

## 2 FRANKFURT AIRPORT INTERCONNECTIONS

### 2.1 THE KEY ISSUES ADDRESSED BY THIS CASE STUDY

The Frankfurt airport case study addresses the following key topics:

➤ **New Interchanges**

Beside the Regionalbahnhof (regional station) Frankfurt airport has a separated station exclusively served by long-distance trains. The case study highlights the role and the impact of this station concerning intermodality.

➤ **New Links**

Frankfurt airport is not only connected with a rail link to surrounding towns served by commuter trains, but is also fully accessible from the German high speed rail network, namely the high speed line Cologne – Frankfurt.

➤ **New and Improved services**

Frankfurt airport is served by multiple trains, some of them with a special service for intermodal passengers. The case study will elaborate the effects.

➤ **Integrated Ticketing and Pricing**

The new and improved train services to Frankfurt airport are accompanied by offers for integrated ticketing and pricing.

➤ **Improved check-in and luggage transfer**

The services available to/from or at Frankfurt airport also covers aspects of check-in and luggage transfer.

➤ **Legal and Organisational Arrangements.**

To enable the services and corresponding integrated ticketing and pricing a number of organisational arrangements are in place. This topic will not be handled as a separate section but occurs within the issues mentioned before.

### 2.2 GENERAL DESCRIPTION OF THE CASE STUDY

Obviously air transport implies intermodal travelling, so looking at an airport in principal is useful to analyse multiple topics concerning transport chains consisting of different modes.

Frankfurt airport, after London Heathrow and Paris Charles de Gaulle the number three in Europe concerning passenger figures (> 50 million / year), has numerous services offered to reach the airport, and together with the related infrastructure and the historic development of both in more than 30 years this makes Frankfurt the outstanding example of an intermodal platform in Europe today.

The key solution concerning intermodality at Frankfurt airport is the long distance railway station of the airport, which connects the airport to the high-speed rail network in Germany, so that numerous long-distance trains connect the airport to all parts of the country.

#### 2.2.1 Targets to be Achieved

The targets to be achieved are quite different, depending on the different stakeholders (airport, airlines, railway companies, provider of regional public transport, policy makers).

From the airport's view:

- enlarge the catchment area and handle more passengers

- faster accessibility by high speed trains and alternative access mode to road
- improve competition position towards other gateway airports in continental Europe
- better (more profitable) usage of the constraint slots by long-haul instead of short-haul flights

From the railway's view:

- get a higher market share on passengers travelling to the airport by a shift from using other feeder modes
- improve loads on long distance trains

From an airline's view:

- strengthen the own market position against competing airlines by offering a seamless transport chain to the traveller
- improve loads on their own flights

The policy:

- sustainable growth of the airport business in Germany, meaning more jobs, more direct and indirect income
- improvement of the accessibility of regions not only in the direct vicinity of the airports, meaning not only time savings but also strengthen the attractiveness of regions for investments, employment and tourism

It should be noted that all targets are driven by the market, i.e. effective competition and improving (financial) benefits.

### 2.2.2 Background and Current Situation

In 1972 Frankfurt airport (at that time with slightly more than 10 million passengers per year) was the first airport in Germany to be equipped with its own railway station and an adjacent terminal (today's Terminal 1). At that time the airport was served only by local trains on the line Frankfurt – airport – Mainz – Wiesbaden, with a high frequency but without a synchronised timetable. Before, there were only local buses from Frankfurt downtown and some infrequent services from surrounding towns.

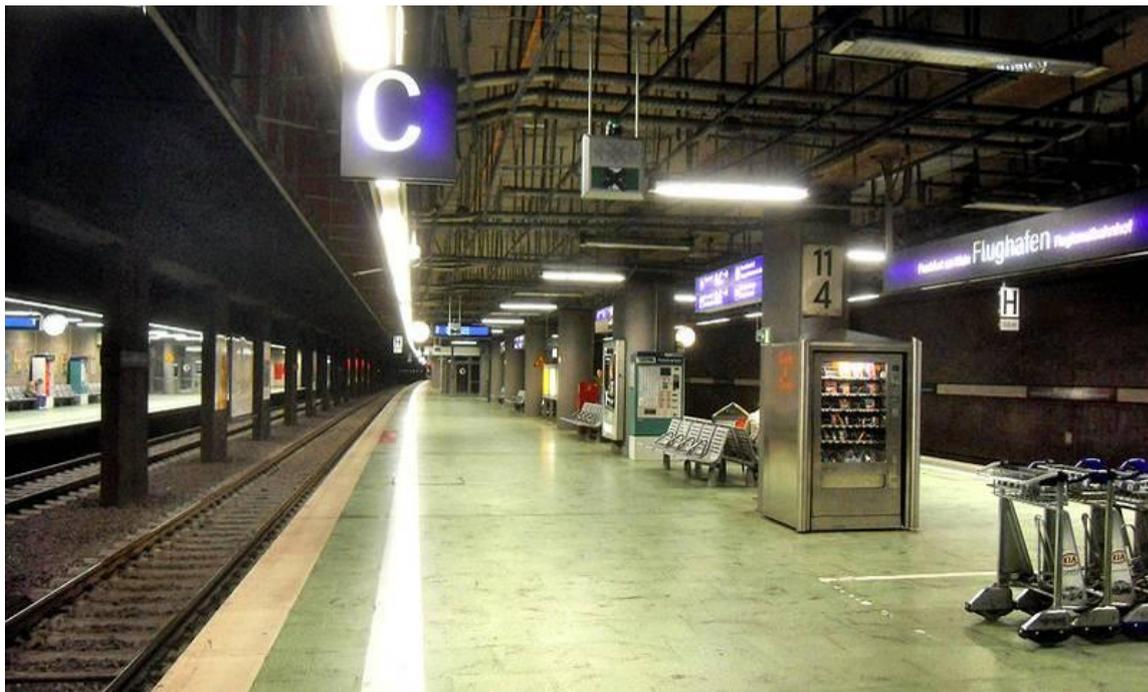


Figure 2-1 Frankfurt airport, railway station for regional trains

In 1978 these services were enriched by infrequent semi-fast trains to several other destinations in the wider catchment of the airport, but long distance trains (the first class only InterCity (IC) trains as well as ordinary fast trains) were still bypassing the airport.

In 1980 the local trains were replaced by high frequency (up to every 15 minutes) commuter trains running 20 hours per day on the route from Frankfurt via the airport to Mainz - Wiesbaden. In addition the airport became a regular stop of an Intercity (now offering 1<sup>st</sup> and 2<sup>nd</sup> class) line from the Rhine/Ruhr (Dusseldorf, Cologne) area along the River Rhine to Frankfurt continuing to Nuremberg – Munich with a synchronised timetable on a hourly base.

In 1982 the Deutsche Bundesbahn started to run special Business-Class only trains on a wet-lease base for Lufthansa connecting Dusseldorf, Cologne, Bonn and later also Stuttgart with Frankfurt airport. The trains (“Lufthansa-Airport-Express”) were to be used exclusively by air travellers connecting in Frankfurt to/from flights of Lufthansa and co-operating airlines. This service ceased in 1993, as the railway company (to be merged with Deutsche Reichsbahn to the Deutsche Bahn Inc. in 1994) and Lufthansa (starting to be privatised in 1994) stopped cross subsidising these services. They were partly replaced by a few public InterCity trains of Deutsche Bahn to be used with ordinary rail tickets connecting selected towns non-stop with Frankfurt airport but these were ceased due to unsatisfactory loads in 1995.



**Figure 2-2 1980s Lufthansa Airport Express in the Rhine valley**

In parallel to the demise of the Lufthansa-Airport-Express Lufthansa and Deutsche Bahn started the project DB-Lufthansa-Airport-Service, which developed to AirRail in 2001 after a short period of disruption. The AirRail concept will be described in detail in section 2.4.4.

To promote intermodal travelling rail/air Deutsche Bahn offers a to contract with any airline or tour operator with airline/tour operator issued vouchers to be accepted in all trains (not only) to Frankfurt airport to and from any railway station in Germany. See section 0 for details of this tariff concept.

Concerning infrastructure in 1999 the 2<sup>nd</sup> railway station at Frankfurt airport, dedicated especially for long-distance trains was opened and three IC-routes now incorporated hourly stops at Frankfurt airport, as well as additional regional services on medium distances.

In 2002 the high-speed link was opened, reaching Cologne and Bonn in less than one hour and additional InterCityExpress (ICE) routes served Frankfurt airport, and this allowed Lufthansa to cease all flights between Cologne and Frankfurt.

### 2.2.3 Geographic Coverage

The geographic coverage of Frankfurt airport in principal is worldwide air transport, as there are passengers transferring not only between destinations in Germany and Europe but also to other continents and even for travelling between other continents. When focusing on the intermodal aspect, the catchment of Frankfurt for surface feeder transport does not cover only wide parts of Germany but also parts from neighbouring countries. Direct trains to the airport e.g. from the Netherlands, from Belgium, Switzerland or Austria emphasise this real international scope of intermodality.

The following figure shows a (modelled) catchment of Frankfurt airport, indicating the market share of the airport for the total demand on air transport on each region. Regions with market shares below 5% are not depicted.

