

THE INTEGRATION OF AIR AND RAIL TRANSPORTS: CURRENT SITUATION AND FUTURE PERSPECTIVE

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I. Introduction

The integration of air and rail transports provides a great potential of resolving transport capacity and related environmental problems.

As part of the inter-modality framework, the following services are currently on offer:

- Transport of individuals to the airport by special trains,
- Baggage carriage - DB offers to carry passenger's baggage, which has to be submitted three days prior departure. In Switzerland, SBB offers baggage carriage from more than one hundred railway stations one-day prior departure including customs clearance, while at the same time, passengers receive their boarding cards.
- Check-in, check-out – The passenger has the possibility to check-in at other places than the airport (automat, phone, fax, web/wap). During the check-in, the passenger receives all necessary travel documents (boarding card, baggage label, baggage tag). The checkout version of this service is made available to arriving

passengers. This means that the checkout procedure does not take place at the final destination airport but at the final railway station.

- Ticketing – This involves offering a combined travel document: "train ticket - air ticket".
- Information – This refers to a possibility of getting access to important updated information about air transport at other places than only the airport (system Travelnet - Fraport, Infoflyway - Lufthansa, Infoplattform - RMV).

It seems that a big obstacle to the integration of air transport and rail transport lies in the incompatibility of their respective distribution systems of air tickets and train tickets. The main difference between these two consists of a certain degree of stability in regards to train fares and timetables, which contrasts with a great fluctuation in airline fares including changes in flight schedules and carriers. Furthermore, travel agencies already distribute not less than 80% of air tickets and they have even higher expectations in regards to their distribution via Internet. Train tickets are not yet distributed by such a distribution system. A combined travel document (train ticket – air ticket) that would be compatible with not only air-ticket, but also rail-ticket, computerized sale systems seems to be the right solution. At the Air/Rail 99 Conference held in November 1999 in Copenhagen, the International Air Transport Association (IATA) published a report, in which its representative stated the possibility of a BSP (Billing and Settlement Plan) enlargement and of an extended use of interrelated general documents between air associations and between other providers of transport services.

Further use of information systems that provide substantial cost savings promises a bright future to both air and rail transports. The development of IT systems mainly focuses on:

- Electronic ticketing - Commonly known paper documents (air ticket, train ticket) are replaced by a simple computer printout that certifies the booking.
- Automated self-service check-in systems including baggage services.

However, the above-mentioned principles that classical air and rail associations agree with are currently facing dynamic changes due to the entry of low-cost airlines in the market. All activities pertaining to these low-cost carriers are subordinated to their efforts to ensure that costumers will always get the cheapest available air-ticket's price. A change in use of information systems also contributes to maintaining the lowest level of expenditures. Information systems play in fact an essential role in minimizing expenses incurred by the low-cost airlines. The main reasons for this situation are as follows:

Booking of air-tickets mainly via Internet or by phone (e-ticketing) without using paper air-tickets anymore;

The carrier does not provide any additional discounts or loyalty programs such as Frequent Flyer (low-cost carriers often argue that their prices are so low that they do not allow for any other discounts).

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Revenue management. Another basic characteristic of low-cost carriers is their ability to maintain profit through active management of revenues. The task of the Revenue Management Team involves getting the most accurate information on the level of demand of each particular destination, determining the Booking Curve, and then offering the optimal price for each flight in real time. To fulfil this, sophisticated computer programs are being used.

Currently, low-cost airlines do not represent a viable solution for the integration with rail transport.

Future economic model of air transport functioning could include:

- Conventional network carriers offering their services in alliances,
- Regional companies (independent or as daughter companies of bigger firms),
- Tour operators and rental carriers,
- Low-cost airlines.

Whereas

- Network carriers will focus on long-distance and intercontinental flights,
- New companies established by these network carriers will constitute “feeders” for long-distance flights, thereby taking over some parts of the low-cost airlines’ clientele,
- Regional carriers will supply demand for regional airport services,
- Low-cost airlines will specialize in direct flights,
- Low-cost airlines will compete with companies specialized in flights on order (rental carriers).

To realize the above-mentioned integration of air and rail transports, railway stations are being built mainly at airports in attraction zones, thus enabling the intended cooperation between air transport and railway’s traffic. Two options are available: either to connect the high-speed railway line directly with the railway station at the respective airport or to interconnect airports with a suburban railroad, eventually a specialized high-speed rail line (e.g. Heathrow Express in London, and etc.).

