METHODOLOGY FOR TERRITORIALISATION OF AIR TRANSPORT

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SUMMARY

The methodology for 'territorialisation' of air transport data in the European Union, presented below, has been developed by Eurostat.

- '**Territorialisation principle**' means that only freight and passenger transport performed within the territory of a country is considered. In terms of air transport, 'territorialisation' means that the transport performed in the air space is allocated to the countries overflown on each air transport route.

- **The aim of territorialisation** is to compare shares of each transport mode into the total transport performance in the European Union and also at national level. This is called the 'modal split' between the different transport modes.

- 'Territorialisation' is straight-forward for transport by road, railway and inland waterways, as it takes place on the territory of a country. The calculation is more complex for maritime and air transport, which only uses airport or port infrastructure in the country where the transport starts (origin) and where it ends (destination), and merely passes through the national waters or airspace of other countries on the route.

- 'Transport performance' is measured in tonnes-kilometres (tkm) for freight and passenger-kilometres for passengers (pkm). A tonne-kilometre is defined as one tonne of freight flying for one kilometre; a passenger-kilometre is defined as one passenger flying for one kilometre. The total tkm or pkm on an air route are, first, calculated based on passengers/freight transported between pair of airports and a distance matrix; and, then, the calculated tkm/pkm are 'territorialised' by allocating them proportionally to the countries overflown, according to the distance flown over each country.

- Eurostat maintains a database of distances (distance matrix) between EU airports, and between EU airports and World-wide airports. The distances are based on the 'greater-circle' distance, which is the *shortest distance* between two points on the surface of a sphere (i.e. the shortest possible flight path between the airport of origin and the airport of destination). This shortest distance is then split into distance legs for each country overflown during the flight in order to 'territorialise' the transport performance. **The distance for each country is based on its national airspace, which includes territorial waters of 12 nautical miles off its coast.**

- **It must be highlighted that the 'territorialised' air transport performance is a** *concept used only for comparing the transport modes' activity at countries' level. The resulting statistics are not comparable with statistics on energy consumption in transport or with GHG emissions as these are based on different methodologies.*

A number of concrete examples of application of the methodology for different flight routes are given towards the end of this document. These examples include national flight routes (including routes passing over another country, flight routes to overseas territories, 'intra-EU' flight routes between two Member States (including routes passing over other countries) and international 'extra-EU' routes between a Member State and a country outside the EU.

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1   INTRODUCTION

The main cornerstone for the EU transport policy is the White Paper 'Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system'[1], adopted in 2011. The White Paper lists ten goals for a competitive and resource efficient transport system in Europe. In order to monitor progress towards certain of these goals, comprehensive and comparable data on passenger-km and tonne-km by distance travelled is needed for all modes of transport.

The transport statistics data collection, in its significant part, is based on legislation applied by EU Member States, European Free Trade Association (EFTA) countries and certain candidate countries. Transport performance is measured in tonne-km (for freight transport) or in passenger-km (for passenger transport). However, the legislation for collecting data on the different transport modes varies to some extent, reflecting the peculiarities of the specific transport modes and to the data needs for each mode.

2   MODAL SPLIT INDICATORS: WHAT DATA ARE NEEDED FOR TRANSPORT MODES

2.1   MODAL SPLIT INDICATORS

Modal split indicators (MSI) are defined as the share of each mode of transport in the total transport performance, measured in tonne-kilometres or passenger-kilometres. MSI measure the composition of transport performance, i.e. the importance of each mode of transport for the total freight or passenger transport, and the evolution over time in the share of each transport mode.

2.2   TERRITORIALITY PRINCIPLE

Dependent on the transport mode in question, transport performance is reported by the countries according to the **"territoriality principle"** (rail and inland waterways) or is 'territorialised' by Eurostat from the detailed region-to-region data (road freight). In practice, only the transport performance that takes place on the territory of the country, performed by any operator (domestic or foreign) is taken into account by territorialised transport statistics. In the case of international transport, only the leg of the journey that takes place within the territory of the country is considered.

Within the frame of transport statistics, according to the 'territorialisation principle', only freight and passenger transport performed within the territory of a country is considered. This also includes all parts of cross-border transport performed on the country's territory, irrespective of whether the journey is only crossing the territory or whether its origin or destination lies within the country.

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[1] https://ec.europa.eu/transport/themes/strategies/2011_white_paper_en

Rail and inland waterways statistics, as they are reported by the countries to Eurostat according to the legal acts on statistics in force[2], are already reported following the 'territoriality principle'[3] and data refer only to transport performance that has taken place on the territory of the countries.

In contrast, road freight transport is currently collected[4] on *all* movements of vehicles registered in the reporting country (i.e. the 'nationality principle'), whether these are carried out within the territory of the country or abroad. Road freight transport data, particularly for international transport, need to be recalculated according to the "territoriality principle". This is done by Eurostat on the basis of journey-related data, with the help of a distance matrix that models the most likely route taken (the fastest route). This allows cross-border transport journeys to be 'cut' into national legs for each country of the route[5].

Furthermore, the data collections[6] on air and maritime transport cover passengers and freight transported between a pair of airports or ports, without having data reported in tonne-km or passenger-km.

Consequently, the main challenge in calculating modal split is being able to use coherent data series across the different transport modes, based on methodologies that are as comparable as possible.

3 AIR TRANSPORT STATISTICS

3.1 AIR TRANSPORT DATA COLLECTION

Eurostat collects **air transport data expressed in tonnes and in number of passengers carried between pairs of airports** according to Regulation (EC) No 437/2003 of the European Parliament and of the Council of 27 February 2003 on statistical returns in respect of the carriage of passengers, freight and mail by air.

According to this legal act, data are reported **for commercial air services**. This means that military flights, flight activities relating to aerial work, hospital flights and any other non-commercial flights are excluded.

The legal act specifically states that detailed reporting (on transported passengers/cargo between pairs of airports) should be done by **airports with traffic in excess of 150 000 passenger units annually**. For the smaller airports, aggregated reporting is sufficient.

Thus the coverage of estimates for tonne-km and passenger-km are always restricted by the reporting obligations of the countries. In addition, it is also restricted only to data on passengers and freight provided by the reporting to Eurostat countries and it will always exclude the transport performed between two airports of non-reporting countries (e.g. between ports of the UK, Russia or Brazil).

3.2 DISTANCE OVERFLOWN AND CALCULATION OF TONNE-KM AND PASSENGER-KM

In addition to these data on volumes of freight and passengers transported, the distance over which they are transported and the resulting transport performance data in tonne-kilometres and passenger-kilometres are also useful to measure the transport activity.

For this purpose, Eurostat has developed a **distance matrix for air transport, based on the shortest (great-circle) distance** between pairs of airports. This allows the calculation of passenger-km and tonne-km data;

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[2] Regulation (EC) 91/2003 and Regulation (EC) 1365/2006, respectively

[3] Transport taken place on a territory of a country

[4] Regulation (EU) 70/2012

[5] http://ec.europa.eu/eurostat/statistics-explained/index.php/Freight_transport_statistics_-_modal_split

[6] Regulation (EC) No 437/2003 and Directive 2009/42/EC

when the distance between two airports is known (input in the matrix) and the number of passengers or the volume of the freight forwarded on this route is reported, the transport performance (tonne-km and passenger-km) can easily be calculated.

However, as explained above, the transport performance can be computed only for airports that provide detailed reporting (transport between pairs of airports) according to the legal act; small airports cannot be included in the calculation.