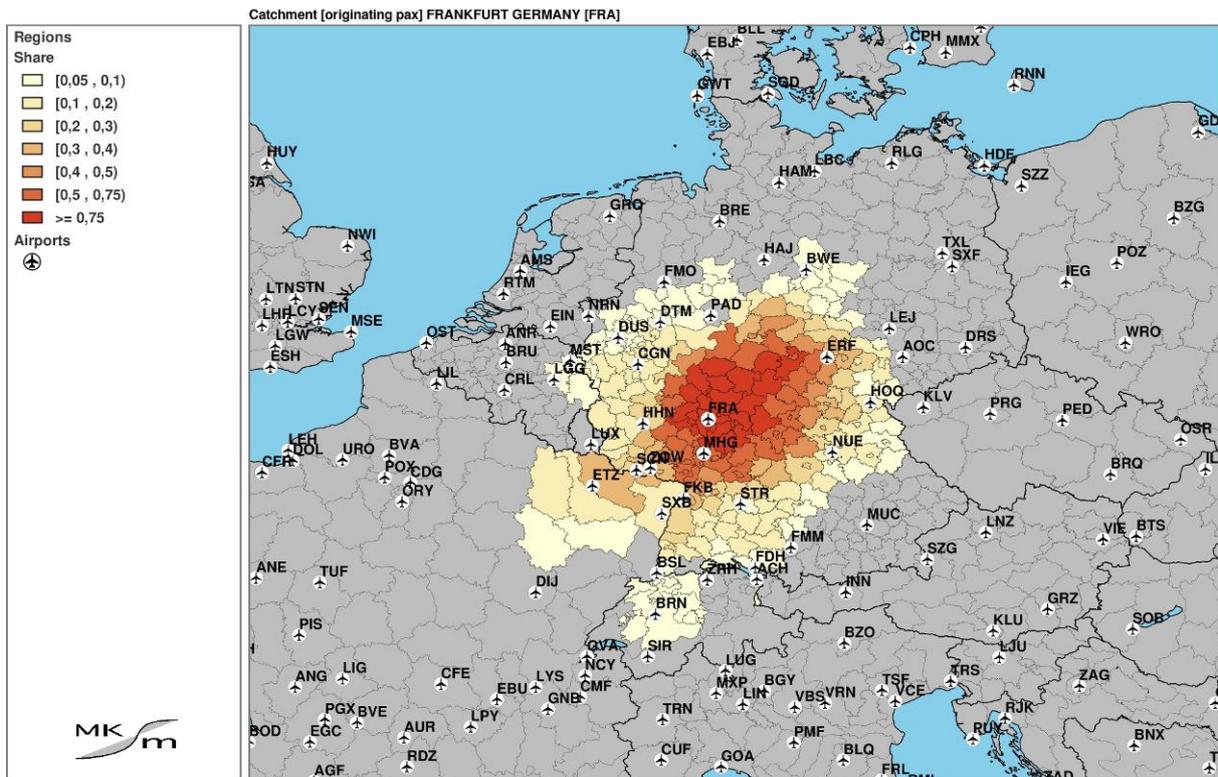


Figure 2-3 Catchment of Frankfurt airport

The catchment covers not only the Rhine-Main area, but also partly Southwest Germany and Eastern France down to Switzerland in the South, while towards Northwest the Ruhr area and parts of Belgium are covered as well.

## 2.3 SPECIFIC CHARACTERISTICS OF THE CASE STUDY

The solutions found are those which improve the interconnectivity between surface transport and air transport with special focus on public transport as a feeder to the airport.

### 2.3.1 Modes and Infrastructure Involved

The solutions described in detail include infrastructure topics:

- the long distance railway station at the airport as a new interchange between rail and air mode, connected to existing and improved or new built high speed railway links
- effective integrated services, which developed through multiple forms of co-operation and interaction based on organisational arrangements between the different actors during the last decades, including
  - special feeder trains or at least segments of public trains for air passengers usable only with airline tickets and through checking of passengers and their luggage already at the station where the trip begins to any destination served by the airline or its alliance partners in the world
  - worldwide marketing and information for such intermodal co-operation by availability through airline booking engines (trains included with flight numbers) and a common brand "AirRail"
  - airline tickets which include the fare for an individual rail trip under the travellers own responsibility between Frankfurt airport and any railway station in Germany offered by airlines or tour operators

### 2.3.2 Existing Institutional and Regulatory Barriers

The barriers which had to be overcome or that still exist and also may have enforced the development of intermodal structures come from:

- monopolistic structures on the supply side for the distinct modes
- different companies operating the transport in the different modes with different core markets in their business
- capacity constraints at the airside of Frankfurt airport and the regulations to deal with that (slot allocation, grandfather rights)
- different responsibilities for infrastructure projects concerning the different modes (Federal Government versus Länder)

To give some examples:

- Deutsche Bahn and Lufthansa are competitors on distinct short haul routes, this has complicated their co-operation on other fields where they do not compete.
- Airlines competing with Lufthansa and are not member of STAR-Alliance can hardly benefit from Lufthansa short haul air feeders, so a co-operation with Deutsche Bahn allows them to feed their flights at Frankfurt.
- The slot constraints at Frankfurt and the "use it or lose it" principle enforced Lufthansa to replace short haul flights by train services to be able to inaugurate more intercontinental flights.

### 2.3.3 Intermodal and Interconnection Opportunities

Frankfurt airport is the biggest and (up to 1992 when the new airport in Munich opened) the only airport with a hub functionality in Germany and offers by far the highest number of destinations especially in intercontinental transport of all airports in Europe, many of them offered uniquely in Europe. For that reason about 50% of total passenger demand comes from travellers who transfer at Frankfurt to another flight.

Both the high number of (unique) destinations and the high share of transfer passengers make Frankfurt airport a perfect candidate to be connected with long distance trains, which allow the traveller to reach the airport directly from their hometown, avoiding short haul feeder flights or transfer connections via other airports. This may also apply for distinct coach services where rail is not an adequate option with various types of operating forms.

The following table describes surface transport to / from Frankfurt airport concerning volumes and mode choice. The data were collected for the process of the planning approval for the planned capacity improvement of Frankfurt airport.

**Table 2-1 Amount and mode choice of surface transport to Frankfurt airport (2005)**

Segment	Private / Rental Car	Taxi	Coach	Public Transport (PT)	Total	Share of PT
	(000 passenger movements per average working day)					%
Air Passengers	29.7	11.5	2.9	21	65.1	36.7
Employees	55	0	0	29.1	84.1	34.6
Attendants	35.3	0	0	1.8	37.1	4.7
Visitors/Customers	17.6	0	0	3.2	20.8	15.5
Rail passengers not airport related	1.9	0.6	0	2.3	4.8	48.2
Sum	139.5	12.1	2.9	57.4	211.9	27.1

The focus of the case study is with the air passengers using public transport (and especially long-distance trains) to the airport.

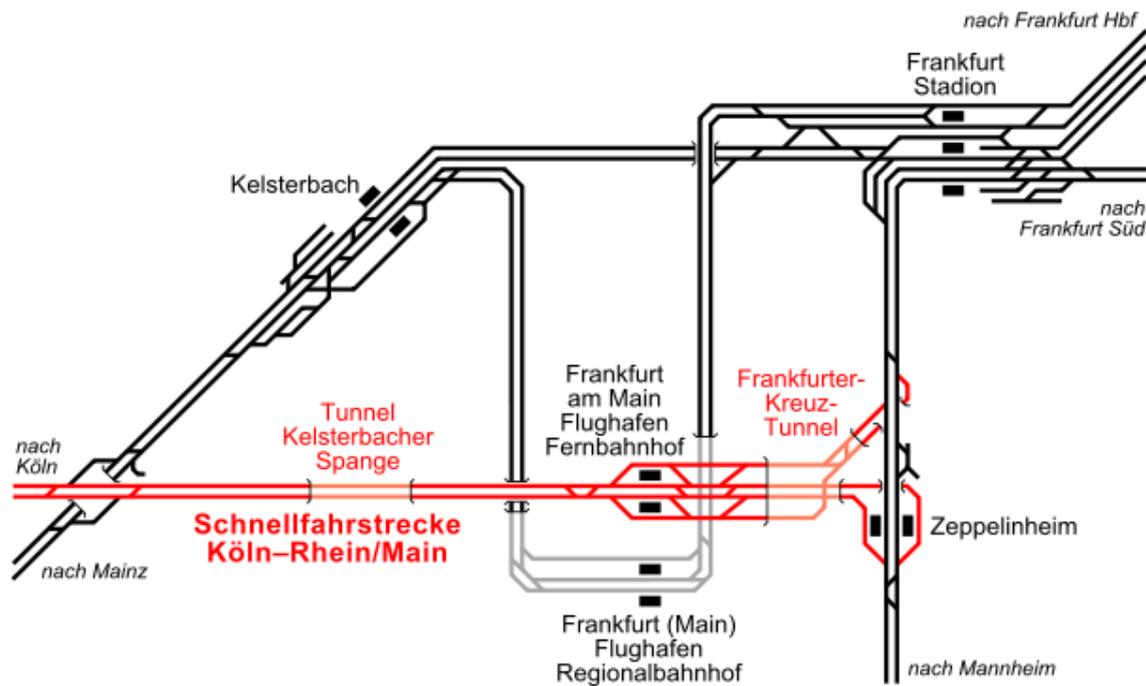
## 2.4 SOLUTIONS ALREADY IN PLACE

### 2.4.1 Overview

The solutions described in the following sections deal mainly with infrastructure, the services run on it and some details of the latter concerning ticketing and seamless intermodal transport. The first section is for the long-distance railway station at Frankfurt airport and its connections to the rail network; a prerequisite without the new services connecting this airport with the German high speed railway network could not have been established. The section includes the effects caused by the new services using this infrastructure.

