PTV Entfernungswerk Straße

Toll Germany

R2024_V1.0

A	B	C	D	E	F	G
Land	PLZ	Name1	Name2	SK	Ortsgr_kl	Index_Matrix_D
D	76131	Karlsruhe	Nordstadt	3	8	4804
D	76131	Karlsruhe	Nordweststadt	3	8	4805
D	76131	Karlsruhe	Oststadt	3	8	4804
D	76131	Karlsruhe	Rintheim	3	8	4804
D	76131	Karlsruhe	Südstadt	3	8	4804
D	76131	Karlsruhe	Waldstadt	3	8	4804
D	76133	Karlsruhe		1	3	4804
D	76133	Karlsruhe	Innenstadt	3	8	4804
D	76133	Karlsruhe	Innenstadt-Ost	3	8	4804
D	76133	Karlsruhe	Innenstadt-West	3	8	4804
D	76133	Karlsruhe	Mitte	3	8	4804
D	76133	Karlsruhe	Nordstadt	3	8	4804
D	76133	Karlsruhe	Südstadt	3	8	4804
D	76133	Karlsruhe	Südweststadt	3	8	4804
D	76133	Karlsruhe	West	3	3	4805
D	76133	Karlsruhe	Weststadt	3	8	4804
D	76135	Karlsruhe		1	9	4804

Karlsruhe, 19.12.2023

Contents

1 Introduction

On January 1, 1994, the validity of the long-distance freight tariff (GFT) in Germany expired. This meant that not only the tariffs no longer existed, but also the previously binding basis for calculating distances when settling freight forwarding services. A new basis of calculations was provided by the Entfernungswerk Straße (EWS), which was originally jointly developed by PTV GmbH, the Federal Central Cooperative for Road Traffic (BZG), Dr. Malek Software GmbH and DST Dresden. From 2012 to 2020, the EWS distance tables were produced by DDS GmbH in cooperation with Dr. Malek Software GmbH. In 2021, PTV GmbH again took the place of DDS GmbH, after DDS GmbH was merged with PTV GmbH, now PTV Logistics GmbH. The cooperation with Dr. Malek Software GmbH still exists.

Although it is not a binding basis, the EWS distance tables have now established themselves as a quasi-standard. Due to the simple EWS data structure, convenient EDP-supported information systems can be easily created or existing systems or databases can be extended.

Toll charges for trucks were originally to be levied in Germany from August 1, 2003. For this reason, DDS GmbH, together with PTV GmbH and Dr. Malek Software GmbH, developed the Entfernungswerk Straße Toll (EWS Toll) for the first time at the end of 2002, in addition to the standard product EWS. This means that EWS Toll Germany, with excellent results in long-distance transportation, is an ideal addition to EWS Germany and EWS Europe Plus. The introduction of toll charges in Germany took place on January 1, 2005 and was extended to four-lane national main roads on August 1, 2012. As of July 1, 2015, toll charges on national main roads similar to highways was extended to roughly an additional 1,100 kilometers.

As of July 1, 2018, toll charges were extended to all national main roads. This extension brings the toll charge network for national main roads to around 40,000 kilometers. This toll charge information has been adopted as standard from R2019_V1.0. The total length of toll roads including highways is roughly 51,000 km.

EWS Toll Germany is characterized by the following features:

- Calculation of highway distances for truck transportation between all locations in Germany based on a digitized street network
- Simple and transparent handling
- Excellent accuracy for long-distance transportation
- Simple integration of EWS Toll Germany into the products EWS Germany and EWS Europe Plus

1.1 Release notes

In EWS Europe, there were small position corrections at inner-city nodes of major cities in DACH, France, Poland and the Netherlands to create a better connection to major roads. Furthermore, there is a new node in France.

The underlying map base has been refined in some cases for through traffic in Germany. The map basis is the latest, detailed PTV premium map, which is based on data from HERE Technologies.

In addition to current changes in the postal and statistical offices in Germany, Austria and Switzerland, the locations in Hungary and Romania were updated regarding location and postal code, and a densification was carried out.