3.3   ATTRIBUTION OF CALCULATED TONNE-KM AND PASSENGER-KM AT COUNTRY LEVEL

The distance matrix enables calculation of passenger-km and tonne-km. However, a methodological approach is needed for 'attributing' the calculated tonne-km and passenger-km to the specific countries. This approach should, irrespective of the peculiarities of air transport, produce 'territorialised' tonne-km and passenger-km data that are as comparable as possible to the transport performance data existing, for example, for road and rail transport.

Eurostat **developed a 'territorialisation' tool that, for each pair of airports, would calculate the distance overflown over each country on the straight (great-circle) route of the flight**. This would break down the calculated transport performance (tonne-km and passenger-km, respectively) to each country. This tool has been integrated into the distance matrix.

4   DISTANCE MATRIX/TERRITORIALISATION TOOL

4.1   GENERAL PRINCIPLES

The air transport distance matrix[7] is based on a large number of airport pairs, covering the majority of the combinations of origin and destination airports within the EU Member States, the UK, EFTA and Candidate countries, but also the majority of pairs with destination airports worldwide. The total distance between each pair of airports is available in the distance matrix (calculated on the basis of the geographical coordinates of the airports), as well as the distances flown over each individual country crossed during the course of a flight between this pair of airports (according to the great-circle distance).

The distance matrix/territorialisation tool has been developed on the basis of the main features described in the following sections.

4.1.1   GREAT-CIRCLE DISTANCE

> The great-circle distance ('orthodromic' distance) corresponds to the shortest distance between two points on the surface of a sphere.

The distance actually flown by a plane is likely to be longer than the shortest distance stipulated by the matrix. Flight corridors need to be respected and airport take-off and landing paths require specific routes. A change in wind direction has effects on airport approach paths and may lead to considerably longer flight distances. These effects would be proportionally higher for short-distance flights. Air traffic control

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[7] The air distance matrix is available in the Transport Statistics interest group on CIRCABC, under the path:
  06. Aviation / 4. Nomenclatures / Distance matrix (territorialisation tool) – version 2015 / Consolidated air matrix.

authorities (such as Eurocontrol) may have information on exact routes for every individual flight that could render the distance information even more precise. However, it should be kept in mind that air transport statistics provided to Eurostat contain aggregated information (monthly data), and it would be difficult to link them to the exact routes of each flight.

Therefore, the tool developed is based on a pragmatic and common approach. This allowed constructing a universal distance-calculation tool, easily applicable at European level. The tool calculates the distance from a 'single point' of an airport (based on its geographical coordinates) to another 'point' of the partner airport. Moreover, the tool is based on a methodology that is already applied in certain countries.

4.1.2 COUNTRIES COVERAGE OF TERRITORIALISATION TOOL

The total distance between a pair of airports is broken down into distances flown over each country crossed during the course of a flight between this pair of airports. Overall, the tool covers **39 European countries**:

- ➢ 27 EU Member States;
- ➢ The United Kingdom;
- ➢ EFTA countries: Switzerland, Liechtenstein, Norway and Iceland;
- ➢ Candidate and potential candidate countries: Albania, Bosnia and Herzegovina, Montenegro, North Macedonia, Serbia, Kosovo[8] and Turkey.

Distant EU territories / overseas territories are considered part of the respective EU countries. These 'outermost regions' include:

- ➢ French Overseas Departments: Martinique, Guadeloupe, French Guiana, Réunion and Mayotte; French overseas community: Saint-Martin;
- ➢ Portuguese autonomous regions: Madeira and the Azores;
- ➢ Spanish autonomous community of the Canary Islands, as well as Ceuta and Melilla.

The following countries and territories are <u>not</u> included in the territorialisation tool:

- ➢ **Andorra, San Marino, Monaco, Gibraltar, Jersey, Guernsey, Isle of Man, Faroe Islands, Åland, Svalbard and Jan Mayen.**

Therefore, distances flown over these territories are not allocated to the respective countries they might be linked to.

4.1.3 TERRITORIAL WATERS

Territorial waters of 12 nautical miles (=22.2 km) from the coastline, as determined by the United Nations Convention on the Law of the Sea (UNCLOS), are considered to be part of countries' *sovereign airspace* according to international law.

Therefore, where applicable, the territories of the European countries in the territorialisation tool include also the 12 nautical miles zone of the national territorial waters. The distance flown over a country with a sea coast automatically includes its national territorial waters.

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[8] This designation is without prejudice to positions on status, and is in line with UNSCR 1244/99 and the ICJ Opinion on the Kosovo declaration of independence.

4.1.4   TOTAL DISTANCES VS. TERRITORIALISED BREAKDOWN

The distance matrix contains:

➢ the TOTAL distance between each pair of airports

➢ the BREAKDOWN of the distances flown over each country (among the 39 European countries mentioned above) on the course of the flight between each pair of airports (great-circle straight line)

> The TOTAL distance is not necessarily equal to the sum of the BREAKDOWN over each country overflown, as there may be 'non-allocated distances'.

The following legs of a flight **are not allocated**:

➢ Distances flown over international waters (i.e. beyond a country's territorial waters of 12 nm);

➢ Distances flown over countries that are not included in the territorialisation tool.

In practice, this means that the cumulated distances rendered by the territorialisation tool might not correspond to the full distance of the journey, as certain parts will not be attributed to individual countries. This mainly affects intercontinental flights and other international flights with origin and destination outside the EU (and the other countries covered by the territorialisation tool). These non-attributed parts of the transport performance can range from very substantial (when the largest part of a flight route leads over international waters, for instance) to negligible. This is clearly illustrated in the various examples presented at the end of this document.

4.2   COMPLETION OF THE MATRIX

When combining the distance matrix with passengers and freight transport data by airport pairs, sometimes a distance cannot be allocated for some of them. The reasons for this are, for instance, cases when either the departing or the arrival airport is reported as unknown, or the airport code (ICAO code) is not recognised by the tool (wrong or outdated code, or an airport that is not (yet) covered by the distance matrix).

The territorialisation tool has been further developed by prioritising the code-list of 'airport pairs' linked to Eurobase dissemination tables[9] AVIA_PAR and AVIA_GOR, which focus on the most important routes.

In order to include in the calculations as many airport pairs as possible, Eurostat has attributed distances to routes for which no distance was available in the developed distance matrix. The following cases have been covered:

● When the reporting airport is the same as the partner airport quoted:

➢ A standard distance of **30 kilometres** is used

● Cases where one of the airports is unknown but the country is known:

➢ Distance to a 'reference airport' in the country in question is used - the airport with the largest volume of traffic in the country is selected as a 'reference airport'.

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[9] http://ec.europa.eu/eurostat/web/transport/data/database

- Specific case – Airport code not in the air distance matrix, but an airport located in the same city is available in the matrix. These airports are used instead of the missing ones; the missing airport is transcoded into the other airport in the same city, The table below lists the codes concerned:

Code reported	Transcoded into
LGAC	LGAV
EGRA	EGPF
LKAA	LKPR
LFBB	LFBD
EGQG	EGPK
LIMM	LIML
EGRY	EGMN
EGRD	EGGD
LYSK	LWSK
ENOS	ENGM
LOVV	LOWW
LZIB	LZBB
EDDB	EDDT
FM99	FMCZ

4.3 COVERAGE OF THE MATRIX

There are still some airport pairs for which the distance is not available in the distance matrix. These pairs are not taken into account in the calculations.

