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TRANSPORT ECONOMIC IN A FUNCTION OF TRAFFIC SYSTEM TO AIRPORT PLANNING

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ABSTRACT

Effective integration of airport systems with surrounding settlements is crucial for ensuring smooth access and sustainable growth, requiring comprehensive planning that anticipates future traffic increases and infrastructure expansion. Road transport remains vital due to its flexibility and direct access, especially for air freight, while rail and subway systems offer environmentally friendly, efficient alternatives, particularly in developed countries like Japan, emphasizing the importance of multimodal connectivity. Coordinated development plans between airports and local communities are essential to prevent disruptions and optimize infrastructure investments, underscoring the need for long-term strategic planning that aligns transportation networks with urban growth to facilitate efficient, sustainable, and accessible air travel.

1.0 INTRODUCTION

The task of this paper is to describe the ways of connecting the airport system with the settlement in which it gravitates. It is very important that the airport is well connected to the settlement that uses its services.

In today's time, when we try to keep time losses as low as possible and when every action is planned and observed through the time limit of execution, we have no room for waiting. That is why we are trying to ensure that the airport is well connected with other modes of transport, that is, that we have a developed combined transport. First of all, we mean the connection with road and rail traffic. Large airports have two or more well-developed airport access systems, in order to use the system's capacity as efficiently as possible. The primary users of the airport terminal are passengers, a wide range of airport employees, state regulatory bodies, air carriers, concessionaires and others. While terminal facilities must, first of all, ensure a high level of service to users, the planning and design of the entire terminal is influenced by more stringent requirements for accommodation. The terminal complex consists of an interface between aircraft, passengers and various modes of land transportation.

2.0 AIRPORT LOCATION

Airports play a crucial role in the economy by serving as hubs for transportation, trade, and tourism, which boosts local and national economic growth. They facilitate the movement of goods and people efficiently, supporting businesses and creating jobs in sectors like retail, hospitality, and transportation. The location of an airport significantly impacts its economic benefits; strategically placed airports near urban centers or key economic zones tend to generate

Volume: 08, Issue: 05 September - October 2025

ISSN 2582-0176

more economic activity, attract foreign investment, and enhance regional connectivity. Additionally, airports contribute to the development of surrounding infrastructure, such as roads and public transit systems, further integrating them into the broader economic landscape and promoting sustainable regional development. Most airports serve one large city or at least a group of smaller settlements. The most favorable distance between the airport and the settlement is about 10-15 km. A smaller distance often creates difficulties due to the built-up area and the interests of the city with which the airport project conflicts (noise, land use, etc.), while a longer distance represents an inconvenience for passengers, then complicates the organization of transport and reduces the number of airport visitors. If the conditions of the route of the access road are more favorable, driving speeds increase and thus the travel time is shortened, so a greater distance between the airport and the settlement can be accepted. At airports that are about 30-50 km away from the settlement (served area), highways should be built or connected by rail transport systems (high-speed urban railway, metro, light rail transport), and more recently by helicopters and hydrofoils if the airport is near the sea. .

For example, the sheer distance involved in traveling to Narita Airport (located about 37 km from downtown Tokyo) or Oslo Airport (located about 30 miles outside of Oslo) makes taxi a poor competitor. So, airports that are relatively close to downtown, such as Reagan Washington National, tend to have a high proportion of taxis to the airport. At the same time, in the immediate vicinity of the airport can offer many destinations by public transport with only a moderate amount of transfers. New York is studying the possibility of transportation from Manhattan to Kennedy Airport" and "New York" with special rail vehicles that move on separate (underground) routes at high speeds and thus significantly reduce travel time. Paris airports also plan to build a rail connection with at high speeds ('TGV'-trains) which would connect Charles de Gaulle and Orly Airports with Paris, i.e. railway stations. "Frankfurt" Airport is connected to the city by metro lines, as well as "Geneva" Airport. "Tokyo Narita" Airport is located 60 km from Tokyo and is connected by the highway and the high-speed "Tokaido" railway, so that the airport can be reached from the center of Tokyo in 30 minutes.

