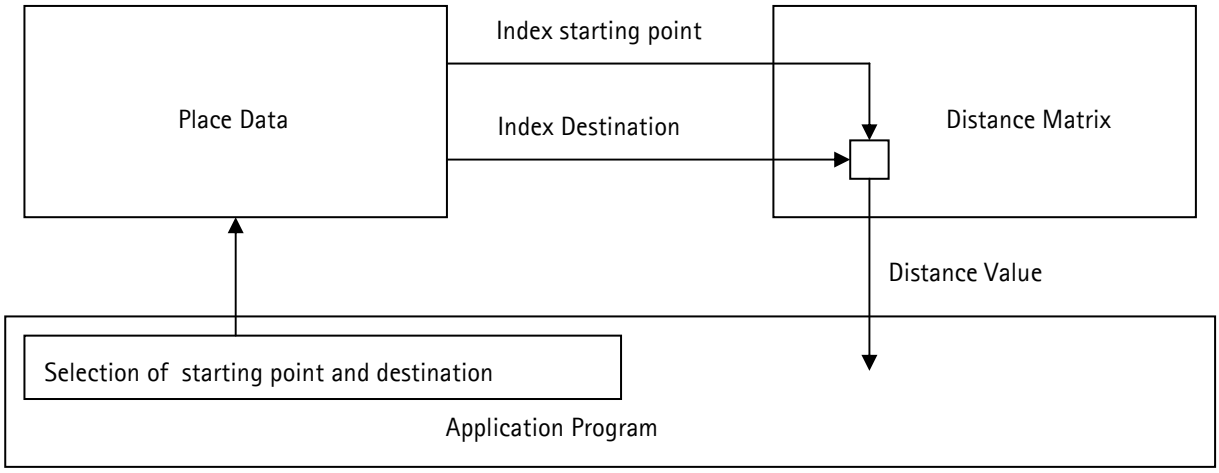
2.2 Distance calculation between places

Place file and distance matrix are separate data records. Start and destination place are selected for the distance calculation from the place file. Each place entry contains an index which is used to define the distance value from the matrix.

Example:

Country	Postcode	Place Name	Matrix index
D	10969	Berlin	813
:	:	:	:
D	36419	Geisa	2723

The Distance from Berlin to Geisa is found within the nodes/matrix 813 and 2723. The distance from node 2723 to node 813 is same as from node 813 to node 2723 (look up at 3.3 distance matrix).



2.3 Digital Road network as basis for calculation

The distance matrices are calculated on the basis of an extensive digital road network. Each network is up-to date and complete, containing all roads, which are required for the selected area coverage, border crossings and ferries. Each distance results from an optimum route calculation. The distance of this route is entered in the matrix field.

Average Speeds:

Motorway	Fast	75 km/h
Motorway	Average	65 km/h
Motorway	Slow	60 km/h
Trunk Road	Fast	45 km/h
Trunk Road	Average	42 km/h
Trunk Road	Slow	40 km/h
B-Road	Fast	40 km/h
B-Road	Average	35 km/h
B-Road	Slow	30 km/h
Urban Road	Fast	30 km/h
Urban Road	Average	20 km/h
Urban Road	Slow	15 km/h

2.4 Accuracy

The allocation and therefore the matching of places to their corresponding nodes means that inaccuracies will occur in the distance. The distances between place and nodes can be between 3 and 8 km in EWS Germany. This is 10 to 15 km in the EWS Europe. In lesser populated areas the distances can be even more than 8 or 15 km.

Only the distances between the nodes are exact. However it must be noted that EWS only provides a possible distance between two places. When calculating this distance the time factor (quickest route) plays a 90% role; the distance factor (shortest route) is included at 10%. The distance covered by a ferry is not taken into account (Distance = 0 kilometers).

Since the EWS version from 1998 the connection between the street network and the matrix nodes has been realised using the nearest street. In the previous version the connection took place using the nearest network node. All major rivers were taken into account as barriers for the connection of places to the matrix nodes.

In 2009 a large number of places was added to 14 Eastern European countries. These places are still included in the current EWS release, bringing the total number of places in Europe to almost 560,000. The places file is updated regularly.

The German matrix contains 7,261 nodes and about 26 mio distances. The European matrix contains 9,953 nodes and about 49,5 mio distances. The matrix was calculated by the newly 2010 road network.

To calculate a distance from Germany to another country a simple way is to use the European matrix (EWS Europe). A better way which is more accurate is possible with EWS Europe Plus: First, calculate the distance from the German starting point to the border crossing via the German matrix, and then calculate the distance from the border crossing to the destination point abroad via the European matrix. To do this the border crossing must be known and found in the place file.

2.5 The EWS versions

Three different EWS versions are available: EWS Germany, EWS Europe and EWS Europe Plus. All versions are provided on CD. For Germany and Austria toll flags are additional provided.