As an example, when considering the respective air transport categories on the basis of total number of passengers reported by the countries over the period 2008-2020 (=100%), the situation was:

- National (domestic) flight connections: 99.8% of all reported passengers are covered.

- Intra-EU flight connections: 99.997% of all reported passengers are covered.

- Extra-EU flight connections: 96.74% of all reported passengers are covered.

For freight transport, on the basis of the total freight and mail tonnage reported by the countries over the period 2008-2020 (=100%), the situation was:

- National (domestic) flight connections: 99.999% of total tonnage is covered.

- Intra-EU flight connections: 99.995% of total tonnage is covered.

- Extra-EU flight connections: 95.3% of total tonnage is covered.

5 METHODOLOGY

5.1 CALCULATION OF PASSENGER-KM/TONNE-KM

Eurostat uses an air distance matrix containing great circle distances (minimum distance on a spherical line) between the different pairs of airports to **calculate tonne-kilometres or passenger-km for air transport**.

5.2 TONNE-KM AND PASSENGER-KM FOR AIR TRANSPORT, ACCORDING TO THE 'TERRITORIALITY PRINCIPLE'

The objectives of the modal split indicators are to observe the composition of transport activity, i.e. the share of each mode in the total, and to monitor changes over time in this share for each of the five main transport modes (road, rail, inland waterways, maritime and air) in total transport performance. **In the case of air transport**, the challenge is to **measure transport performance** (i.e. tonne-kilometres and passenger-kilometres) **according to the "territoriality principle"**.

The inland freight transport considered (road, rail and inland waterways) for modal split is essentially performed on the European territory. In order to assure that the data used to analyse the modal split are as comparable as possible across the different transport modes, the scope considered for air transport has been limited to the same territory. Thus, distortions in the overall picture of transport on European territory, which would occur if intercontinental air transport was included, are avoided.

The territorialisation tool applied is an estimation method based on certain assumptions. In this context, it must be underlined that the 'territorialised' air transport performance is a concept used only for comparing the transport activity by mode of transport at countries' level. The resulting statistics are not comparable with the statistics on energy consumption in transport or with GHG emissions statistics, as these are based on different methodologies.

The main features of Eurostat's territorialisation tool for air transport are:

- In terms of the 'territoriality principle', **the 'national territory' of a country with respect to air transport is defined as the land mass of the country, including islands, together with the adjacent national territorial waters (12 nautical miles from the coastline)**, if any. This corresponds to the definition of the **national airspace**.

- A **tonne-kilometre with respect to air transport is defined as one tonne of freight flying for one kilometre**. Similarly, a **passenger-kilometre with respect to air transport is defined as one passenger flying for one kilometre**. Tonne-kilometres (tkm) and passenger-kilometres (pkm) are used for measuring **transport performance**.

- The **distance of each flight route, connecting a pair of airport, is defined as the great circle distance between the airport of origin and the airport of destination**; the 'great circle distance' is the shortest distance between two points on a sphere (globe). This distance is **proportionally assigned to each country overflown on the route, according to the distance flown over the national territory (i.e. through the national airspace) of the respective countries**.

- For each airport pair, the **number of passengers or tons of freight/mail carried is multiplied by the distance flown over each individual country's territory, producing passenger-kilometres and tonne-kilometres for each country according to the 'territoriality principle'**.

- Subtracting this sum of distances for the countries overflown from the total distance for this airport pair leaves the distance that cannot be 'territorialised'. **This non-attributable distance is either flown over international waters or over countries that are not included in the territorialisation tool** (i.e. all countries other than the 39 countries specified in section 4.1.2 above).

Data on passengers and freight/mail are reported to Eurostat by all Member States of the EU, EFTA countries (Norway, Iceland and Switzerland) and also by Turkey (started reporting air data from reference year 2012), North Macedonia (from 2015), Montenegro (from 2016) and Serbia (from 2015). All these data are used in the calculation and 'territorialisation' of the tonne-km and passenger-km at national and EU level. However, it should be taken into account that in some cases it may lead to a certain break in series as some of the countries started reporting data later than 2008, the first reference period when these series are calculated. Data reported by the UK until 2019 is not taken into account in the calculations.

It should be kept in mind that the territorialisation of air transport performance excludes a certain amount of tonne-km/passenger-km, as these are not allocated to any EU Member State. Furthermore, a segment of the transport performance is allocated to countries that are not origin or destination of the flight, but are merely overflown.

Thus, territorialised data on tonne-km or passenger-km are *not intended or suitable for energy consumption or environmental impact of air transport.*

5.3   CALCULATION OF THE AGGREGATES

Passenger-kilometres and tonne-kilometres are calculated with the following breakdowns at country or EU level:

■ **At EU level**:

	Only the part flown over EU territory is considered
INTRA-EU	Includes: **National transport + International intra-EU transport** This is transport between EU Member States [including national (domestic) transport]
EXTRA-EU	Includes: **International extra-EU transport** This is transport between EU Member States and non-EU countries.
OVERFLOWN	Transport **between non-EU countries** that passes through the airspace of one or more EU Member States, without departing or landing at their airports. This is based on data from the non-EU countries that report data to Eurostat (currently IS, NO, CH, TR (from 2012), MK (from 2015), ME (from 2016), RS (2015).

■ **At country level**:

|	Only the part flown over the country's national territory is considered
INTRA-EU	Includes: **National transport + International intra-EU transport** This is transport between the concerned country and EU Member States [including national (domestic) transport]
EXTRA-EU	Includes: **International extra-EU transport** This is transport between the concerned country and non-EU countries
OVERFLOWN	Transport **between other countries** (**EU countries or non-EU countries** reporting data to Eurostat) that passes through the airspace of the concerned country, without departing or landing at its airports.

Concrete examples of Intra-EU, Extra-EU and 'Overflown' are given in section 6.

The total tonne-km and passenger-km calculated for the EU aggregate are equal to the sum of the Member States totals. However, the sum of the presented breakdowns of the Member States are not equal to the respective breakdowns for the EU aggregate as the concept differs. For better understanding, please, refer to the diagram on the next page.

The calculations of tonne-km and passenger-km for the Member States or for the EU, are based on all data reported to Eurostat that covers as well some non-EU countries, except data reported by the United Kingdom until reference period 2019. **It is important to bear in mind that the category 'overflown' is particularly influenced by the availability of data for non-EU countries and their inclusion or not in the calculations.** For example, for the EU aggregate, the exclusion of the data reported by the UK from the calculations has as an effect a reduction of total passenger-km between 6% and 10% in the period 2008-2019, while for the category 'overflown' it reaches between 60% and 80% for the period 2008-2019. The impact on total tonne-km corresponds to a reduction between 13% and 15% in the period 2008-2019, while for the category 'overflown', the reduction reaches between 82% and 86% for the period 2008-2019.