1.2 Release notes archive

Changes in release R2023_V1.0

The processing of the EWS has been fundamentally revised this year and now offers even more detailed content. This year's release R2023_V1.0 not only uses the latest PTV development components for distance calculation, it is also based on the latest map material from PTV, respectively HERE Technologies. The combination of extensive map material including closures and precise truck routing results in an EWS that is optimally adapted to long-distance traffic.

Furthermore, a comprehensive revision of the nodes (local representatives) was carried out. On the one hand, existing nodes were checked for their location, especially near the border, and on the other hand, the number of nodes was significantly increased:

- Germany: so far 7,407 nodes → now 10,382 nodes
- Europe: so far 9,953 nodes → now 14,845 nodes
- Austria as a subset of Europe: so far 605 nodes → now 888 nodes
  NEW: The nodes in Austria now have their own numbering - different from the European nodes in the same position

The densification of the node network results in a doubling of the number of relations in the distance matrix for Germany and Europe. All nodes receive a new ID once with this release. For a matching between new and old node IDs a lookup table is included. The format of the distance matrix remains the same.

This year, the EWS Toll Austria also takes international routes into account, so that the toll kilometers are based on the road kilometers of the EWS Europe.

Current information from the postal and statistical offices of Germany, Austria and Switzerland in the period from quarter 3/2021 to quarter 3/2022 was taken into account in the location file. For Portugal, a holistic revision of the existing locations with regard to location and postal code as well as a densification was carried out - with the result that over 1700 new Portuguese locations were added.

As announced in release R2021_V1.0, this release sets the location file version with character set codepage850 and 24 character location name length. The location file with utf-8 character set and 60 characters location name length is included in the delivery.

Changes in release R2022_V1.0

Current information from Germany's postal and statistical offices have been taken into account in the location file. Furthermore, node assignments of individual locations were checked and adjusted when necessary.

General street updates and a complete overhaul of toll information have been made. The Salzbachtal bridge (A 66 near Wiesbaden) was blocked in the EWS because it was taken down. Changes to the street network also cause changes to distances compared to the previous EWS.

See also notes on the previous release.

Changes in release R2021_V1.0

Current changes by the postal and statistical offices in Germany have been included in this release.

The location file in ods format is available in two versions, now – as always – with character set Codepage 850 and 24 characters location name length and additionally with character set utf-8 (BOM) and 60 characters location name length.

The version with character set Codepage 850 and 24 character location name length is discontinued with release R2023_V1.0.

Likewise, each distance matrix is now also supplied as a binary file (*.bin). Points 3.1, 4.4 and 4.5 of this description are helpful here.

2 The principle of EWS Toll Germany

Like the EWS, EWS Toll Germany consists of a location file and a corresponding distance matrix in which the road distances are stored. The design and structure of EWS Toll Germany is completely identical to the EWS.

In contrast to the EWS, only those kilometers are entered in the distance tables of EWS Toll Germany that are marked as kilometers on toll roads in the underlying street network. If the distance between two locations was calculated only on secondary roads, this distance is equal to “0”, because secondary roads are not subject to toll charges. For example, a distance from A to B on highways has a distance of 450 km in EWS, but only 400 km in EWS Toll Germany, as 400 km are marked as subject to toll charges in the underlying street network.

The location file includes the locations that can be found in the BZG location file available since July 1993. This file was developed jointly by BZG and PTV GmbH. An update of the location file takes place once a year. The location file for EWS Toll Germany has exactly the same status as that used in the other EWS versions of the same year.

2.1 Nodes as representatives of the location file

Due to the high number of available locations, it is not the distances between all locations that are calculated, but only between selected representatives of the location file. These representatives are also referred to simply as nodes. They are selected depending on the population density. Economically significant areas are therefore covered by more nodes.

The remaining locations (non-representatives) are each assigned to the nearest node. This assignment is based on the shortest distances (= road distances) to the nodes.

EWS Toll Germany is based on the same nodes as EWS Germany (approx. 10,400).