### 2.4.2 The Long-distance Railway Station at Frankfurt Airport, its Links and Rail Services

The long-distance railway station (“Frankfurt am Main Flughafen Fernbahnhof”) at Frankfurt airport was opened in 1999. It is the largest railway station in Germany at an airport and used by about 23,000 travellers per working day. It is situated in the north of the airport as an extension of the already existing station (“Frankfurt (Main) Flughafen Regionalbahnhof”) which today handles the regional rail traffic. The construction of this new station was necessary in terms of the additional capacity needed when connecting the airport to the new high speed link (HSL) Cologne – Frankfurt which was opened in 2002. In addition the airport is connected to the classic railway line towards Cologne via Mainz along River Rhine and also to the trunk line Frankfurt – Mannheim towards the south, i.e. the airport can be served not only by high speed trains in the east-west- but also in the north-south direction, although for trains serving the latter route a change of direction in the airport station is required. The following figure shows the connections (marked red) of the station to the different railway links in the Frankfurt area. Please note that in case of disruptions or maintenance work concerning each of the two railway stations at the airport, rail traffic in east-west-direction and vv. can be routed either via the old or via the new railway station. As the connection between this different rail lines had to be build anyway, the applicable costs for that part of the infrastructure are not be assigned to the airport station.



**Figure 2-4 Connections of Frankfurt airport to the rail network**

With the links as mentioned above it was possible to serve the airport by multiple ICE- and IC-lines. These allow direct connections from many parts of Germany and also some neighbouring countries. These services mainly run on an hourly base, while some are offered every two hours. As the paths of the distinct lines overlap partly and often are linked by corresponding stops at core stations on the same platform (e. g. Mannheim, Cologne), at least hourly connections but in many cases even two travel opportunities per hour are available from all parts of the country. From abroad Frankfurt airport can be reached by direct trains from the Netherlands, Belgium, Switzerland and Austria.

The following figure shows the ICE services available to the airport. Additional IC-trains complement the ICE-services along the old rail link to Cologne along the River Rhine. Furthermore the regional station is not only served by high frequency commuter trains from the Rhine/Main area but also by some Regional Express trains running on medium distances and connect the airport e.g. with Saarbrücken and Koblenz at least every two hours.

**ICE-Netz 2009**

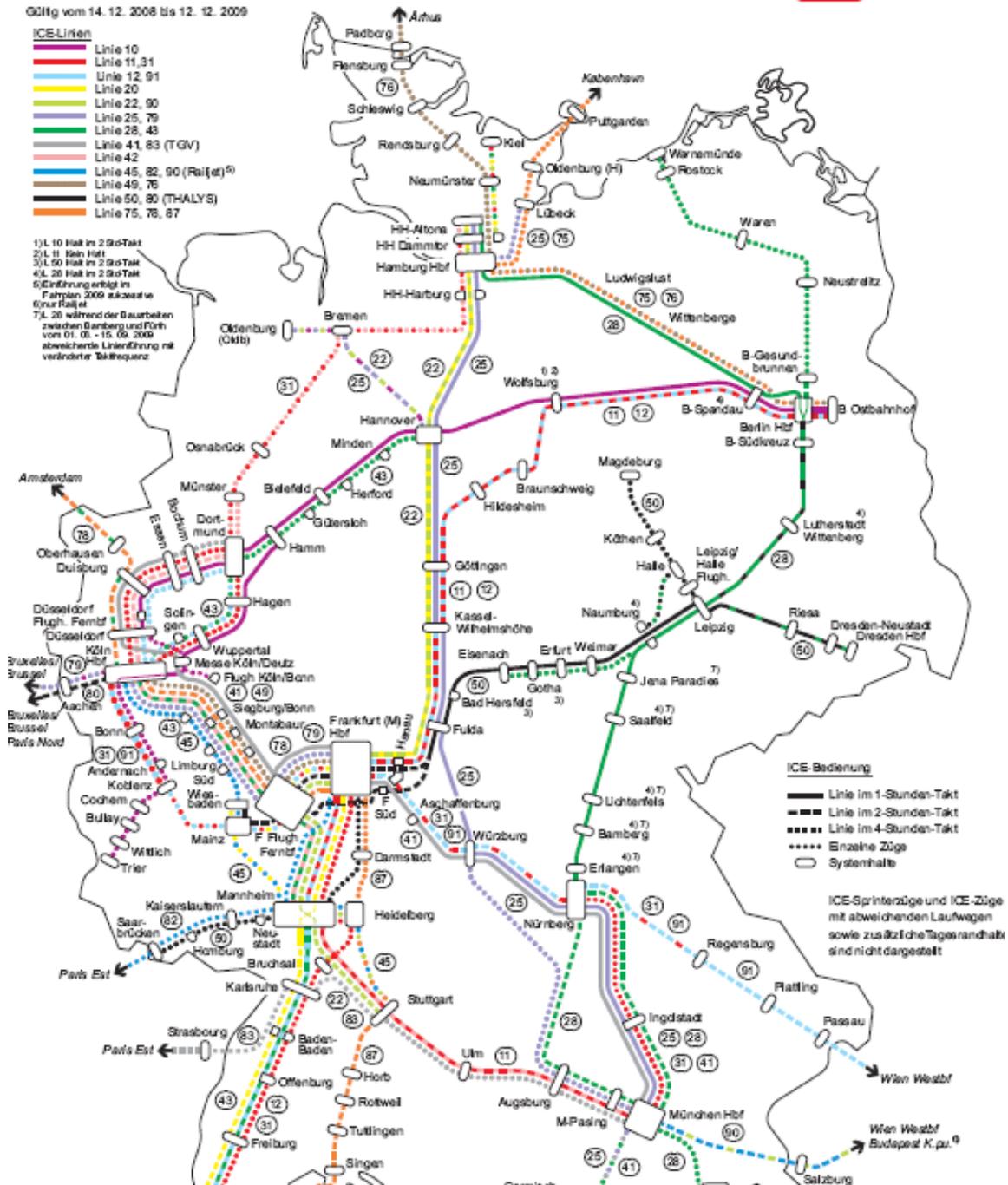


GÜltig vom 14. 12. 2008 bis 12. 12. 2009

**ICE-Linien**

- Linie 10
- Linie 11, 31
- Linie 12, 91
- Linie 20
- Linie 22, 90
- Linie 25, 79
- Linie 28, 43
- Linie 41, 83 (TGV)
- Linie 42
- Linie 45, 82, 90 (Railjet®)
- Linie 49, 76
- Linie 50, 80 (THALYS)
- Linie 75, 76, 87

- 1) L 10 Halt in 2 90-Takt
- 2) L 11 kein Halt
- 3) L 50 Halt in 2 90-Takt
- 4) L 28 Halt in 2 90-Takt
- 5) Einführung erfolgt im Fahrplan 2009 ab dem 15. 09. 2009
- 6) während der Bauarbeiten zwischen Garmisch und Föhn vom 01. 08. - 15. 09. 2009 abweichende Linienführung mit veränderter Taktfrequenz



(source: DB)

**Figure 2-5 ICE network in Germany**

*Performance against main toolkit criteria*

**Cost and financial feasibility**

The construction costs of the station were at € 225 million, of which € 97 million came from the Federal Government, in line with the political target to foster intermodality by connecting airports to the railway network, i.e. the political feasibility of such infrastructure investments is given. The remaining € 128 million came from Fraport AG, the company running Frankfurt airport. This investment included the footbridge from the airport to the station and all check-in and luggage facilities dedicated for the air passengers arriving by rail.

The project of the station itself has been realised in co-operation between state owned Deutsche Bahn and the Fraport AG. A better part of refinancing the station is done by station fees which apply for all trains using the station of for the time being € 22.28 per train stop, resulting in more than € 1.5 million per year, enriched by rental income from shops etc. The pricing for train stops has to be approved by the Federal Network Agency.



**Figure 2-6 Long-distance station Frankfurt airport (platform area)**

Furthermore on top of the railway station the 'Frankfurt AirRail Centre' (now known as 'The Squire') is built by a private investor for roughly € 1 billion to be opened in 2011. This building consisting of nine structural levels will contain two hotels, a supermarket, restaurants and office space which sums up to 140,000 square meters of rentable area. Refinancing works fully with rental income.



**Figure 2-7 Long-distance station Frankfurt airport with 'The Squire' on top**

The long-distance trains serving Frankfurt airport all run fully on the financial responsibility of the operator Deutsche Bahn, while the regional and commuter trains at the regional station run on behalf of the Länder which pay for these services.

**Impact on users' door to door travel time**

With the inauguration of the high speed link Cologne – Frankfurt and its connection to the Frankfurt – Mannheim line a reduction in the travel-time to reach the airport between 30 and 60 minutes has been established. The following table shows these travel-times for dedicated areas.

**Table 2-2 Reduction in travel-time achieved by new rail links**

From	Old travel-time (minutes)	New travel-time (minutes)	Saving (minutes)	Remark
Dusseldorf	155	75 - 85	60- 80	Increased reduction when bypassing Cologne Central station (20 min)
Cologne	125	50 - 65	60-75	Reduction varies with intermediate stops and station of origin at Cologne
Bonn	105	40-75	30-65	Reduction varies with the station of origin at Bonn
Montabaur	135	35	100	Served before only by local trains of a secondary line requiring train changes
Limburg	100	20	80	Served before only by local trains of a secondary line requiring train changes
Mannheim	70	30	40	Detour via Frankfurt Central station incl. train change required before

Savings outlined for Dusseldorf also apply for most parts of the Ruhr area and for some additional destinations (e.g. Amsterdam).