These concepts are further illustrated in the following diagram, which also highlights the similarities and differences in calculating the 'territorialised' aggregates for air transport performance at the EU level and at individual country level:

Diagram illustrating the different types of transport/routes
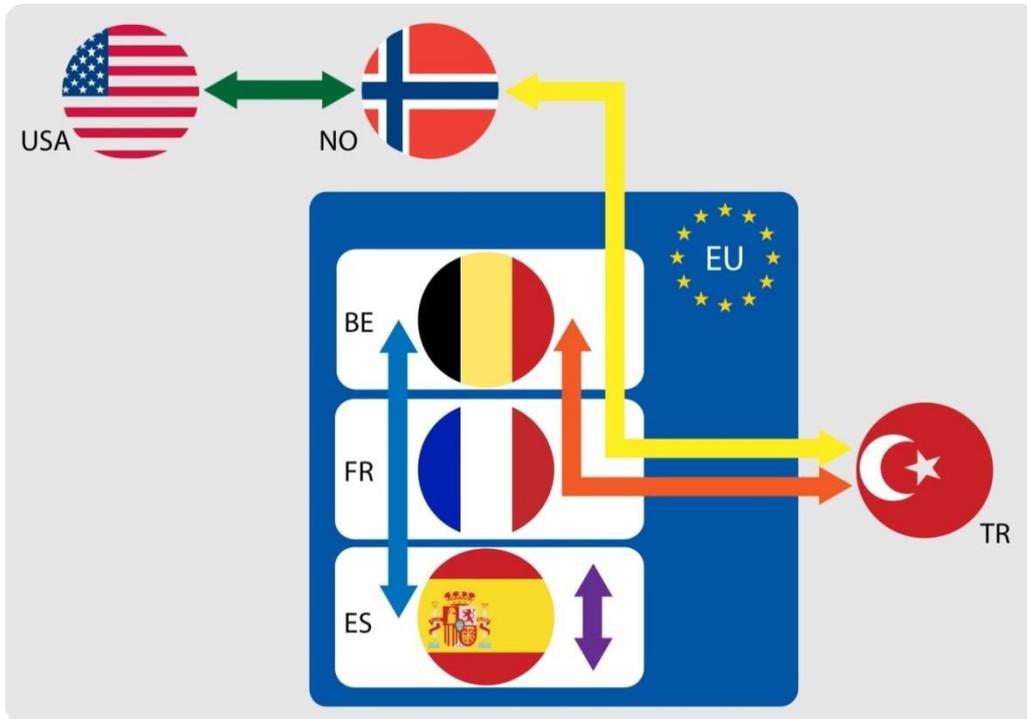
At EU level: tkm/pkm are attributed as **Intra-EU transport**

At country level:
- tkm/pkm are attributed proportionally to **Belgium and Spain** as **Intra-EU transport** (origin/destination)
- tkm/pkm are attributed proportionally to **France** as **Overflown** (only overflow)

At EU level: tkm/pkm are attributed as **Intra-EU transport** (it is national transport)

At country level:
- tkm/pkm are attributed to Spain as Intra-EU transport (it is actually national transport)

At EU level: tkm/pkm are attributed as **Extra-EU transport**.

At country level:
- tkm/pkm are attributed proportionally to **Belgium** as **Extra-EU transport** (origin/destination)
- tkm/pkm are attributed proportionally to **France** as **Overflown** (only overflow)
- tkm/pkm are attributed proportionally to **Turkey** as **Extra-EU transport** (origin/destination)

At EU level: tkm are attributed as **Overflown**.

At country level:
- tkm/pkm are attributed proportionally to **Belgium** and **France** as **Overflown** (only overflow)
- tkm/pkm are attributed proportionally to **Norway** and **Turkey** as **Extra-EU transport** (origin/destination)

At EU level: *No* tkm/pkm *are attributed*.

At country level:

- tkm/pkm are attributed proportionally to **Norway** as **Extra-EU transport** (origin/destination)

5.4 DISTANCE CLASS

As an example of further use of the territorialised data on air transport performance can be also produced according to the distance classes. The data according to these distance classes can be calculated on the basis of detailed airport-to-airport data reported by the countries and the air distance matrix.

In such cases, each route is attributed to a distance class on the basis of the *total distance for this route* (airport pair) according to the distance matrix.

Examples:

■ Flight between **Frankfurt** and **Ottawa**

Total distance: 6 002 km; the Member States crossed during this flight are: DE, BE, NL and IE.

The four countries will be attributed tonne-km/passenger-km proportionally, depending on the distance flown over their respective territories according to the territorialisation tool of the air distance matrix. These tonne-km/passenger-km can be categorised, for example, in the distance class **'300 km or more <u>for all these countries</u>,** as the **total distance** between this specific pair of airports is <u>longer than 300 kilometres</u>.

■ Flight between **Frankfurt** and **Luxembourg**

Total distance: 175 km; the Member States crossed during this flight are: DE and LU.

The two countries will be attributed tonne-km/passenger-km proportionally, depending on the distance flown over their respective territories according to the territorialisation tool of the air distance matrix. These tonne-km/passenger-km can be categorised, for example, in the distance class **'Less than 300 km'** for <u>both of these countries</u>, as the **total distance** between this pair of airports is <u>shorter than 300 kilometres</u>.

5.5 EXCLUSION OF DOUBLE COUNTING

When declarations on the number of tonnes/passengers between a pair of origin and destination airports (A and B) are available from both airports, the transport performance for this pair is calculated on the basis of the outward traffic (departure) for each of these airports, in order to avoid double counting:

- *Transport performance between A and B = (outwards of A + outwards of B) * (distance between A and B) where:*

    – *'outwards of A' is traffic from A to B, and*

    – *'outwards of B' is traffic from B to A.*

If the declaration is available from only one of the two airports (for example, airport A; i.e. the outward traffic was not declared by the partner airport B), the transport performance is calculated on the basis of the inward and outward traffic of the declaring airport A for flights to airport B:

- *Transport performance between A and B = (inwards of A + outwards of A)* (distance between A and B) where:*

    – *'inwards of A' is traffic from B to A, and*

– *'outwards of A' is traffic from A to B.*
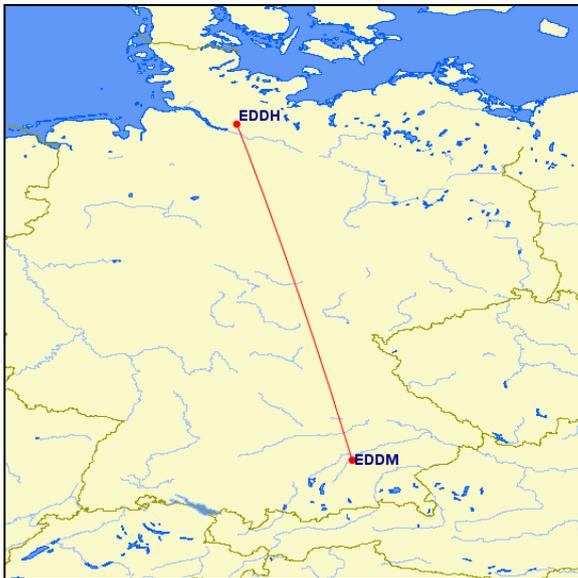
6 EXAMPLES[10]

The following section presents a number of examples that illustrate how the territorialisation tool is used and how the territorialisation principles are applied in practice to attribute tonne-km and passenger-km at country and EU level. The examples below cover also cases where EU and countries are attributed tonne-km and passenger-km as 'overflown'.

6.1 NATIONAL (DOMESTIC) TRANSPORT

National (domestic) transport is defined as transport where departure and arrival airport are located in the same country. Normally, the flight path leads in its entirety over the territory of the country in question; however, in certain cases a part of such a national route may pass over the territory of a neighbouring country.

This is particularly the case for national routes involving outermost-regions (e.g. French oversea territories Réunion, Guadeloupe, Martinique, etc.). In that case, only the distance over the French national territory (mainland or oversea territories) is considered in national tonne-km/passenger-km. Please see further below an example of flight between LFML Marseille (France) and FMCZ Dzaoudzi Airport, Mayotte (France).