A possible recommendation could be that the inter-modal product meets the following requirements:

- Guaranty of connections – This means that passengers with an integrated fare ticket have to be sure that they will not be left halfway due to delays.
- Inter-modal portal – This involves a unified source of information for passengers.

- Central marketing – The inter-modal product has to be offered by all participating carriers together.
- Related services at the baggage delivery office – This refers to information on connecting transportation, ticket sale, etc.

As part of the already mentioned integration, several airports currently offer the following services:

- Mass transit
- Baggage carriage– DB offers to carry passenger's baggage, which has to be submitted three days prior departure. In Switzerland, SBB offers baggage carriage including customs clearance from more than one hundred railway stations when submitted one-day prior departure. Boarding cards are provided to passengers simultaneously.
- Check-in, check-out – The passenger has the possibility to check in at other places than the desk at the airport (automat, telephone, fax, web/wap).
- Ticketing – This refers to an offer of combined travel documents "train ticket - air ticket".
- Information – This means access to important updated information about air transport not only at the airport, but also through other possible sources (system Travelnet - Fraport, Infoflyway - Lufthansa, Infoplattform - RMV).

General requirements for inter-modality according to passengers' demands could be formulated as follows:

- Short travel period – This also includes an optimisation of the actual time of transfer and of the period of time spent on both transfers and activities at the airport, plus a guaranty of connections. For transcontinental flights, services with a higher level of comfort should be offered.
- Check-in and baggage carriage – If possible, this should be done so as to have only one check-in with the first carrier to be used by the passenger, and to whom it would submit the baggage. Baggage collection should take place from the last carrier once at the destination place.
- Clearance during the travel.
- Integrated travel document.

II. Evolution of the integration of air transport and rail traffic in Europe

Picture **fig. 1** shows the current state and evolution of the European railway network known as TEN. In several countries, this network also includes a railway station labelled “airport” or it is connected to the respective airport by rail.