2.6 EWS Versions and their specifications

EWS-Type	Consignment	Memory
EWS Germany	Place file including 116,541 places	ca. 17 MB
	Distance matrix based on 7,261 nodes	ca. 170 MB
EWS Europe	Place file including 559,496 places (including 116,541 German places)	ca. 80 MB
	Distance matrix based on 9,953 nodes	ca. 320 MB
EWS Europe Plus	Place file including 559,496 places (including 116,541 German places)	ca. 80 MB
	Distance matrix based on 7,261 nodes	ca. 170 MB
	Distance matrix based on 9,953 nodes	ca. 320 MB

2.7 Number of places and nodes EWS Europe / EWS Europe Plus**

Nr.	Country Code	Name	Places	PC_Places*	Nodes
1	A	Austria	23,533	23,426	605
2	AL	Albania	405	0	42
3	AND	Andorra	41	7	3
4	B	Belgium	4,582	4,395	293
5	BG	Bulgaria	7,129	7,108	68
6	BIH	Bosnia-Herzegovina	909	154	43
7	BY	Byelorussia	22,445	22,415	104
8	CH	Switzerland	7,325	7,207	279
9	CY	Cyprus	213	101	20
10	CZ	Czech Republic	15,541	15,483	195
11	D	Germany	116,541	116,260	1,678**
12	DK	Denmark	6,412	6,392	146
13	E	Spain	39,904	32,703	735
14	EST	Estland	3,864	3,856	37
15	F	France	54,429	54,214	756
16	FIN	Finland	6,210	6,184	91
17	FL	Liechtenstein	23	15	1
18	GB	Great Britain	50,759	50,700	616
19	GBZ	Gibraltar	6	0	2
20	GE	Georgia	21	0	21
21	GR	Greece	850	500	109
22	H	Hungary	5,548	5,512	121
23	HR	Croatia	4,659	4,602	50
24	I	Italy	29,189	29,118	607
25	IRL	Ireland	2,963	112	43
26	L	Luxemburg	4,139	4,093	4
27	LT	Lithuania	13,424	13,401	50
28	LV	Latvia	12,392	12,371	27
29	M	Malta	74	71	2
30	MC	Monaco	5	3	0
31	MD	Moldavia	1,671	1,659	89
32	MK	Macedonia	2,600	2,591	22
33	MNE	Montenegro	275	68	8
34	N	Norway	4,606	4,441	94
35	NL	Netherland	7,921	7,776	282
36	P	Portugal	9,669	9,649	148
37	PL	Poland	29,759	29,707	577
38	RO	Romania	11,798	11,769	271
39	RSM	San Marino	11	11	1
40	RUS	Russia	8,063	8,021	595
41	S	Sweden	11,589	11,516	92
42	SK	Slovakia	3,997	3,969	49
43	SLO	Slovenia	2,562	2,519	21
44	SRB	Serbia	1,468	734	65
45	TR	Turkey	1,160	1,002	560
46	UA	Ukraine	28,811	28,771	331
47	V (new in R2012_V1.0)	Vatican	1	1	0

* PC like „-PORT“ or „-NL“ are not counted.
** In addition there are 7,261 nodes for Germany in EWS Europe Plus

2.8 Comment to places in Austria

In EWS 2004 a reorganisation of places in Austria took place, and is still valid: the data was restructured in line with the Austrian postal office.

- main place field (Name 1) place name of part place name submitting to main postal office.

- part place field (Name 2) place name of main postal office

2.9 Updates

Due to the constant and independent further development of the base data records for the network and location file, regular updates are performed. Completely new data records are provided each time. EWS currently appears annually.

2.10 The alternative to EWS – Creating custom distance lists

It is possible to create individual distance matrices as an alternative to the distance matrix. In order to do this the starting point and destination may have to be preset by the customer. For example distance calculations are possible

- from one starting point to all places in Europe,
- from 10 starting points in Germany to all other places in Germany,
- from all major cities in Germany to all major cities in France,
- for various fleets (car, HGV),
- while considering certain conditions (e.g. transportation of dangerous goods).

Further information, prices and delivery formats are available upon request.