- **Example 1 - National flight flying over a unique country:** Flight between **EDDH Hamburg (Germany)** and **EDDM München (Germany)**


Total distance: 600.5 km, entirely over German territory

If, for a given year, 800 000 passengers are registered on this route:

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[10] *Please note that the maps for these examples have been taken from the Great Circle Mapper website, available through: http://www.gcmap.com/mapui?P=LPPT-SBEG&MS=wls&DU=mi*

> ➢ Passenger-km are attributed <u>entirely</u> to Germany (classified as 'Intra-EU'):

800 000 passengers * 600.5 km = **480.3 million passenger-km in total for this route**

- **Example 2 - National flight flying over another country:** Flight between **EDDM München (Germany)** and **EDDT Berlin-Tegel (Germany)**
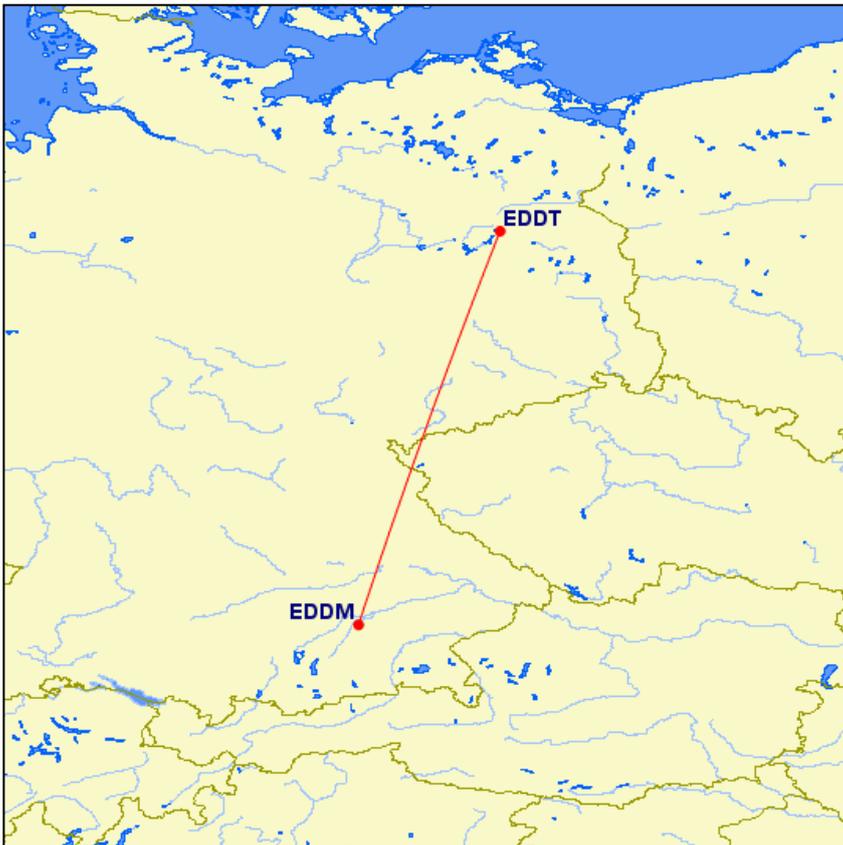
<u>Total distance</u>: 479.8 km, crossing over both German and Czech territory.

This is an example where a part of a national route passes over the territory of a neighbouring country:

- 441.152 km over German territory
- 38.689 km over Czech territory

If, for a given year, 900 000 passengers are registered on this route:

> ➢ <u>Attributed to Germany</u> (classified as 'Intra-EU):

900 000 passengers * 441.152 km = 397 million passenger-km

> ➢ <u>Attributed to Czechia</u> (classified as 'Overflown'):

900 000 passengers * 38.689 km = 35 million passenger-km

> ➢ **Total attributed to EU for this route:**
> 397 million + 35 million = **432 million passenger-km**

- **Example 3 - National flight flying in majority over another country**: Flight between **LDZA Zagreb (Croatia)** and **LDDU Dubrovnik (Croatia)**
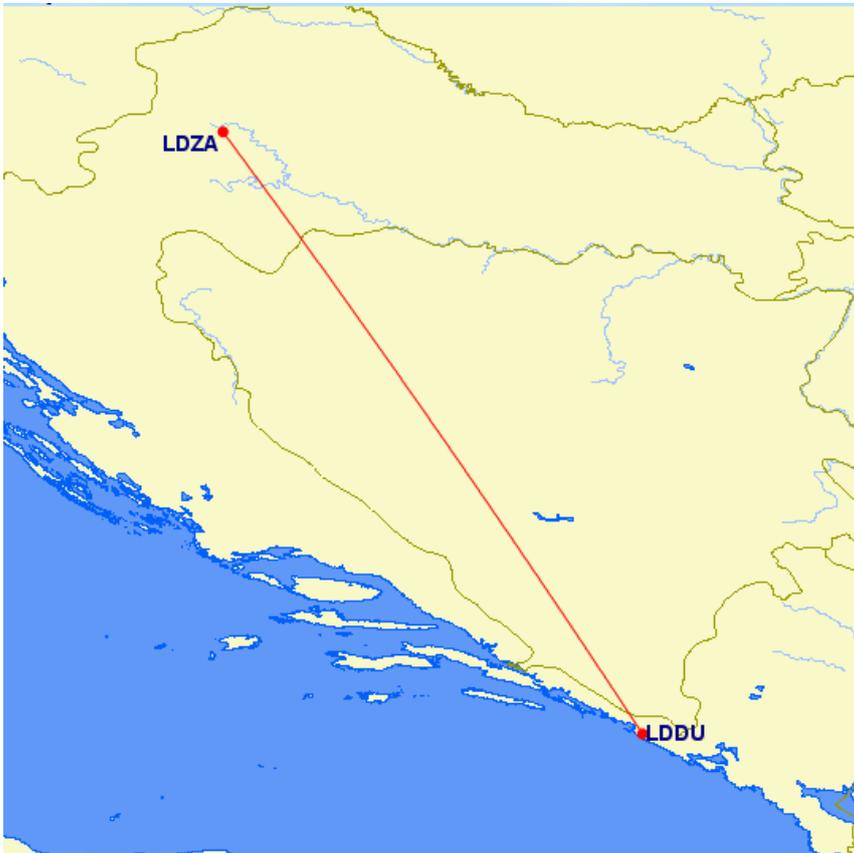
Total distance: 395 km, crossing over both territories of Croatia and Bosnia and Herzegovina:

- 77 km over Croatian territory
- 318 km over territory of Bosnia and Herzegovina

If, for a given year, 20 000 passengers are registered on this route:

➢ Attributed to Croatia (classified as 'Intra-EU):
20 000 passengers * 77 km = 1.54 million passenger-km

➢ Attributed to Bosnia and Herzegovina (classified as 'Overflown'):
20 000 passengers * 318 km =6.36 million passenger-km

➢ **Total attributed to EU for this route:**
1.54 million passenger-km

- **Example 4 - National flight between mainland and oversea territory**: Flight between **LFML Marseille (France)** and **FMCZ Dzaoudzi Airport, Mayotte (France)**


Total distance: 8 130 km, crossing over French, Italian and Maltese territory, as well as international waters and African territory:

- 85 km over French territory (mainland)
- 271 km over Italian territory (Sardinia)
- 50 km over Maltese airspace (see red circle on the map)
- 7 684 km over international waters
- 40 km over French territory (Mayotte)