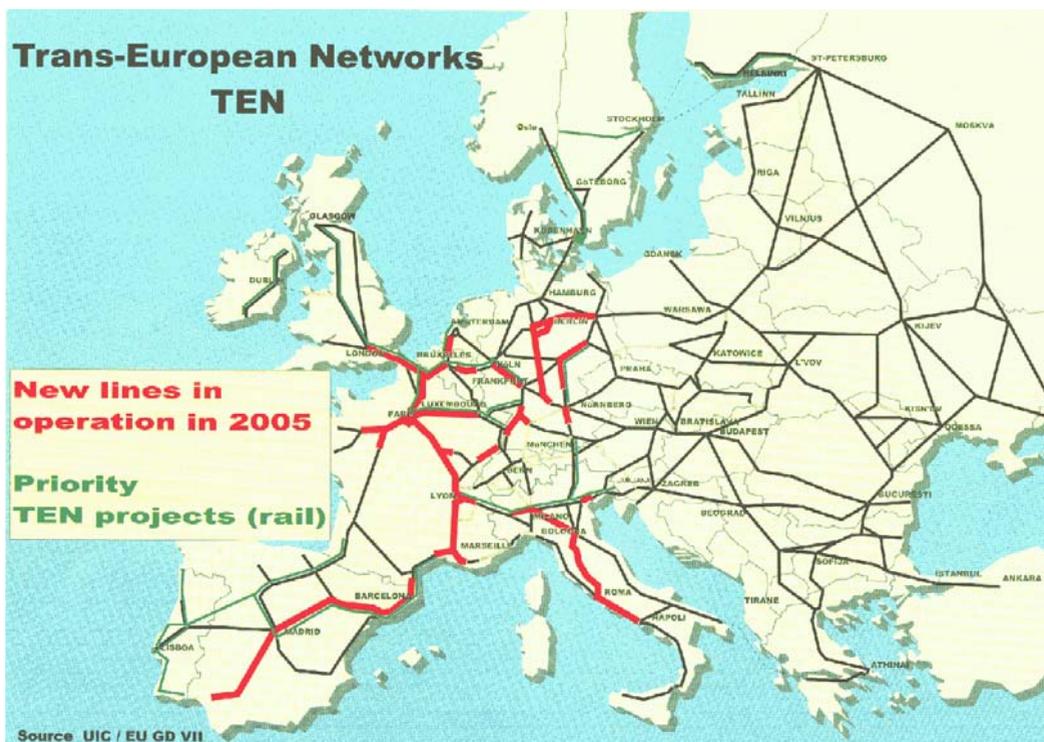


Fig. 1 Trans-European Rail Networks TEN

The French railway company SNCF (in French - Société National des Chemins de Fer) is one of the first to have started cooperation with airline companies Air France, Lufthansa, American Airlines, United Airlines, and Delta Airlines. Passengers are flying to Charles de Gaulle airport in Paris and then transfer to a train TGV (in French - Train à Grande Vitesse / High-speed train). According to data from Airbus Industrie, when travelling 550 kilometres far from, passengers mostly use high-speed trains, but for distances above 900 kilometres, they dominantly favour air transport. The bimodal cooperation is basically set out in an agreement between SNCF and each respective airline company, which enables passengers who use both means of transportation to benefit from simplified services. Agreements of this kind are available only for individual passengers (other forms of agreement exist for groups) and they do not include baggage handling. This cooperation enable passengers anywhere in the world to buy an integrated travel document that includes an international flight combined with a precedent, or following, travel by high-speed train TGV from, or to, the station indicated on the air-ticket. This product is an indivisible component of the airline company's bundle of services, because the travel by rail is registered under a particular flight number of a

partner airline company, and as such it also appears in the flight reservation system and on the air-ticket.

The **TGV AIR** service is distributed and sold by airline companies and travel agencies all around the world. The railway company operates the TGV trains, which rail timetable is synchronised with international flights' arrival and departure times. Bimodal transport services are available only at selected TGV stations, from, or to, which TGV trains are running from the railway station at Charles de Gaulle airport in Paris. At the moment, the TGV AIR service covers ten stations in France (Avignon TGV, Lille-Europe, Lyon Part-Dieu, Saint-Pierre des Corps, Rennes, Nantes, Angers, Le Mans, Poitiers, and Bordeaux). In addition, similar agreements exist with the railway company Thalys for connections between Brussels and the Charles de Gaulle airport in Paris. SNCF currently has agreements with airline companies Air France, Delta Airlines, United Airlines, American Airlines, and Lufthansa. Charles de Gaulle airport (CDG) in Paris is a model of an inter-modal terminal for air, road, and rail transport. The airport is managed by a public authority body called Aéroports de Paris (ADP) that was founded in 1945 with the objective of planning, building, and managing civil airports and supporting infrastructure within a radius of 50 km around Paris. Apart from highway connections (highways A1 and A3), two railway stations, which include both a suburban railway network RER (Regional Express Network) and mainly high-speed trains TGV, were inaugurated in 1994 directly in the centre of CDG terminals. High-speed TGV rail lines are interconnected with two other TGV railway stations in Paris, and thus constitute the base of a multi-modal air-rail transport in Europe.

ADP company in cooperation with both French railways SNCF and RFF (Réseau Ferré de France - rail network management company) has conducted a feasibility study for another railway connection between Paris and CDG airport that would serve the same purpose – it is known as CDG Express. Its inauguration is expected to take place in 2008 and investment costs are being estimated to 770 million Euros. It is expected that an express 15-minute-connection between Gare de l'Est in the centre of Paris (check-in terminals for flying passengers) and CDG airport, which would be operated on a 15-minute-interval base, will be also set up. In 2001, 1,8 million passengers have used some connecting trains of the TGV transportation network. At the beginning of this millennium, the TGV network has become more effective than air transport on short, and medium, distances.

Similarly, Air France and Thalys have made an agreement, which sets out that all clients of Air France flying from Brussels to Paris to connect on any medium-, or long-, distance flight will travel to Paris by Thalys train. The reservation system reports the travel by Thalys train like a flight with Air France.

In 1994, a Memorandum of Understanding (MoU) was signed between airline companies Deutsche Lufthansa (LH), railway company Deutsche Bahn AG, and Frankfurt Airport. The objective was to replace short-distance flights with rail transport, synchronise

rail timetables with flight schedules, and make sure that the necessary period of time for transfer be less than 45 minutes. In 1999, a new high-speed railway terminal called AIRail Service was created at Frankfurt Airport. This AIRail service is once again a combined service of high-speed railway and plane. The high-speed trains ICE currently connect Frankfurt Airport with the towns of Köln (travel duration 57 minutes), Stuttgart (travel duration 73 minutes and 7 trains per day) and Cologne (travel duration 57 minutes and 16 trains per day). These railway connections are simultaneously reported as LH flights and as such are also indicated in the flight schedule. The duration of check-in at the respective railway station including segments of connecting flights is 20 minutes prior train departure. When checking in, passenger receives all necessary documents (boarding card, baggage label, baggage tag). Baggage is loaded into containers and together with passengers is driven to the airport by the same train. Once at the airport, the passenger does not go through check-in again and so can board the plane directly. For passengers who have just landed, this service is offered as a checkout, that is, the procedure does not take place at the final destination airport, but at the ultimate railway station. Similar solutions are being implemented, or prepared, at several other airports, and so not only in Europe.