Savings outlined for Mannheim also apply for all towns on the line towards Basel – Zurich and Stuttgart – Munich.

Due to rerouting of long-distance lines minor decreases of travel-times from other parts of Germany apply (e. g. Hamburg, Hannover, Dresden, Leipzig, Erfurt).

**Impact on users' door to door travel cost**

When using the ICE-trains on the HSL Cologne – Frankfurt a higher fare is charged in comparison when travelling by InterCity trains on the old line along River Rhine which amounts to € 61- instead of € 41 full fare 2<sup>nd</sup> class. As the possibility of travelling on the old line still exists, this surcharge applies only to those who actually want to use the faster trains. As the actual yield on long distance rail travel in Germany is only at about 50% of the standard price, the average surcharge actual paid for the faster ICE-services should be at around € 10 and is not applicable when using integrated tariff schemes as mentioned in section 0.

**Impact on comfort and convenience**

The connection of the new airport station to the Frankfurt – Mannheim line brought direct train services to many parts of Germany where a change of trains had been necessary before. This mainly applies for cities situated on the ICE-Lines Dresden – Leipzig – Erfurt – Frankfurt airport ( - Mainz – Wiesbaden), Hamburg – Hannover – Göttingen – Kassel– Frankfurt airport – Mannheim – Stuttgart, Basel – Freiburg – Karlsruhe – Mannheim Frankfurt airport (- Cologne) and Munich – Augsburg – Ulm – Stuttgart – Mannheim Frankfurt airport (- Cologne).

For people with physical disabilities avoiding train changes is of special value.

**Acceptance by users**

As the old railway station existing before was at the limit of its capacity the acceptance by users. i.e. the train operating companies (for the time being the Deutsche Bahn business unit 'Long Distance') welcomed the construction of the station. Today the long-distance station is served by more than 200 trains per day of which about 180 are ICE-trains. The passenger figures at the long distance station grew from 9,000 in the year of opening 1999 when the HSL Cologne – Frankfurt was still under

construction to 22,500 per weekday in 2008. After a downturn in the total passenger figures at Frankfurt airport in 2009 (world financial crisis), it is expected to reach this volume again in 2010. Note that these figures do not include those travellers using the regional station, where another 30,000 per working day (more than 3,000 in peak hours) use the regional and commuter trains to/from the airport.

As mentioned in section 2.3.3 many of these train passengers are not air-travel related (employees etc.), so when focusing on intermodality (i.e. only counting air passengers using the train as a feeder mode) the following figures for the year 2008 apply:

- 7.7 million p.a. (14,000 per day) air passengers using rail as a feeder mode, of which
- 5.2 million air passengers use the long-distance railway station, and
- 2.5 million air passengers use the railway station for regional trains.

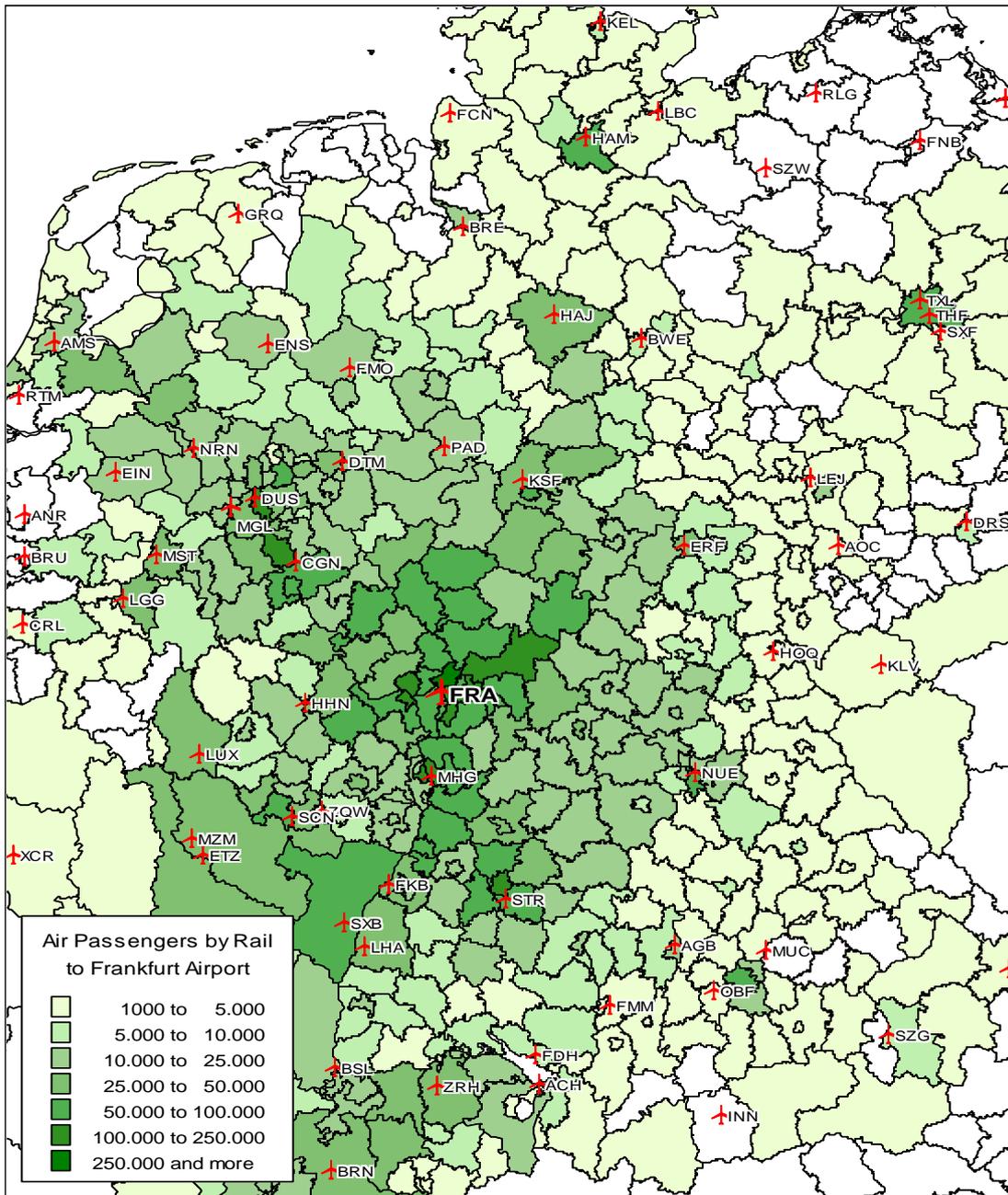


Figure 2-8 Spatial distribution of air passengers using public transport as feeder mode

The map in Figure 2-8 shows the (modelled) origins of passengers to Frankfurt airport using public transport as a feeder mode. For a better orientation the identifier codes of airports in the catchment area are displayed as well. There are several highly populated areas which are quite far away from Frankfurt airport (FRA), from where a significant number of passengers are travelling by rail to/from the airport. Examples are Hamburg (HAM), Berlin (TXL etc.), Hanover (HAJ) and Kassel (KSF) in the north, the Dusseldorf / Cologne area (DUS, CGN) in the west and in the south the area of Mannheim (MHG), Karlsruhe (in the North of FKB) and Stuttgart (STR).

#### Users' safety

When air passengers opt for public transport instead of car to reach the airport this means a general increase in users' safety, as the accident rate of public transport is significantly lower than for private car usage. In Germany in 2008 there were 82 killed and 7,500 injured people in accidents per billion passenger trips by individual road transport (car etc), while the fatality rate of rail transport is 1.25 travelling persons per billion passenger trips. So a missing rail connection at Frankfurt airport (assuming all these passengers then would use private car to reach the airport, which is quite unlikely) would have a net impact of not more than 1 person killed and 100 people injured per year.

#### Mode shift, GHG emission

On the first view it should be possible to retrieve information about mode shift and resulting GHG emissions from the figures outlined above for the development of passenger numbers of long-distance rail passengers at Frankfurt airport which rose from 9,000 to 22,500 per working day. Unfortunately this development results in several overlapping effects, described below, for which GHG emissions cannot be quantified:

- Passengers who travel to/from the airport by long-distance train instead of private car. This applies as well for air passengers and for employees, visitors, etc.
- Passengers who travel to/from the airport by long-distance train instead of using a transfer connection with long-distance train to Frankfurt central station plus commuter train to the airport.
- Passengers who use the new airport station as starting point of their rail trips instead of the previously used central stations at Frankfurt, Mainz, Wiesbaden, etc.
- Passengers who travel to/from the airport by long-distance train who otherwise would have taken a short haul feeder flight (this especially applies for passengers from the Cologne area, as the flights Cologne – Frankfurt were ceased after opening of the parallel high speed link).
- Slots are heavily constrained at Frankfurt airport. So slots from the flights ceased were immediately used for other flights. In this case Lufthansa used them to implement long-haul intercontinental flights to destinations not served from Frankfurt airport before.
- Passengers who changed the routing of their travel. e.g. using the train to Frankfurt and fly to New York from there, instead of flying on another route like Dusseldorf – New York nonstop or Cologne – Amsterdam – New York.
- Employees who chose a job at Frankfurt airport after the HSL was opened and allowed long-distance commuting in favour of a job near their residence.
- Air passengers who undertake an additional trip by plane as the accessibility to flights from Frankfurt airport has become much easier for them.
- Air passengers who undertake a trip by plane instead by train as the accessibility to flights from Frankfurt airport has become much easier for them.

So there is no quantitative answer possible concerning mode shift and GHG emissions, and the impact the long-distance railway station at Frankfurt airport with corresponding services and reduction of travel-times actually had.