If, for a given year, 20 000 passengers are registered on this route:

- Attributed to France (classified as 'Intra-EU):
  20 000 passengers * (85 km + 40 km) = 2.5 million passenger-km

- Attributed to Italy (classified as 'Overflown'):
  20 000 passengers * 271 km = 5.4 million passenger-km

- Attributed to the Malta (classified as 'Overflown'):
  20 000 passengers * 50 km = 0.1 million passenger-km

- NOT attributed to any country:
  20 000 passengers * 7 684 km = 153.7 million passenger-km

- **Total attributed to EU for this route:**
  2.5 million + 5.4 million + 0.1 million **= 8 million passenger-km**

- **Example 5 - National flight flying in majority over international waters**: Flight between **LIMF Torino/Caselle (Italy)** and **LICC Catania/Fontanarossa, Sicilia (Italy)**
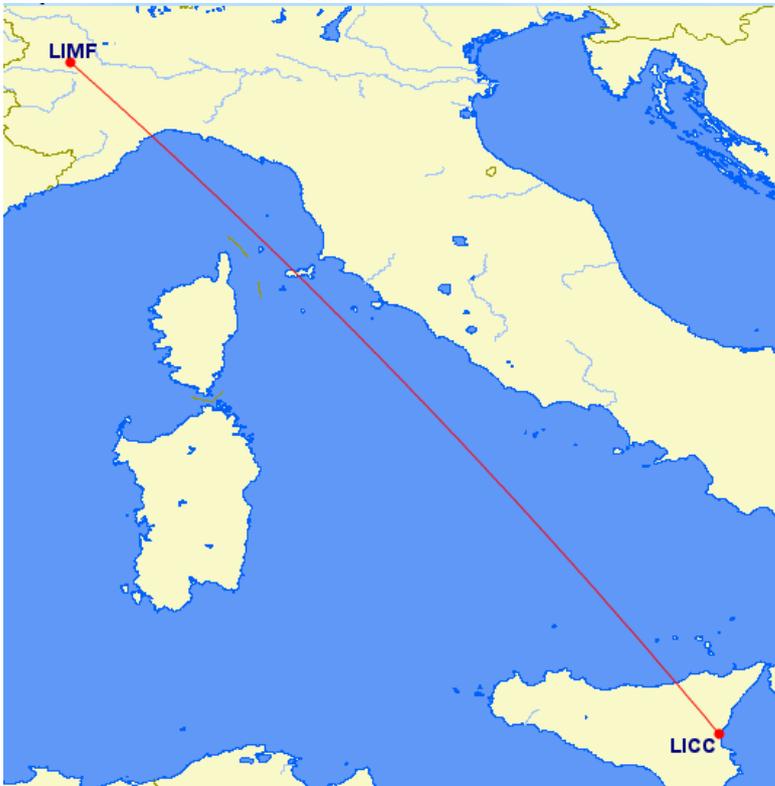
Total distance: 1 059 km, crossing over Italian territory and international waters:

− 307 km over Italian territory (including territorial waters)
− 752 km over international waters

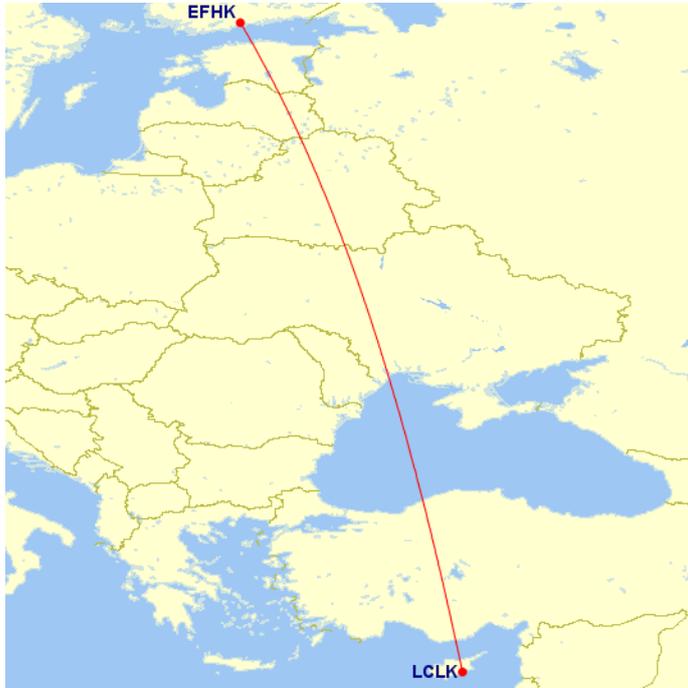For a given year, 200 000 passengers were registered on this route.

➢ Attributed to Italy (classified as 'Intra-EU'):
200 000 passengers * 307 km = 61.4 million passenger-km

➢ NOT attributed to any country:
200 000 passengers * 752 km = 150.4 million passenger-km

➢ **Total attributed to EU for this route:**
61.4 million passenger-km

These three examples illustrate that the transport performance of national (domestic) flights is not necessarily attributed at 100% to the EU Member State/country concerned.

6.2   INTERNATIONAL INTRA-EU TRANSPORT

International intra-EU air transport is defined as transport between airports located in different EU Member States.

- **Example 6 - International flight between two EU countries, flying over several countries**: Flight between **LCLK Larnaca (Cyprus)** and **EFHK Helsinki (Finland)**

Total distance: 2 897 km crossing over Cyprus, Turkey, Latvia, Estonia and Finland, as well as international waters, Ukraine and Belorussia (countries not included in the territorialisation tool):

- 75 km over Cyprus
- 664 km over Turkey
- 205 km over Latvia
- 257 km over Estonia
- 40 km over Finland
- 1 654 km over international waters, Ukraine and Belorussia

If, for a given year, 20 000 passengers are registered on this route:

➢ Attributed to Cyprus (classified as 'Intra-EU'):
   20 000 passengers * 75 km = 1.5 million passenger-km

➢ Attributed to Turkey (classified as 'Overflown'):
   20 000 passengers * 664 km = 13.3 million passenger-km

➢ Attributed to Latvia (classified as 'Overflown'):
   20 000 passengers * 205 km = 4.1 million passenger-km

➢ Attributed to Estonia (classified as 'Overflown'):
   20 000 passengers * 257 km = 5.1 million passenger-km

➢ Attributed to Finland (classified as 'Intra-EU'):
   20 000 passengers * 40 km = 0.8 million passenger-km:

➢ NOT attributed to any country:
   20 000 passengers *1 654 km = 33.1 million passenger-km

Total: 20 000 passengers * 1 243 km = **24.8 million passenger-km attributed to EU for this route.**

6.3 INTERNATIONAL EXTRA-EU TRANSPORT

International extra-EU transport is defined as transport between an airport located in an EU Member States and an airport in a non-EU country.