Some European examples can be seen in picture **fig. 2**.

City - Airport	Distance Airport-City [km]	Journey time [min]	Interval [min]	Single ticket
Paris - CDG	23	30	15	7,7 EUR
Zurich	12	10	-	-
Frankfurt	10	11	-	-
Düsseldorf	8	7	-	-
Amsterdam	15	14	-	-
Roma	35	33	30	-
Oslo	45	19	10	-
Wien	18	16	30	9 EUR
Munchen	40	39	20	-
London - Heathrow Express	15 miles	15	15	13 £
London - Heathrow - Metro	15 miles	50/60	-	5,4£
London - Gatwick Express	30	30	15	11 £
London - Stansted Express	-	45	15/30	13,8 £

Fig. 2 Railways connection to some european airports (Source: websites of respective airports)

Already in 1992, a significant preference for railway connection was revealed in a survey of people's transport preferences as indicated in **fig. 3**. In 1995, the European Commission prepared a report on airports' railway connections. The key outcome was that railway connections have to be operated in regular intervals and speedily so as to attract more than 25% of the total number of passengers.

Airport - City	Number of passengers per year 1992 (millions)	Car	Taxi	Bus	Railway	Other	Public Total
Amsterdam	19	54	12	5	25	4	30
Brussels	9	55	20	-	25	0	25
Cologne	-	64	22	11	-	3	11
Düsseldorf	12	65	19	2	14	0	16
Frankfurt	31	56	12	3	29	0	32
Geneve	6	35	21	10	35	0	45
London Gatwick	20	55	9	12	24	0	36
London Heathrow	45	46	20	13	20	1	33
London Stansted	2	69	8	10	12	1	22
München	12	43	8	7	42	0	49
Paris CDG	25	53	14	9	23	0	31
Paris Orly	25	60	16	18	6	0	24
Zurich	13	29	8	29	34	0	63

Fig. 3 *Percentage of passengers using different sorte of transport mode to/from some european airports, Source: L1 – 1992*

III. Some examples of air-rail transport integration in the world.

A huge spread of air-rail transport integration can be seen in the USA, especially in the New York area. At the Newark Liberty International Airport (hereafter Newark Airport), the railway system Air Train Newark is operated to connect each Newark Airport's terminals with the railway terminal Newark Liberty International Airport Train Station. In this railway terminal, it is possible to transfer to a system of suburban rail transport NJ TRANSIT (including connection with New York city) and trains of Amtrak Company. Amtrak has created an air-rail integrated transport system called Amtrak Air Rail with the airline company United Airlines. The system covers the whole territory of the U.S.A. The transport companies that partner with Amtrak Air Rail are: United Airlines, Continental Airlines (trains between Philadelphia, Wilmington, Stamford, New Haven and connecting flights of Continental Airlines from Newark Airport – the company's home-airport), Icelandair, Alaska Airlines, Hertz, and the well-known bus transport company Greyhound. The railway connection Air Train JFK is in service between New York City and John F. Kennedy Airport (JFK). At the moment, there is no railway connection yet to Laguardia, the third airport in New York City.

In Japan, Narita, the international airport of Tokyo, is situated 66 km far from the town centre. Trains, buses, taxis, and cars are the main means of transport between these two places. The speediest trains (JR East's Narita Express and Keisei Electric Railway's Skyliner) make this travel in one hour, and other fast connections are also available. The airport is also connected via national flights with other important towns: Nagoya, Osaka, Fukuoka, Sendai, and Sapporo.

On March 9th, 2001, a transport survey was organised. It resulted from it that 57,6% out of the 35 522 passengers that were flying on that day abroad had taken a bus, a car, a taxi, or another motor vehicle to come to the airport. 41,0% of passengers had taken the rail and 1,4% have opted for a national flight. These figures are almost the same as the results of a similar survey that was organised in 1999. Out of those who came in motor vehicles, 70% used the services of bus transport providers. Concerning foreign travellers, 36,3% favoured taxi services, out of which only 14,5% were Japanese.