3 Interface Description

3.1 Files Names and Formats

Filename	Contents
d2012.ods	Place file Germany
d2012.dm	Distance matrix Germany
eu2012.ods	Plce file Europe / Europe Plus
eu2012.dm	Distance matrix Europe / Europe Plus

File Formats: ASCII, DOS-Codepage, Codepage 850

3.2 Record structure of place file

Feld	Typ	From	To	Length	Contents
1	A	1	3	3	Country ID (see legend for contents)
2	A	4	12	9	Postcode Not available for every country and every place. In Germany the 5-digit postcodes are provided. Exceptions: a) Border crossings have the ID of the neighbouring country entered here with an additional minus sign (e.g. –F or –CH) b) Ports have the postcode -PORT
3	A	13	36	24	Place name 1 Postal name
4	A	37	60	24	Place name 2 Description of place name. This can be a district for example, or a neighbourhood or a historical name. It can also be the community name, if this is not the same as the postal name (= Place name 1).
5	A	61	61	1	Record ID 1 = Main place 3 = District or historical place name 5 = Description of place name 9 = Border crossing

Field	Type	From	To	Length	Content
6	A	62	62	1	Record ID addition If the record ID from field 5 is 1 or 3: 0 = Standard 1 = Description in place name 2 If the record ID from field 5 is 9: 0 = International street crossing 1 = International ferry 5 = National street crossing 6 = National ferry
7	A	63	67	5	GTB/Nodes East Germany GTB = 5 Digits D-East = 0 followed by 4 digits This field only exists for reasons of compatibility with older versions. It is no longer maintained!
8	A	68	68	1	Carriage class A-Z, for Germany only House freight-place class according to catalogue from Bundesverband Spedition and Logistik e.V. (BSL) This field only exists for reasons of compatibility with older versions. It is no longer maintained!
9	A	69	77	9	Place ID (IKONA-ID) The ID is a unique key for Germany or an individual country. This ID is not unique in the European place file. A unique key is only provided when the ID is combined with the country code.
10	A	78	82	5	Former 4-digit postcode for Germany including code for East or West, e.g. O2251 for Usedom or W8991 for Lindau. This field only exists for reasons of compatibility with older versions. It is no longer maintained!
11	A	83	91	9	Administration number Not available for every country and every place. In Germany the 8-digit district IDs are provided: 1st up to 2nd digit = Federal State 3rd digit = Administrative area 4th up to 5th digit = District 6th to 8th digit = Community
12	N	92	93	2	Place size class (see legend for contents)
13	N	94	102	9	Horizontal co-ordinates (optional, additional charge)
14	N	103	111	9	Vertical co-ordinates (optional, additional charge) Prices are available upon request.

Field	Type	From	To	Length	Content
15	N	112	120	9	Index for matrix Germany
16	N	121	129	9	Next node point in street network Germany (is always filled in with 0)
17	N	130	138	9	Index for matrix Europe
18	N	139	147	9	Next node point in street network Europe (is always filled in with 0)

Legend

Typ:

A = Alphanumerical (always left aligned)

N = Numerical (always right aligned)

Co-ordinate system:

If the place file contains co-ordinates they are available in one of the following systems (maybe others):

- Geographic: Decimal information with 4 decimal points (±GGGNNNN) or with 5 decimal points (±GGGNNNNN)
- UTM: Details in converted UTM co-ordinates, zone 32, unit 100m,
- Conform: Details in converted conform co-ordinates, Unit 100m. The range of values in Europe is between 0 and 40000.

Place size class:

The place size classes do not refer to the actual number of inhabitants, but to a place's or a town's relative importance. They must therefore be seen as a guideline which only serve as a general classification of places. The population status is unknown.

Each district has its own size class. However it often occurs that all or several postal code districts have the same classes.

0 = unknown

1 = < 100

2 = 100 <= x < 200

3 = 200 <= x < 500

4 = 500 <= x < 1000

5 = 1000 <= x < 2000

6 = 2000 <= x < 3000

7 = 3000 <= x < 5000

8 = 5000 <= x < 10000

9 = 10000 <= x < 20000

10 = 20000 <= x < 50000

11 = 50000 <= x < 100000

12 = 100000 <= x < 250000

13 = 250000 <= x < 500000

14 = x>= 500000

Country Code:

A = Austria
AL = Albania
AND = Andorra
B = Belgium
BG = Bulgaria
BIH = Bosnia-Herzegovina
BY = Belarus
CH = Switzerland
CY = Cyprus
CZ = Czech Republic
D = Germany
DK = Denmark
E = Spain
EST = Estonia
F = France
FIN = Finland
FL = Liechtenstein
GB = Great Britain
GE = Georgia
GR = Greece
GBZ = Gibraltar
H = Hungary
HR = Croatia
I = Italy
IRL = Ireland
L = Luxemburg
LT = Lithuania
LV = Latvia
M = Malta
MC = Monaco
MD = Moldova
MK = Macedonia
MNE = Montenegro
N = Norway
NL = Netherlands
P = Portugal
PL = Poland
RO = Romania
RSM = San Marino
RUS = Russia
S = Sweden
SK = Slovakia
SLO = Slovenia
SRB = Serbia
TR = Turkey
UA = Ukraine
V = Vatican (new in R2012_V1.0)

3.3 Record structure of distance matrix

The number of the matrix rows is given in the first row. The distance matrix is stored row by row in the matrix. Each matrix row in the distance matrix begins with the number of the displayed matrix row. Each matrix row is split after 12 values, i.e. a matrix row can consist of several text rows. Each matrix row ends with the character sequence "0000". The following matrix row begins with a new text row. The matrix values represent the distance in km. A few matrix values can have the value "0". The row 24 begins with the row number and the first 12 values, then a new text row begins with a further 11 values and the end of the row 0000.