Nevertheless one can have a look at the passenger figures of Frankfurt airport and their development. The following table shows the passenger figures of the years 2000, 2003 and 2008. These years were chosen as the year 2000 saw the highest passenger figures on domestic flights to/from Frankfurt ever recorded, 2003 was the first year with full service all year round on the HSL Cologne – Frankfurt, and

2008 was the year with highest passenger figures in total ever recorded at Frankfurt and will be probably reached again in 2010 after the decrease due to the world financial crisis in 2009.

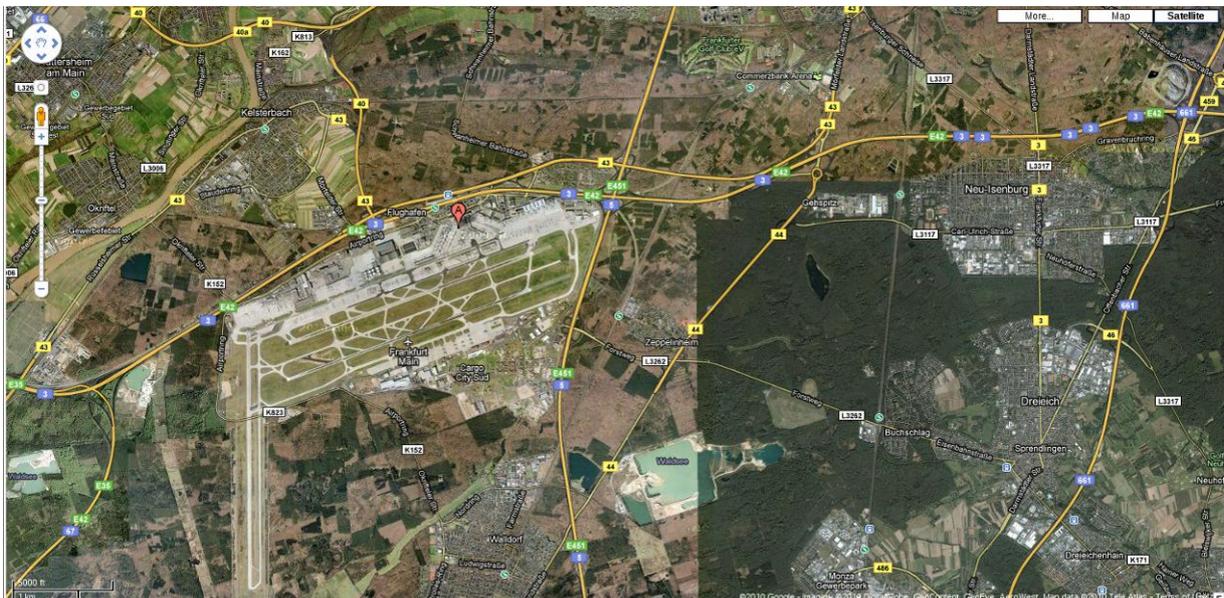
**Table 2-3 Passenger figures for selected years at Frankfurt airport**

Passengers at Frankfurt Airport (million)	Year 2000	Year 2003	Year 2008	Change 2000 - 2003	Change 2000 - 2008	Change 2003 - 2008
Domestic	8,8	7,57	6,38	-14,0%	-27,5%	-15,7%
International European	22,94	22,99	25,24	+0,2%	+10,0%	+9,8%
Intercontinental	26,42	25,12	28,23	-4,9%	+6,9%	+12,4%
Total	49,36	48,11	53,47	-2,5%	+8,3%	+11,1%

Although many different events which took place in the time period covered (9/11, arrival of low cost carriers at regional airports, etc.) it can clearly be seen that passenger figures for domestic flights from/to Frankfurt decreased, while European and Intercontinental passenger figures increased significantly. This development is remarkable especially when comparing the passenger figures of total domestic air transport for which more than additional 5 million passengers were recorded on German airports between the years 2000 and 2008.

**Congestion**

Concerning congestion it has to be stated that even in the case where all the additional travellers using the long-distance trains otherwise would have taken a car to reach Frankfurt, the amount of these trips is far too low to change the situation of congestion in peak hours which applies at all motorways and trunk roads around the airport almost daily, as each of them is used by more than 100,000 vehicles per day, of which only a minority can be considered as used for airport related trips.



**Figure 2-9 Road network around Frankfurt airport**

**Transferability of findings**

In principle the solution of long-distance railway services to an airport can be transferred to nearly every airport, assuming a rail network exists at all in the larger vicinity of the airport. Nevertheless some aspects have to be considered:

- **Size of airport.** Assuming a modal split achievable for rail transport to an airport of about one third, and an average number of passengers leaving or entering a train at the airport of at least 50 people to ensure the economic viability of train stops at the airport and services offered at least every hour, results in a minimum airport size of about 1.5 million annual passengers. Hourly train connections to an airport are the absolute minimum level of service required for their acceptance

by potential intermodal users, as lower frequencies cause to long average connecting times between train and plane.

- **Number of destinations served in comparison to competing airports in the vicinity.** Long-distance services to an airport only make sense if it is served by flights to destinations which are not offered at most other airports in its larger vicinity. The passenger demand to those destinations served exclusively from this airport in minimum should be at about 1.5 million per year. The airport of Lyon- (Saint-Exupéry) equipped with a railway station only accessible by long-distance TGV-trains of the Paris – Avignon – Marseille – Nice line bypassing the city of Lyon showed minimal passenger numbers on intermodal connections. The station – served by only 6 to 9 trains per day – is used mainly by true rail passengers from the vicinity of Lyon, who have better access by car to this station instead to the TGV-stop downtown Lyon.
- **The airport's location.** The airport should be located in a way that railway lines already existing or which are new built anyway due to demand independent from the airport require no or only short links to be built additionally. The rerouting of trains via the airport must not cause a significant prolongation of travel-times for non airport-related passengers. For that reason branch lines with a terminus at the airport are to be implemented only when all trains are supposed to begin/end at the airport and in addition (or mainly) serve local demand. The railway station of Geneva airport connected with a branch line (3 kilometres) from Geneva Central station is an example for such a solution: all (long-distance) reaching Geneva from the East continue to the airport, i.e. serving the airport does not affect travel-times for traffic to/from downtown Geneva.

#### 2.4.3 Rail&Fly: Integrated Ticketing and Pricing for Air/Rail Passengers

This solution is not limited to Frankfurt airport, but is useful especially for inbound passengers and many airlines at big hubs, so this solution especially fits to the case of Frankfurt airport.

Rail&Fly is an add-on ticket for train usage from any railway station to any airport in Germany and vice versa, and also covering the airports Basel-Mulhouse and Amsterdam (selected carriers only). Rail tickets are sold by the airline (for the time being 80 participating carriers) or tour operator (76 participating companies/brands) when purchasing the air ticket or the tour package. While some airlines / tour operators include these tickets in the air fare / price of package tour, others charge the customer when applying for a Rail&Fly ticket with a fee of € 25. Rail &Fly includes transfer between railway station and airport by public transport if there is no direct rail service to the air terminal. The tickets are valid on any train on the day of the flight departure or the day before and on the day of flight arrival and the following day respectively. To reach the airport in time to meet the check-in deadlines is in the full responsibility of the traveller. Neither the airline nor the train operator takes over any responsibility to keep the intermodal chain working in case of any disruptions.

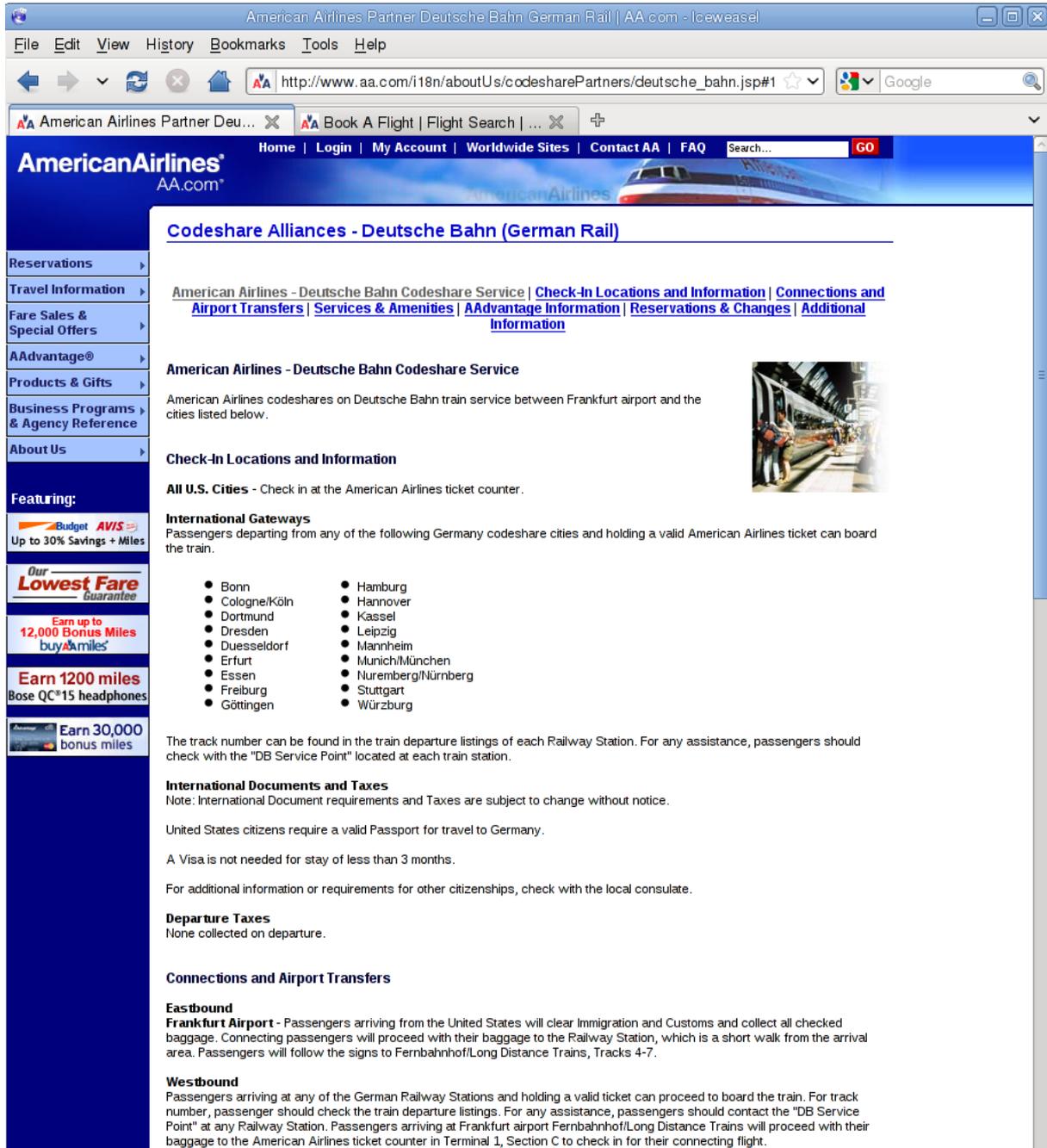
##### *Problems addressed – solution offered*