3.0 AIRPORT TERMINAL

The economic impact of airport terminals and transportation is substantial, as they facilitate global trade, tourism, and business activities, creating jobs and boosting local economies. Efficient terminals improve passenger experience and operational efficiency, attracting more travelers and investments. Investments in transportation infrastructure, including terminals, rail links, and road networks, stimulate economic growth by reducing travel time and costs. Additionally, airports serve as hubs for logistics and freight, further enhancing economic activity. Overall, well-developed airport and transport systems are critical drivers of regional development and international connectivity. Activities at the terminal are primarily caused by passenger terminal operations and secondary cargo activities, if present at the airport. The flow of vehicles is directly related to the number of arrivals and departures of passenger aircraft at the entrance and for the transport of cargo to and from, as well as cargo handling and forwarding facilities. Other factors that affect the volume of ground movement include travel to and from the airport by employees and other visitors to the airport terminal, as well as through traffic that is not destined for airports.

Features that determine landside traffic activity:

Volume: 08, Issue: 05 September - October 2025

ISSN 2582-0176

• Slow speeds: Traffic speeds on airways tend to be much slower than on surrounding roads. These slower speeds are caused by the complex layout of roads, multiple decision points, and the constant stopping and starting of vehicles. Due to the slow speed, many of the standard roadway analysis techniques are often not effective in landside planning. These analyzes should be adapted for the air environment.

• Different types of vehicles: Different types of vehicles pass through the roads at the airport. Private cars often make up the largest share, but there are many buses, taxis, limousines, official vehicles, trucks on the roads. Each of these vehicle types has different operational characteristics. This situation requires an analysis of techniques that can respond to these differences.

• Complex routing: In most airports there is a need for vehicles to have multiple ways of navigating the road system. Although most vehicles operate in a closed system, there are many common routes. For example, a private car may enter an airport to pick up a passenger and then head to short-term or long-term parking (or exit the airport). Other cars can go directly to the parking lot or maybe diverted. Bus transport and commercial vehicles often have more complex routes, stopping at many points in the airport.

• Variability in access to the system: There are many variations in the layout of air traffic, even among airports of the same size and function. The appearance of the road depends on the regional access to the system and the location of the terminal and parking lot.

• Complex decision-making: The combination of multiple routes with a changing layout of the system in a limited area of the country often results in complex decision-making by those using the airport road system. There are usually a large number of merge/divergence points where drivers often have to make decisions in a very short time.

• Infrequent users: Many drivers come to the airport only occasionally, perhaps only once or a few times a year. This lack of constant use often contributes to slower speeds and slower reaction time when making decisions.

All of these factors make for an interesting and challenging landside planning process. This complexity requires using a lot of creativity in adapting traditional transport planning techniques and adopting expert techniques to be used at the airport. Transport economics plays a vital role in the development and optimization of airport access networks, which are complex systems involving interconnected facilities designed to serve diverse users. Effective planning in this context necessitates comprehensive data collection and analysis across all components, including transportation modes, infrastructure, user needs, and operational costs, to ensure efficiency, sustainability, and seamless connectivity. By applying principles of transport economics, planners can make informed decisions that balance costs and benefits, improve service quality, and enhance the overall effectiveness of the airport access network.

4.0 AIRPORT ROAD SYSTEM

The airport road system and transport economy are crucial for ensuring efficient movement of passengers and goods, especially in larger airports where the complexity of roads, including access roads, parking, drop-off zones, and internal circulation, plays a significant role in