- **Example 7 - International flight between an EU country and a non-EU country, flying over another EU country:** Flight between **EDDF Frankfurt (Germany)** and **EGLL London-Heathrow (the UK)**
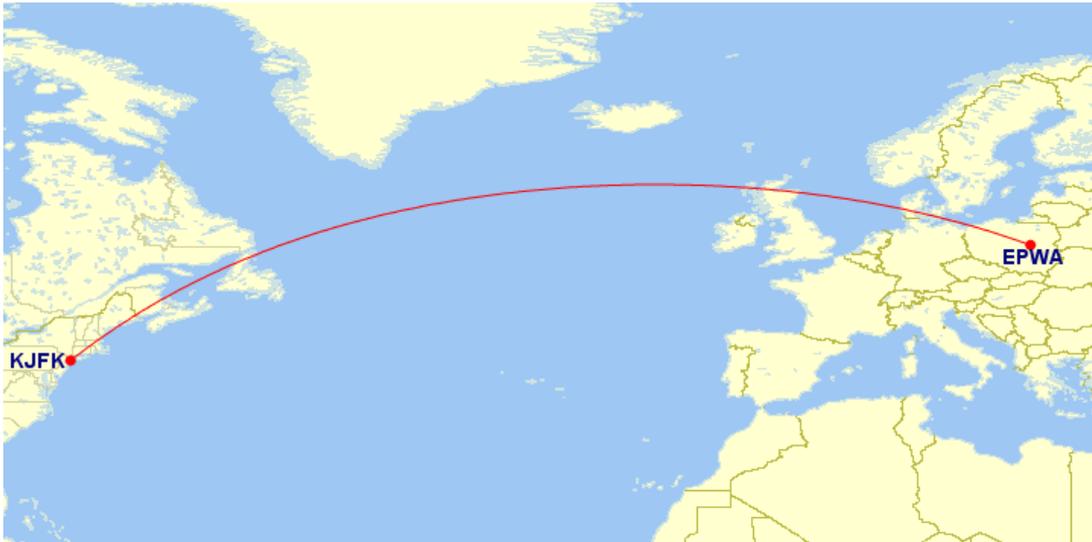

Total distance: 655 km, crossing over German, Belgian, French and the UK territory, as well as international waters in the middle of the English Channel:

− 163 km over Germany
− 278 km over Belgium
− 50 km over France (including the French territorial waters, 12 nm from the coast)
− 153 km over the United Kingdom (including the UK territorial waters, 12 nm from the coast)
− 11 km over the sea (international waters in the English Channel).

If for a given year, 700 000 passengers are registered on this route.

➢ Attributed to Germany (classified as 'Extra-EU'):
   700 000 passengers * 163 km = 114.1 million passenger-km

➢ Attributed to Belgium (classified as 'Overflown'):
   700 000 passengers * 278 km = 194.6 million passenger-km

➢ Attributed to France (classified as 'Overflown'):
   700 000 passengers * 50 km = 35 million passenger-km

➢ Attributed to the United Kingdom (classified as 'Extra-EU'):
   700 000 passengers * 153 km = 107.1 million passenger-km

> ➤ NOT attributed to any country:
> 700 000 passengers * 11 km = 8 million passenger-km:

> ➤ **Total attributed to EU for this route:**
> 114.1 million + 194.6 million + 35 million = **343.7 million passenger-km.**

- **Example 8 - International flight between an EU country and a non-EU country, flying mainly over international waters:** Flight between **EPWA – Warsaw (Poland)** and **KJFK – New York/John F. Kennedy airport (US)**
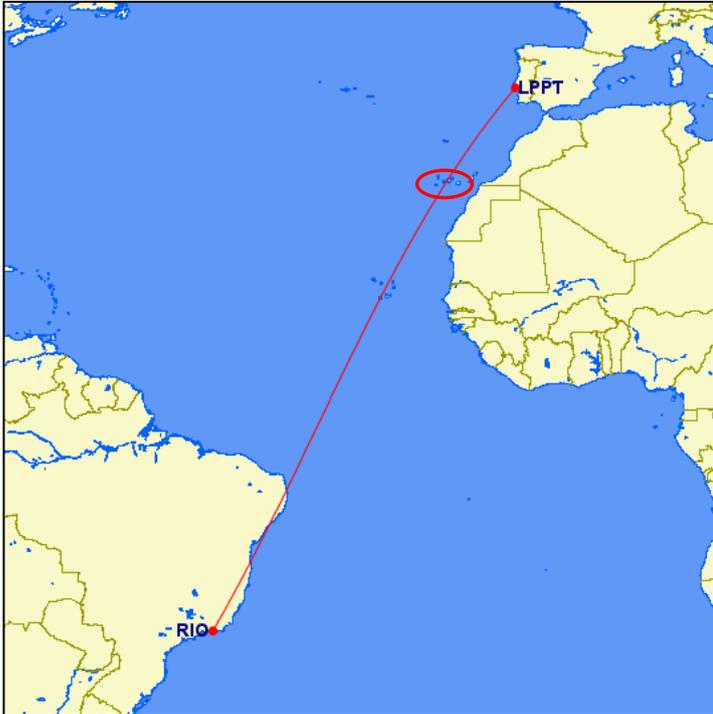

Total distance: 6 866 km, crossing over Poland, Germany, Denmark and United Kingdom, as well as international waters, Canada and the United States (non-EU countries not included in the territorialisation tool):

- 480 km over Poland
- 85 km over Germany
- 331 km over Denmark
- 364 km over the United Kingdom
- 5 606 km over international waters, Canada and the United States

If for a given year, 20 000 passengers are registered on this route.

> ➤ Attributed to Poland (classified as 'Extra-EU'):
> 20 000 passengers * 480 km = 9.6 million passenger-km

> ➤ Attributed to Germany (classified as 'Overflown'):
> 20 000 passengers * 85 km = 1.7 million passenger-km

> ➤ Attributed to Denmark (classified as 'Overflown'):
> 20 000 passengers * 331 km = 6.6 million passenger-km

> ➤ Attributed to the United Kingdom (classified as 'Overflown'):
> 20 000 passengers * 364 km = 7.3 million passenger-km

> ➤ NOT attributed to any country:
> 20 000 passengers * 5 606 km = 112.1 million passenger-km

➢ **Total attributed to EU for this route:**
9.6 million passenger-km + 1.7 million passenger-km + 6.6 million passenger-km = **17.9 million passenger-km**

- **Example 9 - International flight between an EU country and a non-EU country, flying over oversea territories**: A flight between **Lisbon (Portugal)** and **Rio de Janeiro (Brazil)**
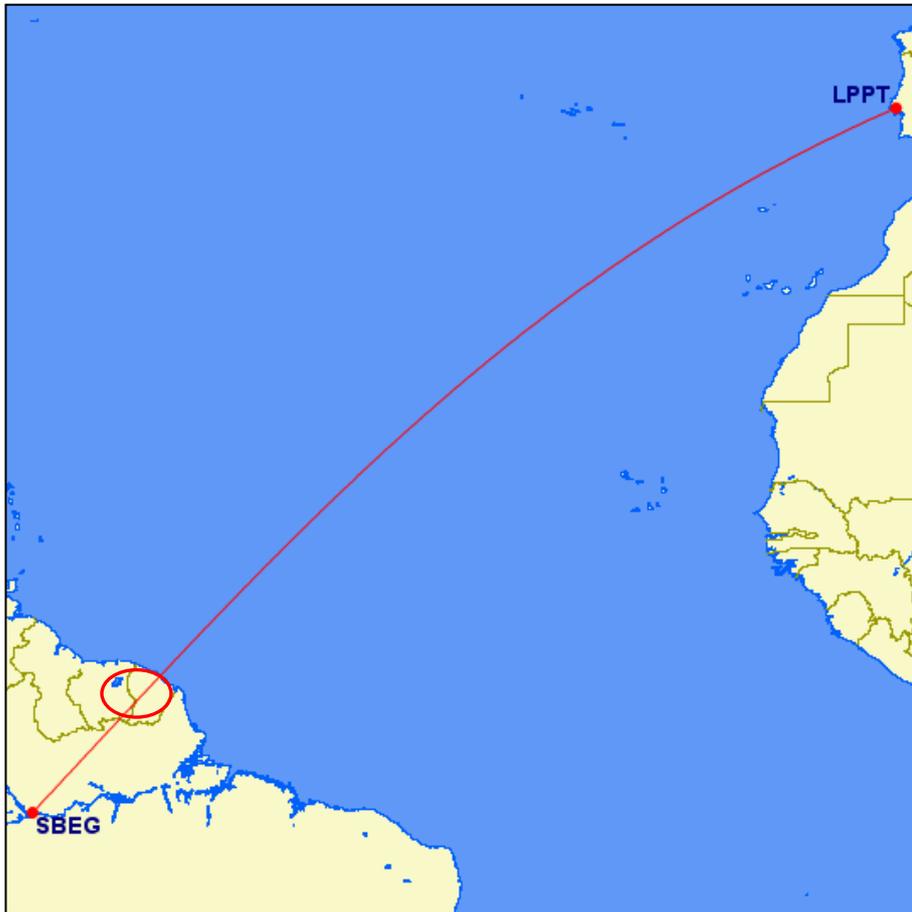