For example:

```
7261 Matrixzeile(n), 7261 Matrixspalte(n)                (7,261 matrix rows, 7,261 matrix columns)
   1  0000
   2     8  0000
   3     9     3  0000
   4     7    12    15  0000
   5     5    12    12     4  0000
   6    10    18    17    15    16  0000
   7     4    11    11    10     9     9  0000
   8    10    16    13    15    14    13     6  0000
   9    13    20    17    19    17    21     8    11  0000
  10    16    10     7    20    20    26    16    20    28  0000
  11    12    18    15    18    16    26     8     4     9    23  0000
  12     9     8    10    10    11    32    12    17    21    15    19  0000
  13    16    22    14    22    20    25    14     9    17    12    12    27
     0000
  14    24    18    18    28    27    33    27    15    22    10    17    23
        6  0000
  15    19    14    14    23    23    29    22    21    29     5    24    19
       13     8  0000
  16    10    13    16     7     8    28    14    19    22    21    21    11
       33    29    24  0000
  17    13     8     6    20    16    22    16    17    24     5    19    15
        8     8    10    21  0000
  18    13     8    11    16    18    23    17    21    25    13    23     9
       24    27    22    17    18  0000
  19    19    13    14    23    22    28    22    27    30    11    29    18
       22    25    11    24    16     9  0000
  20    26    21    21    30    30    36    29    34    38    19    36    16
       30    32    18    31    23    10     8  0000
  21    21    31    20    41    25    33    17    11    19    23    14    36
        7    11    21    42    14    40    38    46  0000
  22    42    36    37    46    45    52    45    50    53    34    52    28
       45    48    34    32    39    22    19    15    61  0000
  23    30    24    25    34    34    40    33    38    41    22    40    23
       33    36    22    35    27    17    12     7    49     9  0000
  24    33    28    28    37    37    43    36    41    45    26    43    33
       37    39    25    38    30    25    16    18    53    11    12  0000
```

3.4 Notes on working with EWS matrix

A 7000 * 7000 matrix occupies around 170 MB. It is therefore generally not possible to directly load this matrix. As the distances are all symmetrical, i.e. the route from A to B is the same length as from B to A, the ASCII matrix has a triangular matrix structure. Efficient storage can be achieved by reading all distance values (without matrix diagonals) one after another into a one-dimensional field. For the above data this field would look like this:

Position	1	2	3	4	5	6	7	8	9	10	11
Value	8	9	3	7	12	15	5	12	12	4	10

The position "pos" of a distance value for the indexes "a" and "b" are then calculated with

max (a, b) = the greatest value from a and b

and

min (a, b) = the smallest value from a and b

using:

pos = ((max (a, b) – 1) * (max (a, b) – 2)) / 2 + min (a, b)

Example for a = 3

b = 5

pos = ((max (5, 3) – 1) * (max (5, 3) – 2)) / 2 + min (5, 3)

pos = ((5 – 1) * (5 – 2)) / 2 + 3

pos = 9

The distance value for 5 → 3 is therefore at position 9 and is 12 km.

The above mentioned way of generating a one-dimensional field will probably lead to the field "overflowing" due to the amount of data, depending on the development environment.

This can be helped by writing each individual distance value in a binary file (the binary file is only around 50 MB in size compared to the ASCII file which is 170 MB). The above mention formula can also be used to calculate the position of the required distance value in the binary file.

3.5 Reference values

Here are a few distance values from EWS 2012 so that your EWS application can be checked.

- EWS Germany

Startort				Zielort				Entfernung
PLZ	Name1	Name2	Index_D	PLZ	Name1	Name2	Index_D	km
76131	Karlsruhe		4804	12045	Berlin	Neukölln	817	677
33106	Paderborn	Sande	2474	19053	Schwerin	Dwang	1411	388
20095	Hamburg		1506	80331	München		5114	773
24103	Kiel		7257	01067	Dresden	Altstadt	1	564

- EWS Europe / Europe Plus

Startort				Zielort				Entfernung
PLZ	Name1	Name2	Index_Eu	PLZ	Name1	Name2	Index_Eu	km
(D) 76131	Karlsruhe		2755	(A) 1010	Wien		1	725
(D) 76131	Karlsruhe		2755	(GB)E10 5	London		5264	760
(NL) 5626	Eindhoven	Acht	7055	(CH) 8064	Zürich	Grünau	1297	695
(F) 75001	Paris		4840	(I) 80100	Napoli		6589	1625