Volume: 08, Issue: 05 September - October 2025

ISSN 2582-0176

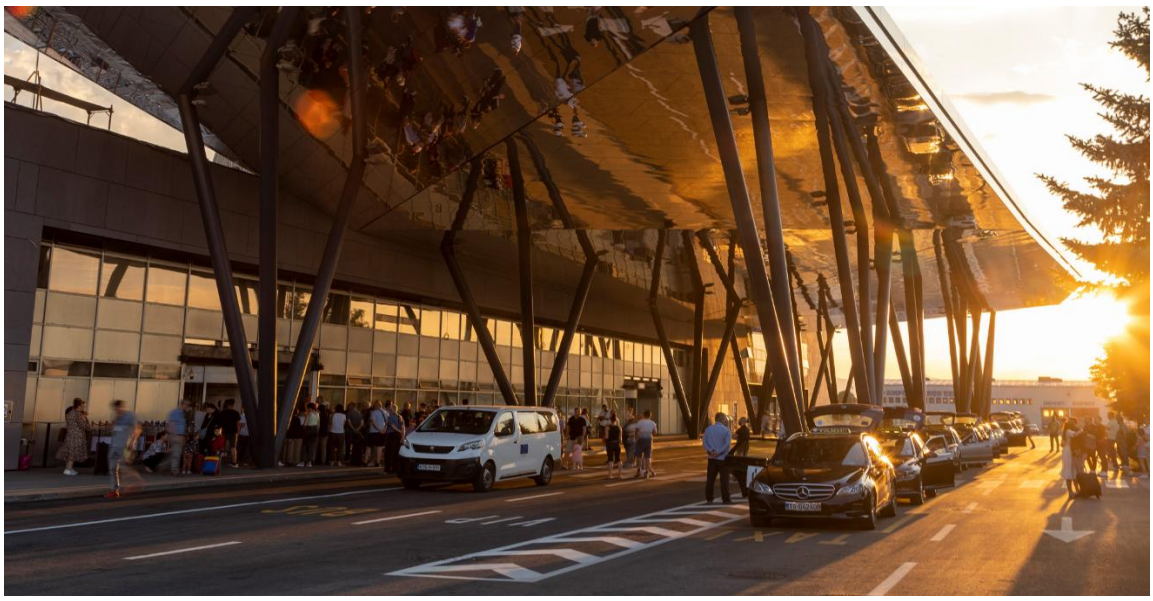
reducing congestion and improving overall operational efficiency. A well-designed road network can significantly enhance the passenger experience, facilitate smooth logistics, and optimize economic benefits by minimizing delays, reducing transportation costs, and enabling better connectivity with surrounding regions. The main types of roads in the airport are:

- Airport access roads,
- Access roads,
- Terminal curb front,
- Recirculation roads,
- Service roads.

Transport economics offers a comprehensive explanation of how road systems are structured around airports, categorizing them into outside, near, and in-airport areas, with variations based on airport size and activity level. Enhancing car access involves strategic physical and operational modifications to regional roads, including those farther from the airport as well as immediate access routes. These improvements aim to optimize traffic flow, reduce congestion, and facilitate efficient passenger and freight movement, ultimately supporting the airport's operational capacity and regional connectivity.

4.1. Airport access roads

The airport access roads and transport infrastructure play a crucial role in ensuring smooth connectivity between the airport and the regional road network, facilitating efficient passenger and freight movement. Properly designed access roads with adequate capacity can reduce congestion, improve safety, and enhance overall transportation efficiency, which in turn can positively impact the airport's economic performance by attracting more travelers and business activities. Investments in controlled signal arterial roads or highway-type access routes at major airports are essential for accommodating current and future traffic demands, supporting economic growth, and ensuring seamless integration with local and regional transportation systems.



Volume: 08, Issue: 05 September - October 2025

ISSN 2582-0176

Figure 1, Access roads of the Sarajevo International Airport

Transport economics at airports involve analyzing the efficiency and cost-effectiveness of access systems like closed-loop road facilities that facilitate smooth transit from regional roads to terminals, balancing the advantages of free-flowing traffic against the costs of infrastructure and signage. When airports are situated near regional/local roads with limited space for interchanges, enhanced signage becomes crucial to guide travelers efficiently, while traffic control measures like traffic lights at entrances help manage congestion and ensure safety. Overall, optimizing these systems requires careful planning to balance infrastructure costs, traffic flow, safety, and passenger convenience, ultimately supporting the airport's operational efficiency and economic viability. Some of the considerations in the design and function of an airport access road are as follows:

- Ensure transition from regional/local roads,
- Provide adequate space for signaling - terminals, airlines, parking lot rental,
- Provide adequate space for decision-making,
- Efficiently distribute traffic on airport facilities.

In designing the airport access road to function as an airport gateway, the primary goal should be to minimize air traffic interference by creating a streamlined, efficient route that prioritizes ground transportation over air traffic considerations. This can be achieved by incorporating dedicated lanes for different types of vehicles, optimizing traffic flow with intelligent signaling, and ensuring easy access to terminal facilities without disrupting aerial operations. Additionally, implementing measures such as restricted airspace near the access road can further limit the impact of ground traffic on air traffic, ensuring the design effectively supports airport operations while maintaining safety and efficiency.