Rail&Fly tickets address the following problems which occur for the different actors involved in intermodal transport rail <-> air

- Passengers find it more comfortable when there is no need for them to buy a separate ticket for their travel to or from the airport. This especially applies for inbound-travellers from abroad, with possibly limited language skills, when they need to buy a rail ticket after arrival at the airport.
- Passengers welcome the existence of flexible tickets for train travel to/from the airport at a price level which usually only applies only for discounted tickets limited to a distinct train and subject to availability.
- The railway company likes to improve the number of passengers transported. The Rail&Fly tariff scheme allows attractive pricing and as the ticket is bound to an actual flight booking it avoids cannibalism effects on full fare rail tickets dedicated to passengers for non air transport related travel.

Frankfurt airport for the time being is a heavily constrained airport concerning available slots. For that reason

- An airport with capacity constraints is happy to increase the number of arriving and departing passengers in favour of twice counted transfer passengers. This allows an increased catchment, more destinations and more retail business.
- Airlines welcome passengers who use the train instead of a short haul flight to their hub, which enables them to cease some of these short-haul flights or at least do not have to increase their frequencies and make a more profitable use of those slots with long-haul flights
- Airlines for which an airport is just a spoke end of their network and which do not have any (alliance) partner airline at such an airports, are happy to feed their long-haul flights by long-distance train services.



**Codeshare Alliances - Deutsche Bahn (German Rail)**

[American Airlines - Deutsche Bahn Codeshare Service](#) | [Check-In Locations and Information](#) | [Connections and Airport Transfers](#) | [Services & Amenities](#) | [AAdvantage Information](#) | [Reservations & Changes](#) | [Additional Information](#)

**American Airlines - Deutsche Bahn Codeshare Service**

American Airlines codeshares on Deutsche Bahn train service between Frankfurt airport and the cities listed below.

**Check-In Locations and Information**

**All U.S. Cities** - Check in at the American Airlines ticket counter.

**International Gateways**  
Passengers departing from any of the following Germany codeshare cities and holding a valid American Airlines ticket can board the train.

<ul style="list-style-type: none"> <li>• Bonn</li> <li>• Cologne/Köln</li> <li>• Dortmund</li> <li>• Dresden</li> <li>• Duesseldorf</li> <li>• Erfurt</li> <li>• Essen</li> <li>• Freiburg</li> <li>• Göttingen</li> </ul>	<ul style="list-style-type: none"> <li>• Hamburg</li> <li>• Hannover</li> <li>• Kassel</li> <li>• Leipzig</li> <li>• Mannheim</li> <li>• Munich/München</li> <li>• Nuremberg/Nürnberg</li> <li>• Stuttgart</li> <li>• Würzburg</li> </ul>
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The track number can be found in the train departure listings of each Railway Station. For any assistance, passengers should check with the "DB Service Point" located at each train station.

**International Documents and Taxes**  
Note: International Document requirements and Taxes are subject to change without notice.

United States citizens require a valid Passport for travel to Germany.

A Visa is not needed for stay of less than 3 months.

For additional information or requirements for other citizenships, check with the local consulate.

**Departure Taxes**  
None collected on departure.

**Connections and Airport Transfers**

**Eastbound**  
**Frankfurt Airport** - Passengers arriving from the United States will clear Immigration and Customs and collect all checked baggage. Connecting passengers will proceed with their baggage to the Railway Station, which is a short walk from the arrival area. Passengers will follow the signs to Fernbahnhof/Long Distance Trains, Tracks 4-7.

**Westbound**  
Passengers arriving at any of the German Railway Stations and holding a valid ticket can proceed to board the train. For track number, passenger should check the train departure listings. For any assistance, passengers should contact the "DB Service Point" at any Railway Station. Passengers arriving at Frankfurt airport Fernbahnhof/Long Distance Trains will proceed with their baggage to the American Airlines ticket counter in Terminal 1, Section C to check in for their connecting flight.

Figure 2-10 Rail&Fly scheme by American Airlines for passengers to/from Germany

The figure above shows a screenshot of the American Airlines website offering Rail&Fly to their passengers heading for Germany. American Airlines, as a member of the Oneworld alliance does not have any code share agreements with Lufthansa (STAR alliance member), so Deutsche Bahn takes the role of the 'Airline' feeding American Airlines flights at Frankfurt airport. Note that this offer is limited to distinct destinations in Germany which are implemented by 'Airport Codes' in the airlines' booking system. For the time being only a minority of airlines participating on the Rail&Fly scheme sell this offer via their website.

### *Performance against main toolkit criteria*

#### *Costs, organisational and financial feasibility*

The costs for implementation are minimal for an airline which wishes to join the Rail&Fly tariff scheme. Beside an agreement with Deutsche Bahn, an update of the airlines' website allowing a direct link to Deutsche Bahn website is necessary for online sales of Rail&Fly. Also the costs for automatic accounting are minimal. From the railway companies' side there is the necessity once to implement an interface from the airlines' which is dedicated for Rail&Fly scheme.

#### *Impact on users' door to door travel cost*

The user's door to door travel cost usually decreases when using the Rail&Fly scheme. As the price for this ticket usually is a flat rate it may occur that for very short distances ordinary train tickets may be cheaper.

#### *Mode shift, congestion and GHG emission*

As there are no figures available on which portion of the increasing passenger numbers on the long-distance trains to Frankfurt is attributable to the availability of this Rail&Fly tariff the effects cannot be quantified. As the tariff scheme has been offered by Deutsche Bahn for than 20 years and the number of airlines and tour operators joining is still growing there must be a positive effect concerning mode choice for trips to/from the airport towards rail.

#### *Transferability of findings*

The transferability of this solution is given, as these tariff scheme works not only with Frankfurt but with all other airports in Germany plus Basel-Mulhouse and for some carriers also for Amsterdam. Similar ticketing is also available when travelling in Switzerland to the airports of Zurich, Basel and Geneva.

## 2.4.4 The AirRail Concept of Lufthansa and Deutsche Bahn

After the end of the Lufthansa special trains to Frankfurt in 1992, and the nonstop trains to Frankfurt airport run by Deutsche Bahn that ran until 1995 (see section **Error! Reference source not found.**), it is clear that long-distance trains run exclusively for air passengers cannot be offered on an economical viable base. While from the point of view of a train operator a service offer like Rail & Fly tariffs (see section 0) is beneficial this does not apply from an airlines' view concerning airports with competition by other carrier on markets of a distinct volume of (high yield) passengers.

#### *Problems addressed – solution offered*

An air trip e.g. from Cologne via Frankfurt to New York offered as a complete transport chain by Lufthansa, bookable in one go from their website, with check-in including baggage from Cologne directly to New York and a homogenous presentation of the brand with all typical service components of air travel, is a superior product to that of a competitor like Delta Airlines which requires independent travel for the customer from Cologne to Frankfurt as his own responsibility. In addition such a product is at least on par with a transfer flight connection Cologne – Amsterdam – New York offered by KLM.

The passenger, who may not be focused that much on a distinct brand as desired by the airline, welcomes a guaranteed transport chain from his true origin to the final destination, including ticketing, check-in, tariff and baggage transfer, if available for a reasonable price at a reasonable total travel-time, i.e. the time needed to transfer must not increase the total travel time too much.