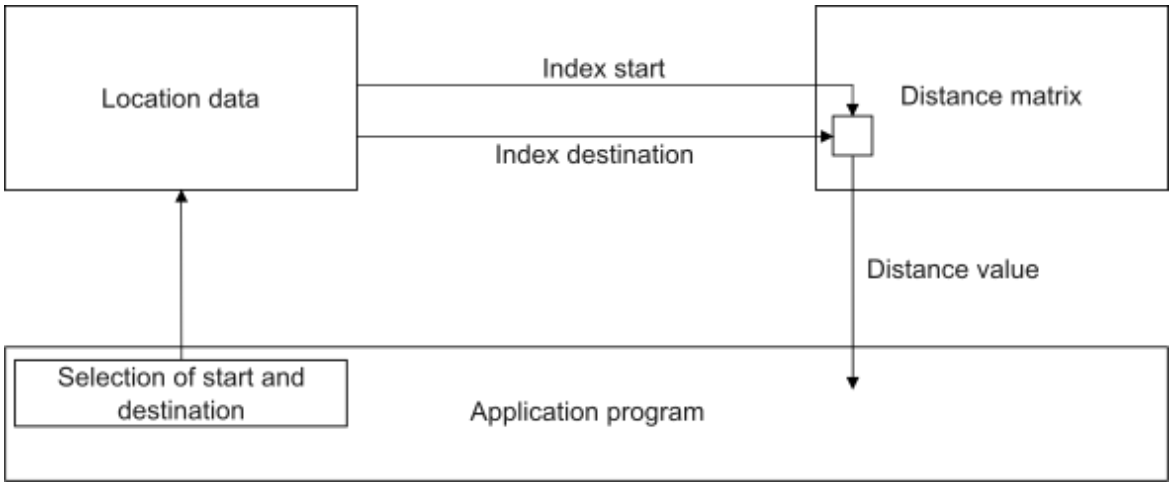
2.2 Distance calculation between any locations

Location file and distance tables are separate databases. To calculate the distance, the start and destination are selected from the location file. Each location entry contains an index that is used to determine the distance value from the matrix.

Example:

Country	Postcode	Name1	Name2	Matrix index
D	01109	Dresden		3
D	01109	Dresden	Klotzsche	4
D	10969	Berlin		937
D	36419	Geisa		3726
D	83435	Bad Reichenhall	Reichenhall	7330

In this example, the distance from 10969 Berlin to 36419 Geisa is found between nodes or matrix indexes 937 and 3726. The distance from node 3726 to node 937 is the same as from node 937 to node 3726 (see also 4.3 Structure of distance matrix).



A distinction is made between main location and district in the EWS location file. Their names are in two separate columns (Name 1 and Name2). The matrix index can be different for each district, even if the postcode and the main location are identical! In the example above, note the different matrix indexes for the locations 01109 Dresden and 01109 Dresden Klotzsche. It is therefore important to also specify the district (if known) to obtain the most accurate distance between two locations.

2.3 Notes on location search

When searching for a location in the location file, main locations and districts should be separated and different or incorrect spellings should be taken into account. In addition, it should be noted that P.O. box postcodes are not included in the location file!

Examples:

- “Dresden-Albertstadt” can be found in the location file with Name1 = “Dresden” and Name2 = “Albertstadt”.
- “Bad Reichenhall” can be found using precisely this spelling in Name1 (“Bad” and “Reichenhall” belong together, with spaces, without hyphen).
- “Villingen-Schwenningen” can be found using precisely this spelling in Name1, because it is the main location name.
- “Villingen Schwenningen” (without hyphen) or “Villingen – Schwenningen” (with spaces before and after the hyphen) would have to be assigned to Name1 = “Villingen-Schwenningen”.
- Umlauts, special characters, etc. must be observed.

2.4 Digital street network as a basis for calculation

The distance matrices are calculated on the basis of a comprehensive digital street network. This street network includes both roads as well as border crossings and ferries. Each distance results from the calculation of an optimum route. The distance of this route is entered in the matrix field. The vehicle profile of a 40-ton truck is used for routing.

For the distance calculation of EWS Toll Germany, only the road mileage is taken into account that is marked as subject to toll charges in the underlying digital street network.