Total number of passengers surveyed	Ground transportation Bus, car, taxi [%]	Railway's traffic [%]	Other national flight [%]
35 522	57,6 out of which: 70 % by bus	41,0	1,4

Fig. 4 Results of a transport survey regarding ground transportation of flying passengers to, and from, the Narita airport in Tokyo on 9.3.2001.

The new high-speed rail line should be opened in 2010. The Japanese Ministry of Agriculture, Infrastructure, and Transport has given a construction licence to companies Narita Rapid Rail Access and Keisei Electric to build the rail line, which would enable a railway connection between Tokyo and Narita Airport in 40 minutes. The construction should start in budget-year 2005 and is planned to be in service 5 years later. This will represent an extension of an already existing rail line Hokuso Kodan Line. The licence assigns to Narita Rapid Rail Access to build a rail line that would begin in the station Inba Nihon-Idaj and after 10,7 km connect with the rail line of Japan Railway (JR). Keisei Electric Railway will become the operator of the entire 51,4km long section between stations Tagasako and Narita Airport. Related costs are estimated to approximately 126,1 billion Yens (c. 31 billion CZK). The section Tsucija-Narita Airport that is 8,4km long and operated by JR company will undergo only minor modifications. The new rail line that will be 5,2 km shorter than the existing one will reduce the time of travel from Narita Airport Station Terminal 2 to Keisei Ueno from 51 to 36 minutes, which is by almost 30%. The new rail line should operate 61 pairs of trains Skyliner category (comfortable express train) and 92 pairs of trains Limited Express (accelerated suburban passenger train) on a daily basis.

In China, representatives of the biggest Chinese town Shanghai have officially put in service on January 1st, 2004, the so-called Maglev, the first "magnetic train" of the world used for commercial travels. This revolutionary means of transport drives passengers from Shanghai's international airport Pudong to the town centre. During the first commercial travel, to which ten passengers took place, it made this thirty kilometres long drive in only seven minutes and twenty seconds. Maglev, which moves on a magnetic field above the wheels, is capable of generating a speed of 430 kilometres per hour. Individual trains should run with

twenty-minute intervals. The price of a regular ticket is nine American dollars (approximately 230 CZK), while an exclusive first-class ticket costs eighteen American dollars. In each train cabin of the Maglev, a screen panel is installed, on which passengers can visualize the actual speed of the train. Before boarding a Maglev, passengers have to go through control that is in no way different from the check-in at the airport. The beginning of high-speed train's commercial use took place one year and a day after German Chancellor Gerhard Schroeder participated in the first test drive of the Maglev during his visit of Shanghai. It is Germany, which has in fact developed the technology based on which the train operates. The testing of this technology, into which German Government has invested several billions of Deutsche marks, has taken scientists many decades. The cost related to the construction of a 30 km long high-speed rail line to Shanghai is about 1,1 billion USD.

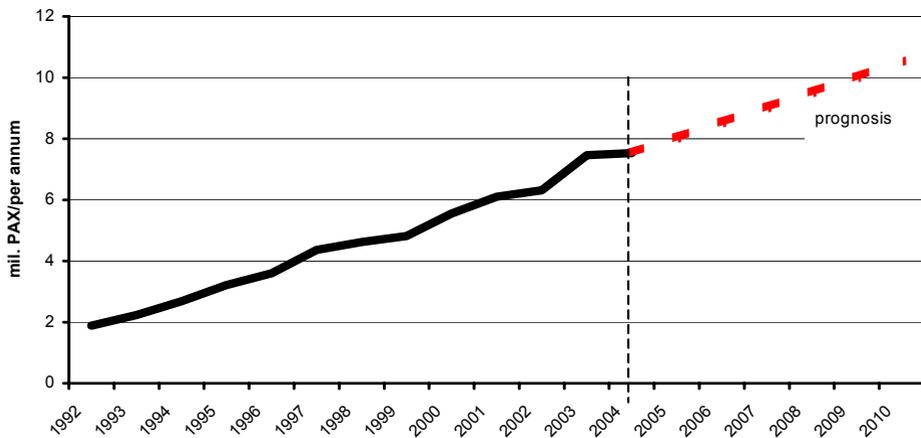


Fig. 5 Number of passenger per year - Prague Ruzyne Airport
 Source: Czech Airport Administration