The following figure shows the offer by KLM for an air trip from Cologne to New York via Amsterdam as presented via KLMs' website

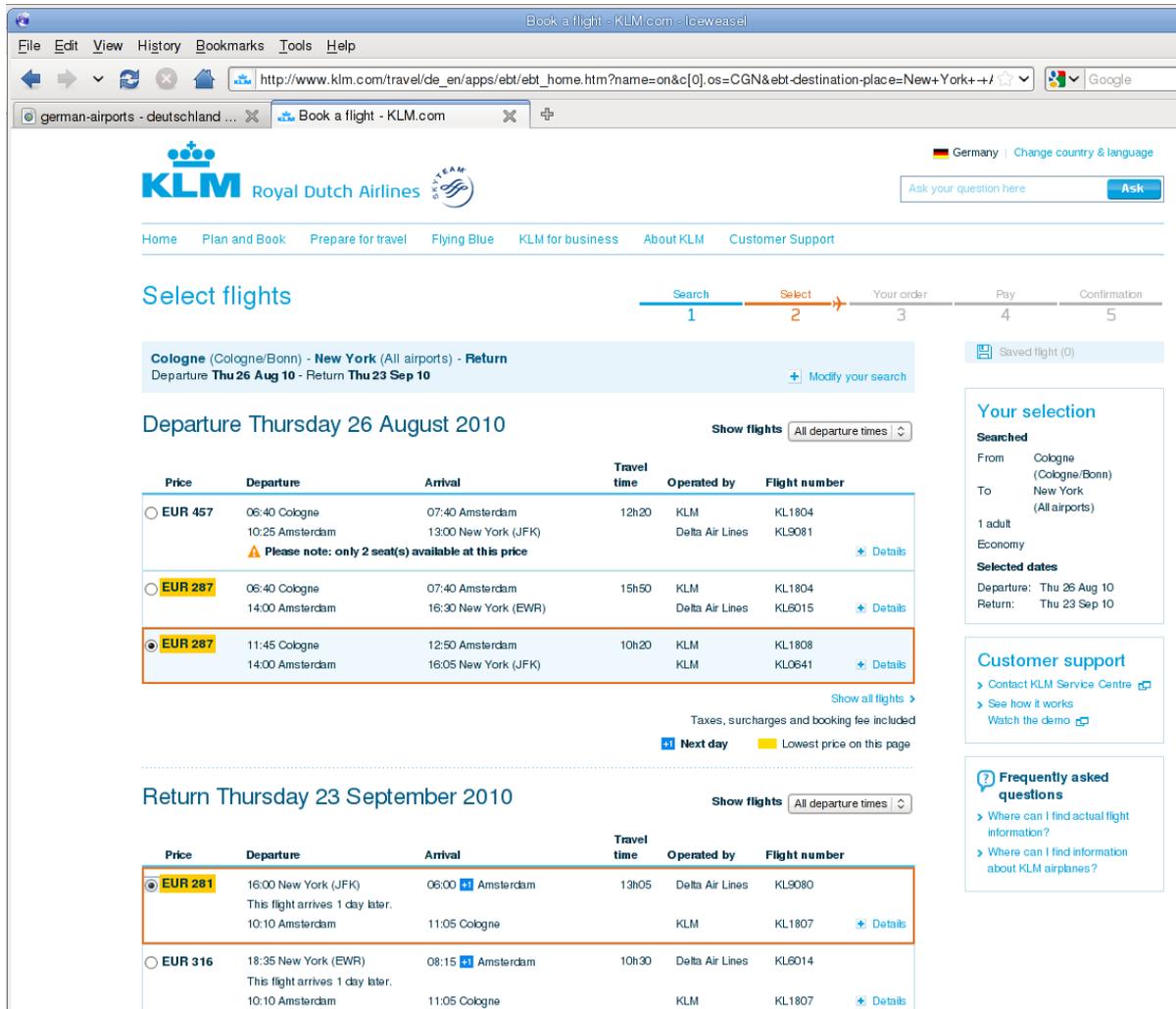


Figure 2-11 Screen shot of KLM website for booking Cologne – New York

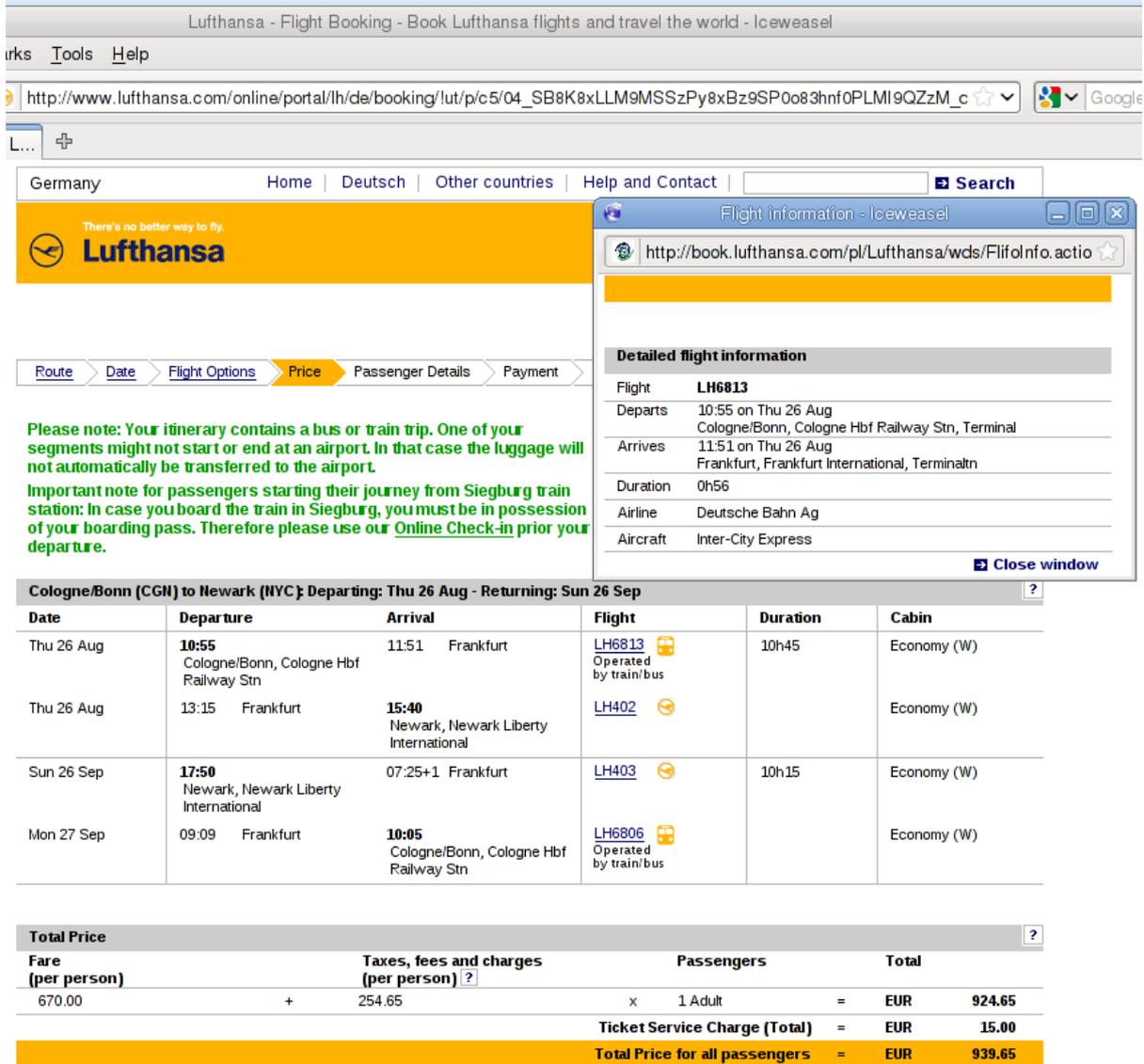
On the other hand those ultra short-haul flights like Cologne – Frankfurt are loss-making for the airline as there are almost no true origin-destination passengers who would generate more income than the small share of the revenue from an intercontinental ticket which is assigned to such a short flight.

For that reason in 2001 Lufthansa, Deutsche Bahn and Frankfurt airport deployed AirRail, as a competitive airline product using the train as a feeder for flights.

The nature of AirRail is the use of regular trains with designated compartments for air travellers as “feeder flights” (with flight numbers in all Computer Reservation Systems (CRS) to Frankfurt airport including a full check-in (including baggage) at the railway stations in Stuttgart and Cologne to the passengers’ final destinations all over the world. The service is offered all day long on an hourly base and open for all passengers of Lufthansa and STAR alliance and co-operating airlines. At the station of Bonn-Siegburg AirRail passengers can board the train as well when using online or mobile phone check-in.

The responsibility for the whole transport chain of AirRail is with the airline, as the train used for travelling to /from the airport is considered as a part of the air travel and booked via the airline, which is responsible to care for the customer in case of disruptions. But although the train is booked like a flight the EU regulations on passenger rights concerning a payment of compensation in cases of delay do not apply for the train segment. The following screenshot from the Lufthansa website, including the

pop-up for “flight”-details for the Cologne – Frankfurt segment of the trip, shows how this product is presented to the customer.



The screenshot shows the Lufthansa website interface. At the top, there's a navigation bar with 'Germany', 'Home', 'Deutsch', 'Other countries', and 'Help and Contact'. A search bar is also present. Below this is a Lufthansa banner with the slogan 'There's no better way to fly.' and the Lufthansa logo. A breadcrumb trail shows 'Route' > 'Date' > 'Flight Options' > 'Price' > 'Passenger Details' > 'Payment'. A green note states: 'Please note: Your itinerary contains a bus or train trip. One of your segments might not start or end at an airport. In that case the luggage will not automatically be transferred to the airport. Important note for passengers starting their journey from Siegburg train station: In case you board the train in Siegburg, you must be in possession of your boarding pass. Therefore please use our Online Check-in prior your departure.'