The distances in EWS Toll Germany are determined using only German, not European, streets. Therefore, these distances are only a useful addition to the German EWS Matrix, which is supplied with either EWS Germany or EWS Europe Plus.

2.5 Accuracy

Due to the assignment and therefore the equation of locations with their respective nodes, there are inaccuracies in the distance. The distances between location and node can be approx. 3 km to 8 km in EWS Toll Germany. In sparsely populated regions, it can also be more than 8 km. EWS Toll Germany shows excellent accuracy for long-distance transportation and can be recommended for this purpose. On the other hand, there can be significant differences for short distances, especially in conurbation areas.

Distances between nodes are precisely calculated. However, it should be noted that EWS only reflects a possible distance between two locations. In determining this distance, the time factor (fastest route) is given a much higher weighting than the distance factor (shortest route). Distances covered by a ferry are not taken into account (distance = 0 kilometers).

Due to the differences between the systematics in EWS Toll Germany and the kilometers on toll roads from the table of toll charges by the Federal Highway Research Institute (BAST), the values from EWS Toll Germany are not identical to the actual kilometers on toll roads.

3 Scope of supply of EWS Toll Germany

EWS type	Scope of supply	Memory size
EWS Toll Germany	Location file Germany with 116,370 locations	
	60 characters, utf-8 (BOM)	approx. 25 MB
	Toll Germany distance matrix based on 10,382 nodes	
	Standard format	approx. 350 MB
	Binary format	approx. 105 MB

3.1 Updates

Regular updates are carried out to account for the permanent, independent further development of the basic street network and location file data records. EWS Toll Germany is published once a year.

The data structure of the EWS has not changed over recent years. If any changes are made in the future, they will be clearly highlighted.

The location identifications (so-called IDs) change from year to year. It is possible that the same location carries a different ID in the current EWS than in a previous version. Also, a location can have a new node number from one version to the next. This is due to the fact that the number of nodes is continuously updated and therefore also the matrix indexes. For these reasons, we do not recommend permanently linking master data (for example customer locations) to locations or nodes. For the same reason, all data should be re-imported during an update.

3.2 The alternative to the EWS – creating custom distance lists

As an alternative to the EWS distance tables, it is possible to create individual distance lists. The starting point and/or destination must be specified by the customer here. It is possible, for example, to calculate the distances

- from one starting point to all locations in Europe,
- from about 10 starting points in Germany to all remaining locations in Germany,
- from all major cities in Germany to all major cities in a neighboring country,
- depending on the country and data volume, also from all postcodes / locations to all other postcodes / locations in a country,
- for different fleets (cars, trucks),
- and taking certain conditions into account.

Please contact us for more information, prices and delivery formats.

4 Interface description

4.1 File names and formats

File name	Contents
d2024_60_utf8.ods	Location file Germany, 60 characters, utf-8
d2024_m.dm	Distance matrix Toll Germany
d2024_m.bin	Distance matrix Toll Germany, binary format

4.2 Structure of location file

Field	Type	From	To	Length	Contents
1	A	1	3	3	Country code (see legend for content)
2	A	4	12	9	Postcode Not available for every country and every location. In Germany, the 5-digit postcode is entered. Exceptions: a) Border crossings have the country code of the neighboring country as the postcode, preceded by a minus sign (e.g. -F or -CH) b) Ports have the postcode -PORT
3	A	13	72	60	Location name 1; postal name
4	A	73	132	60	Location name 2 Linguistic description, this can be, for example a district, part of a city, or a historical name. However, it can also be the municipality name if it is not the same as the postal name (= Location name 1).
5	A	133	133	1	Set code 1 = Main location 3 = District or historical name 5 = Linguistic description 9 = Border crossing
6	A	134	134	1	Set code addition If the set code from field 5 equals 1 or 3: 0 = Standard 1 = Description in Location name 2 If the set code from field 5 equals 9: 0 = International street crossing 1 = International ferry 5 = National street crossing 6 = National ferry
7	A	135	139	5	GTB/nodes East Germany, only for Germany GTB = 5 digits D-East = O followed by 4 digits This field only exists for reasons of compatibility with older versions. It is no longer maintained!