Total distance: 7 416 km, crossing over Portuguese and Spanish territory, as well as international waters, Cape Verde and Brazil (non-EU countries not included in the territorialisation tool):

- 51 km over Portugal
- 99 km over Spain (Canary Islands – see red circle on the map)
- 7 266 km over international waters, Cape Verde and Brazil

If, for a given year, 25 000 passengers are registered on this route:

➢ Attributed to Portugal (classified as 'Extra-EU'):
25 000 passengers * 51 km = 1.3 million passenger-km

➢ Attributed to Spain (Canary Islands) (classified as 'Overflown'):
25 000 passengers * 99 km = 2.5 million passenger-km

➢ NOT attributed to any country:
25 000 passengers * 7 266 km = 181.6 million passenger-km

➢ **Total attributed to EU for this route:**
1.3 million + 2.5 million = **3.8 million passenger-km**

- **Example 10 - International flight between an EU country and a non-EU country, flying over oversea territories**: A flight between **Lisbon** (Portugal) to **Manaus** (Brazil)
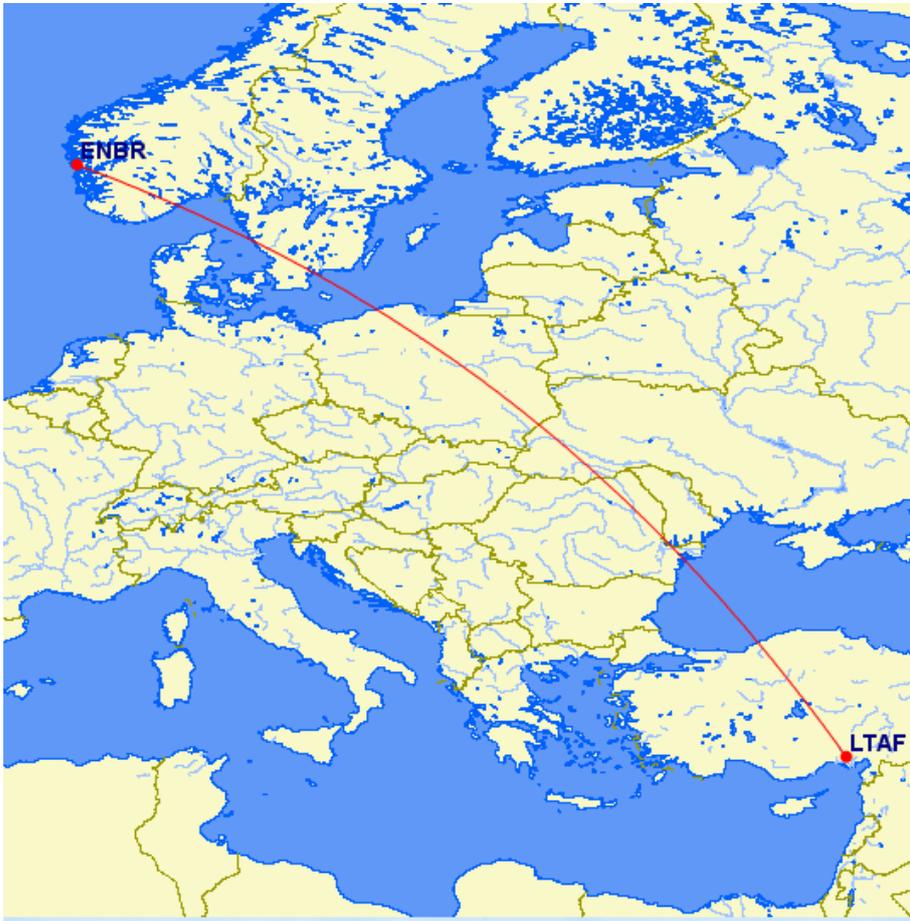

Total distance: 7 016 km, crossing over Portuguese and French territory, as well as international waters and Brazil (non-EU country not included in the territorialisation tool):

- 51 km over Portugal
- 200 km over France (French Guiana – see red circle on the map)
- 7 266 km over international waters and Brazil

If for a given year, 25 000 passengers are registered on this route:

➢ Attributed to Portugal (classified as 'Extra-EU'):
  25 000 passengers * 51 km = 1.3 million passenger-km

➢ Attributed to France (French Guiana) (classified as 'Overflown'):
  25 000 passengers * 200 km = 5 million passenger-km

➢ NOT attributed to any country:
  25 000 passengers * 6 765 km = 169 million passenger-km

➢ **Total attributed to EU for this route:**
  1.3 million + 5 million = **6.3 million passenger-km**

- **Example 11 - International flight between two non-EU reporting countries:** A flight between **ENBR - Bergen** (Norway) to **LTAF - Adana** (Turkey)

Total distance: 3 347 km, crossing over Norway, Denmark, Sweden, Poland, Romania and Turkey, as well as international waters and Ukraine (non-EU country not included in the territorialisation tool):

- 311 km over Norway
- 14 km over Denmark
- 299 km over Sweden
- 690 km over Poland
- 431 km over Romania
- 604 km over Turkey
- 994 km over international waters and Ukraine

If for a given year, 20 000 passengers are registered on this route:

➢ Attributed to Norway (classified as 'Extra-EU'):
20 000 passengers * 311 km = 6.22 million passenger-km

➢ Attributed to Denmark (classified as 'Overflown'):
20 000 passengers * 14 km = 0.28 million passenger-km

➢ Attributed to Sweden (classified as 'Overflown'):
20 000 passengers * 299 km = 5.98 million passenger-km

➢ Attributed to Poland (classified as 'Overflown'):
20 000 passengers * 690 km = 13.8 million passenger-km

➢ Attributed to Romania (classified as 'Overflown'):
20 000 passengers * 431 km = 8.62 million passenger-km

➢ Attributed to Turkey (classified as 'Extra-EU'):
20 000 passengers * 604 km = 12.08 million passenger-km

➢ NOT attributed to any country:
20 000 passengers * 994 km = 19.88 million passenger-km

➢ **Total attributed to EU for this route (as overflown):**
0.28 million + 5.98 million + 13.8 million + 8.62 million = **28.68 million passenger-km**