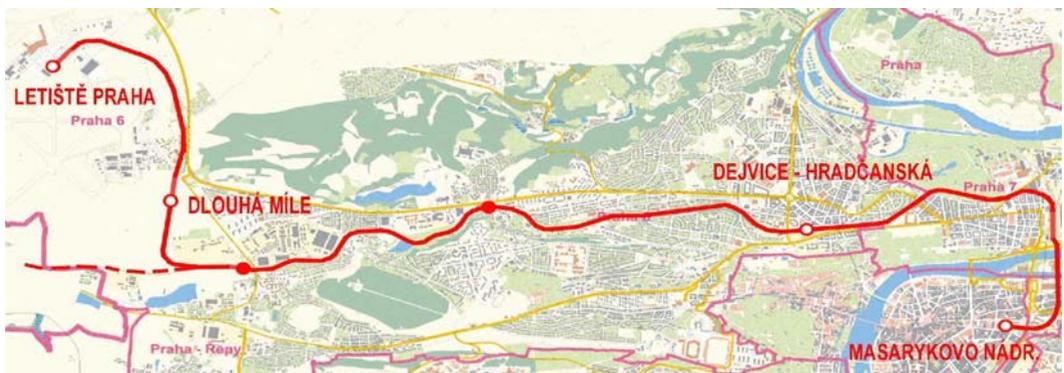


Fig. 6 Railway connection City of Prague – Ruzyne International Airport

IV. Conclusion

The integration of air and rail transports is a very modern and globally spreading trend. This is an important element leading towards higher economic efficiency mainly in regards to the use of rail transport for shorter distance travels and also the overall reduction in travel time. An important component of this has to do with the necessity of implementing information systems, especially in the area of flight schedules and train timetables, and in regards to travel documents including total exclusion of classical "paper" documents and their replacement by electronic ones. In the Czech Republic, the project of a railway connection between the international airport Ruzyně and Prague City with a subsequent connection to the Main Train Station, taking into account a possibility of direct transfer to long-distance railway connections, is too at an advanced preparation stage of engineering. This project is designed to emphasise synergetic effects of interval connections between town Kladno and suburban transportation, and simultaneously addresses the rapidly growing development of Prague's airport Ruzyně. **Fig. 5** illustrates this development from the viewpoint of the number of checked-in passengers. Scheme of the railway connection between City of Prague and Ruzyne International Airport is on the **fig. 6**.

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Resumé

INTEGRACE LETECKÉ A ŽELEZNIČNÍ DOPRAVY – SOUČASNOST A VÝHLED

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Příspěvek se zabývá problematikou integrace letecké a železniční dopravy, která vyžaduje realizaci železničních spojení na spádová letiště a napojení těchto letišť na zejména dálkovou železniční síť. Jsou uvedeny nutné vazby na související dopravní informatiku. Po uvedení a rozboru některých řešení této integrace v Evropě a ve světě je v závěru zmíněn i projekt tohoto řešení v ČR

(napojení mezinárodního letiště Praha Ruzyně na železniční síť), který by řešil pozemní dopravu tohoto dynamicky se rozvíjejícího letiště.

Summary

THE INTEGRATION OF AIR AND RAIL TRANSPORTS: CURRENT SITUATION AND FUTURE PERSPECTIVE

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In the paper there is described the problems of the integration of air and rail transports which requires realization of the railway connection to the hub airports and connections of these hubs to the especially long distance railway network. There are mentioned the necessary links to the transport informatics. After presentation and analysis of some solution in Europe and around the world there is in conclusion mentioned also the similar project in the Czech Republic (connection of the international airport Praha Ruzyně to the railway network) that is ready to solve the ground transport of that dynamic growing airport.

Zusammenfassung

INTEGRATION DES FLUG - UND EISENBAHNVERKEHRS – GEGENWART UND ERWARTUNGEN

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Der Beitrag befasst sich mit der Problematik der Integration des Flug- und Eisenbahnverkehrs, die die Realisation der Eisenbahnverbindungen zu den Knotenflughäfen und Anschluß dieser Flughäfen vor allem an das Fern Eisenbahnnetz benötigt. Es werden die nötigen Verbindungen zu der zusammenhängenden Verkehrsinformatik angeführt. Nach Präsentation und Analyse einiger Integrationslösungen der Europa und in der Welt wird zum Abschluß auch die Projektlösung in der Tschechischen Republik erwähnt ((Verbindung des internationalen Flughafens Prag-Ruzyně zu dem Eisenbahnnetz), die das Landtransport dieses sich dynamisch entwickelnden Flughafens lösen würde.