8	A	140	140	1	Cartage class A-Z, only for Germany **House freight location class according to the directory by the Federal Association of German Freight Forwarders and Logistics Operators (BSL)** This field only exists for reasons of compatibility with older versions. It is no longer maintained!
9	A	141	149	9	Location identification (ID) The identification is a unique key for Germany or a single country. In the case of the European location file, this identification is only unique when the ID is combined with the country code. The ID of a location can change from year to year, it is not a so-called permanent ID!
10	A	150	154	5	Former 4-digit postcode for Germany incl. code for East and West Germany, 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	155	163	9	Administrative number Not available for every country and every location. In Germany, the 8-digit municipality code can be entered: 1 to 2 digit = federal state 3 digit = administrative district 4 to 5 digit = district 6 to 8 digit = municipality
12	N	164	165	2	Location size class (see legend for content)
13	N	166	174	9	Horizontal coordinate (optional, at extra cost, price on request) If available, a geodecimal WGS84 coordinate with 5 decimal places (±GGGNNNNN) is available as standard.
14	N	175	183	9	Vertical coordinate (optional, at extra cost, price on request) If available, a geodecimal WGS84 coordinate with 5 decimal places (±GGGNNNNN) is available as standard.
15	N	184	192	9	**Index for matrix Germany** (for German locations) Reference to distance matrix Germany (relevant in EWS Germany, EWS Germany Toll and EWS Europe Plus). or: **Index for matrix Austria** (for Austrian locations) Reference to the distance matrix Austria (relevant in EWS Austria Toll). **Attention: As of release R2023_V1.0, this index is no longer necessarily equal to the index for the matrix Europe (Field 17).**
16	N	193	201	9	Next node in street network GER/AUT (is always filled in with 0)
17	N	202	210	9	Index for matrix Europe (for all locations) Reference for distance matrix Europe (relevant in EWS Europe and EWS Europe Plus)
18	N	211	219	9	Next node in street network Europe (is always filled in with 0)

Legend

- **Type:**
  - A = Alphanumeric (always left-justified)
  - N = Numeric (always right-justified)
- **Location size class:**
  - The location size classes do not refer to the actual number of inhabitants, but to the relative importance of a location/city. They are therefore to be understood as guideline values that serve to roughly classify locations.
  - The population figure is unknown.
  - Each district has its own size class. However, it often happens that all or many postcode districts have the same classes.

0: unknown	8: 5000 <= x < 10000
1: < 100	9: 10000 <= x < 20000
2: 100 <= x < 200	10: 20000 <= x < 50000
3: 200 <= x < 500	11: 50000 <= x < 100000
4: 500 <= x < 1000	12: 100000 <= x < 250000
5: 1000 <= x < 2000	13: 250000 <= x < 500000
6: 2000 <= x < 3000	14: x>= 50000
7: 3000 <= x < 5000	

4.3 Structure of distance matrix

The first row contains the number of matrix rows and columns.

The distance matrix is stored row by row in the matrix. Each matrix row in the distance matrix starts with the number of the mapped matrix row. Each matrix row is broken down after 12 values, i.e. a matrix row can consist of several text rows. Each matrix row ends with the character string “0000”. The following matrix row starts in a new text row.

The matrix values represent the distance in km. A few matrix values can have the value “0”. This occurs with nodes that are close together and connected to the same road segment.

Row 24 starts with the row number and the first 12 values, then a new text row starts with a further 11 values and the row termination 0000. Each entry is 6 digits long and is right-aligned within these 6 digits. They are preceded by spaces.

Since the distances are all symmetrical, i.e. the route from A to B is as long as from B to A, the ASCII matrix is constructed as a triangular matrix. If you want to read out the sought distance directly from the matrix, the larger index must always stand for the line and the smaller index must always stand for the column.

The distance from index 4 to index 10 is read out as follows in the example below: The larger index is 10 and represents the row number. Row 10, position 4 (column) contains the sought value of 17 kilometers.