A pop-up window titled 'Flight information - Iceweasel' is open, showing 'Detailed flight information' for flight LH6813. The details are as follows:

Flight	LH6813
Departs	10:55 on Thu 26 Aug Cologne/Bonn, Cologne Hbf Railway Strn, Terminal
Arrives	11:51 on Thu 26 Aug Frankfurt, Frankfurt International, Terminaltn
Duration	0h56
Airline	Deutsche Bahn Ag
Aircraft	Inter-City Express

Below the pop-up, a table shows the flight schedule for 'Cologne/Bonn (CGN) to Newark (NYC): Departing: Thu 26 Aug - Returning: Sun 26 Sep':

Date	Departure	Arrival	Flight	Duration	Cabin
Thu 26 Aug	10:55 Cologne/Bonn, Cologne Hbf Railway Strn	11:51 Frankfurt	LH6813 Operated by train/bus	10h45	Economy (W)
Thu 26 Aug	13:15 Frankfurt	15:40 Newark, Newark Liberty International	LH402		Economy (W)
Sun 26 Sep	17:50 Newark, Newark Liberty International	07:25+1 Frankfurt	LH403	10h15	Economy (W)
Mon 27 Sep	09:09 Frankfurt	10:05 Cologne/Bonn, Cologne Hbf Railway Strn	LH6806 Operated by train/bus		Economy (W)

At the bottom, a 'Total Price' table breaks down the costs:

Fare (per person)	Taxes, fees and charges (per person) [?]	Passengers	Total
670.00	+	254.65	x 1 Adult = EUR 924.65
			Ticket Service Charge (Total) = EUR 15.00
			<b>Total Price for all passengers = EUR 939.65</b>

Figure 2-12 Screen shot of Lufthansa website for booking Cologne – New York with AirRail

The option to check-through baggage was ceased in late 2007 for different reasons, described below.

- Security: The processes necessary to guarantee “sterile” baggage checked in at rail stations and transported in trains open for the public audience, similar to the security standards which apply to baggage checked-in directly at Frankfurt airport, were considered to be too complex and costly.
- Increased travel-time: Baggage check-in at railway stations requires longer check-in time, as the baggage has to be controlled by the customs, transported to the train and stored there. So depending on the train and air schedules for distinct connections a passenger could save one hour when travelling by train on own responsibility to Frankfurt airport, especially when using online check-in and travelling with carry-on baggage only. The check-in deadline at the rail stations is now at 15 minutes.
- Harmonising of procedures: Passengers who check-in for Lufthansa (and STAR alliance) flights at Frankfurt airport (not using the online or mobile phone option) can do this not only in the terminal but also at a special check-in area which is directly in the airport’s long-distance railway station and equipped with self-service check-in. Irrespective of which check-in procedure is chosen by the traveller, checked baggage is to be handed over at drop-off points, which are also available in

the railway station of Frankfurt airport. Since 2007 this also applies for AirRail passengers. When travelling in the other direction, i.e. arriving by plane at Frankfurt airport and continuing by train, AirRail passengers can collect their baggage at a dedicated baggage claim point located at the long-distance railway station of Frankfurt airport which is connected to the airports' baggage transportation system.

- Seat capacity blocked in trains by AirRail: The baggage checked at railway stations was transported in the train using a separate section which otherwise could have accommodated 10 travellers. Now, when baggage is checked at Frankfurt airport passengers take their baggage with them and use the trains' overhead bins.



**Figure 2-13 Transfer of checked baggage from train to plane at Frankfurt airport (until 2007)**

The introduction of AirRail made many passengers choose the train to connect for their (long-haul) flights at Frankfurt instead of using an ultra-short haul feeder flight. The capacity offered increased from 46 seats in six trains per day and direction to up to 58 seats (of which 10 are dedicated to business-class passengers) in 16 trains per day and direction on the Frankfurt – Cologne link. The capacity per train between Frankfurt and Stuttgart increased similarly, while the number of trains dedicated for the AirRail services remained at seven per day and direction. Besides the business-class segment the number of allocated seats for AirRail passengers per train varies at short notice according to actual demand. In parallel the corresponding capacity of the equivalent flights decreased. After the introduction of AirRail the frequency offered on Cologne – Frankfurt changed from seven to four daily pairs of flights and the aircrafts used in average offered 75 instead of 125 seats. Flights on this segment ended in 2007.

The air passenger figures for both links are displayed in the following table for the years 2000 (before opening of AirRail), 2006 (last year of 12 months' air services on Cologne – Frankfurt route), and 2008.

**Table 2-4 Passenger figures for selected years at Frankfurt airport**

Passengers (000) from Frankfurt to	Year 2000	Year 2006	Year 2008	Change 2000 - 2006	Change 2000 - 2008	Change 2006 - 2008
Stuttgart	445.6	274.7	203.3	-38.4%	-54.4%	-26.0%
Cologne	316.9	83.0	0.9	-73.8%	-99.7%	-98.9%
Sum	762.5	357.7	204.2	-53.1%	-73.2%	-42.9%

⇒ *No more scheduled flights in 2008 between Frankfurt and Cologne*

The effects outlined (50% reduction on the Stuttgart route and 100% on Cologne route since 2000) cannot fully be assigned to the AirRail concept, as other aspects also influenced the development of demand on these links:

- Mode choice of passengers not transiting at Frankfurt towards rail. These passengers do not use the AirRail concept, but travelling with rail tickets issued by Deutsche Bahn.
- A change in route choice of passengers who refuse to use trains by transferring at Munich instead of Frankfurt to/from their connection flights.
- A change in route choice or airport choice due to the increased number of destinations at the airports of Cologne or Dusseldorf (40 km from Cologne) within the last 10 years.

The biggest competitor of Lufthansa in Germany (Air Berlin) built up a hub at Dusseldorf airport in recent years offering flights to many (also some intercontinental) destinations. So the effects mentioned above and in addition the “use it or lose it” principle for slots at the capacity constrained Frankfurt airport may be the reason why Lufthansa for the time being refuses to cease flights fully on Stuttgart - Frankfurt or to implement AirRail on Dusseldorf – Frankfurt (73 Minutes by hourly trains) with more than 400,000 air passengers in 2008 and seven pairs of flights per day.

**Performance against main toolkit criteria**

**Cost and financial feasibility**

In comparison to short-haul flights or running special trains exclusively for air passengers with comparable frequency (hourly or at least every two hours) AirRail is quite economical. Even when serving these routes with 50-seat aircraft which Lufthansa just decided to eliminate from its fleet in favour of 70- or 90-seaters due to economical reasons, this would mean unsatisfying loads or a level of service with frequencies too low to be accepted by the customer. Concerning long-distance trains Deutsche Bahn considers 150 - 200 passengers per train to break-even, so the given demand is far too low to run air passenger specials, irrespective of the operator. On the other hand 20 passengers more or less for a long-distance train (with ICE train sets typically used on the lines serving Frankfurt airport offering 700 – 800 seats) are not an issue concerning capacity.

**Impact on users’ door to door travel time**

The AirRail service – where available – in principle has the same effects applying for using of trains to/from the airport. In some cases an increased travel-time in comparison to an individually organised train-travel to the airport could apply depending on the schedules, as not every train travel opportunity available is actually dedicated to AirRail.

**Other impacts**

The impacts on other topics by AirRail are not different to those which apply in general for using trains to airports as described in section 2.4.2, as AirRail in the very end is just a variation of intermodal transport of combined train / plane usage. This includes the topics mode shift, congestion and GHG emission.

### *Transferability of findings*

The transferability of a concept like AirRail to other routes served by plane applies when a number of preconditions are given:

- The air link is used in majority by transfer passengers, while local demand is poor.
- The airport must be connected to the railway network with its own railway station.
- The airport's railway station must be served by fast long-distance trains without transfers in parallel to the air link to be substituted or complemented.
- The travel-time needed for trains running in parallel must not be significantly longer than 90 minutes (typical elapsed time of short-haul flights + check-in time).
- The existing demand for rail travel must be sufficient to run these trains. Special trains exclusively for air passengers cannot be offered on a frequency level needed to allow attractive average transfer times to/from connecting flights when assuming sustainable loads for the trains.
- Capacity constraints at the airports push airlines towards the substitution of short-haul flights.

## **2.5 SUMMARY OF CONCLUSIONS**

Connecting airports to the railway network to enable long-distance services can cause significant changes in mode choice towards rail. With time-savings of up to 100 minutes generated by the new links, passenger figures for long-distance trains at Frankfurt airport more than doubled within a few years and are at about 22,500 per working day, resulting in a mode share of more than a third for public transport for originating air passengers. In parallel the passenger figures on the (short-haul) domestic flights decreased by more than a fourth which equals to 2.4 million per year, a development which is contrary to the trend of air transport in Germany in total.

Nevertheless this did not stop the trend to increased air travel, as the slots not longer needed for the feeder flights immediately were used to allow additional (long-haul) flights at the capacity constrained Frankfurt airport.

To justify the costs for both infrastructure and operational costs of running frequent trains, the airport should be attractive enough concerning the destinations offered to attract passengers from a large catchment to allow sufficient passenger numbers for the trains serving the airport. In addition the linkage of the airport to the rail network should allow serving the airport without the effect of extended travel-times for non airport related rail passengers.

An accompanying realisation of through-ticketing solutions for intermodal travel with rail and air improves the effects outlined above. This especially applies for the full integration of the train segment into the air travel as implemented with the AirRail concept on the routes from Stuttgart and Cologne to Frankfurt, where at the latter the flights have been replaced fully by rail.

Beside a co-funding of the costs for the construction of the long-distance railway station and its linkages to the railway network from the Federal Government, all long-distances services offered are financially self sustainable and run by the train operators, the airlines and the airport operator (Fraport AG).