Example:

```
24 Matrixzeile(n), 24 Matrixspalte(n)
 1  0000
 2     0  0000
 3     0     0  0000
 4     0     7    11  0000
 5     0     0     0     0  0000
 6     0    30     0    23     8  0000
 7     0     0     0     0     0     0  0000
 8     0     0     0     0     0     0     0  0000
 9     0     0     0     0     0     0     0     0  0000
10    10     8     0    17    10    40     0     0     0  0000
11     0     0     0     0     0     0     0     0     0     0  0000
12     0     2     5     2     2    26     0     0     0    11     0  0000
13     0    10     0     0     0    10     0     0     0     0     0    14
    0000
14    12    10    12    19    12    43    12     0     0     2     0    14
       0  0000
15    10     8     9    17    10    40    10     2     2     0     2    11
       2     2  0000
16     0     7    11     0     0    18     0     0    18    17     0     2
      19    19    17  0000
17     0     0     0    11     0     0     0     0     0     0     0     5
       0     0     0    11  0000
18     0     0     6     5     5    29     0     0     0     0     0     0
      11    11     9     5     0  0000
19    12    10    12    19    12    42    12    12    12     6    12    14
      17    17    15    19     6     0  0000
20    12    10    12    19    12    42    12    12    12     6    12     0
      17    17    15    19     6     0     0  0000
21     0    19    20    28     0    10     0     0     0    11     0    23
       0     0    11    28     0    20    26    26  0000
22    21    19    21    28    21    52    21    21    21    15    21     0
      27    27    24     0    15     0     9     0    35  0000
23    12    10    12    19    12    42    12    12    12     6    12     0
      17    17    15    19     6     0     0     0    26     0  0000
24    21    19    21    28    21    52    21    21    21    15    21    23
      27    27    24    28    15     9     9     0    35     0     0  0000
```

4.4 Notes on processing method of the EWS matrix

A 10,000 * 10,000 matrix uses approx. 350 MB. It may not be possible to load this matrix directly, depending on the memory capacity. Efficient storage can be achieved if all distance values (without matrix diagonals) are written one after the other into a one-dimensional field, a continuous sequential series.

For the above example, the field would look as follows:

Position	1	2	3	4	5	6	7	8	9	10	11	12	13
Wert	0	0	0	0	7	11	0	0	0	0	0	30	0

The position “pos” of a distance value for the indexes “a” and “b” is then calculated using

max (a, b) = the greater value of a and b

and

min (a, b) = the smaller value of a and b

divided by:

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

Example

a = 4 b = 3

pos = ((max (4, 3) – 1) * (max (4, 3) – 2)) / 2 + min (4, 3)

pos = ((4 – 1) * (4 – 2)) / 2 + 3

pos = 6

The distance value for 4 → 3 is therefore at position 6 and results in 11 km.

If a = b (start node = destination node), then the distance is 0 km and the above formula must be ignored because the 0 values (matrix diagonals “0000”) are not read into the one-dimensional field. The application program should then simply return 0 km.

4.5 The binary file

The above-described possibility of generating a one-dimensional field can, depending on the development environment, lead to the field “overflowing” at some point due to the amount of data.

This could be remedied by writing each individual distance value into a **binary file** (the binary file will be only about 110 MB in size, in contrast to an ASCII file with 350 MB).

The above example from point 4.4 in HEX format:

Position	1	2	3	4	5	6	7	8	9	10	11	12	13
Wert (2 Byte)	00 00	00 00	00 00	00 00	07 00	0B 00	00 00	00 00	00 00	00 00	00 00	1E 00	00 00

The above formula can then also be applied to determine the location of the sought distance value in the binary file.

4.6 Reference values

Below are some distance details from EWS Toll Germany 2022 for the purpose of checking your EWS application.

Starting point				**Destination**				**Distance**
Postcode	**Name1**	**Name2**	**Index_D**	**Postcode**	**Name1**	**Name2**	**Index_D**	**Toll km**
76131	Karlsruhe		6602	12045	Berlin	Neukölln	945	677
33106	Paderborn	Sande	3370	19053	Schwerin	Dwang	1668	379
20095	Hamburg		1778	80331	München		7013	769
24103	Kiel		2123	01067	Dresden	Altstadt	1	555