4.2 Approach roads

Transport economic and approach roads are crucial components of the air traffic circulation system, situated between entrance/exit roads and terminal curbfront roads. They typically feature lower operating speeds, numerous ramps, intersections, and decision points, facilitating traffic distribution within the terminal area and extending to parking lots for passengers and rental vehicles. These roads play a vital role in managing traffic flow efficiently, ensuring smooth access to the terminal while accommodating various vehicle movements.

Some of the operational and design considerations for these roads are as follows:

- Ensure the transition to the curbfront road terminal,
- Provide adequate space for decision making,
- Ensure smooth routing of traffic from terminal curbfronts and parking lots,
- Ensure adequate separation of the decision point.

4.3 Curbfront

In transport economics, the configuration of curbfront roads near terminals significantly impacts operational efficiency and passenger flow. A one-way, clockwise curbfront road

Volume: 08, Issue: 05 September - October 2025

ISSN 2582-0176

optimizes traffic movement and reduces congestion, but its effectiveness depends on terminal layout, such as whether it is single- or double-level. Single-level terminals might have arrivals and departures on the same or opposite sides, affecting vehicle circulation and passenger convenience. Double-level terminals typically separate arrivals and departures vertically, enhancing flow but requiring careful planning for access and ventilation, especially in multi-story setups. These configurations influence demand management, vehicle turnaround times, and overall terminal capacity, highlighting the importance of strategic design to maximize efficiency while ensuring safety and comfort.

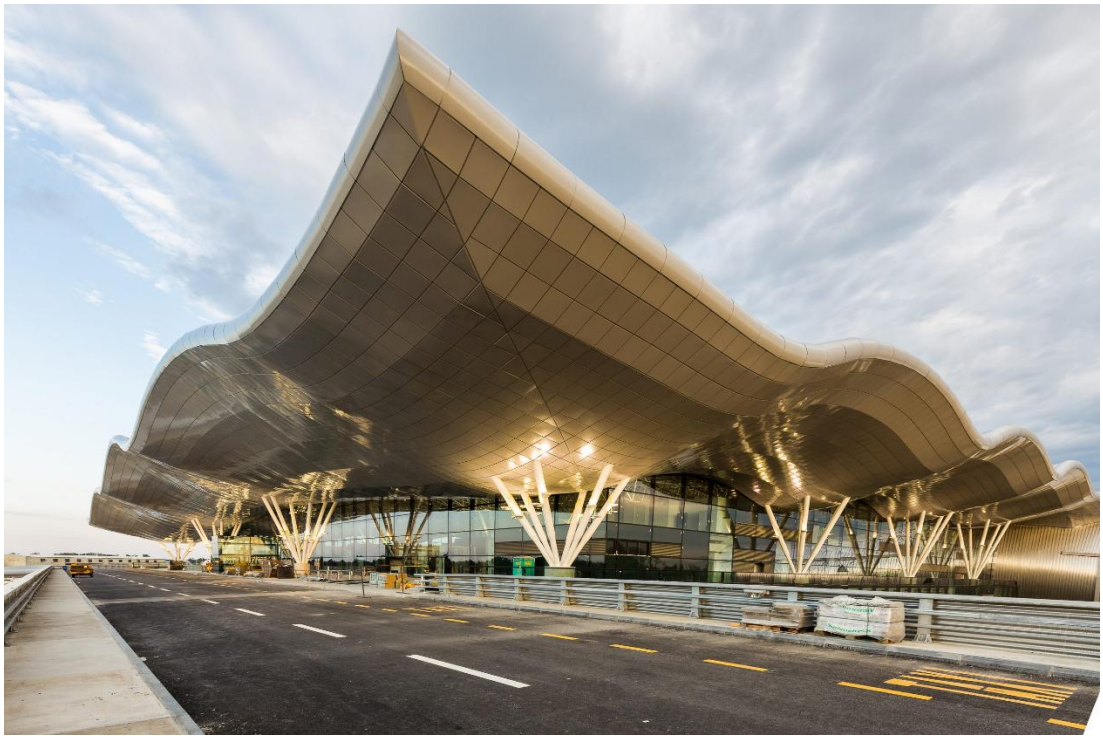


Figure 2, Curbfront at International Airport Franjo Tuđman in Zagreb

The curbfront terminal design in medium and larger airports, situated outside the main curb area, offers extended curb length, which facilitates efficient passenger drop-off and pickup, especially for arrivals. This setup allows private and commercial vehicles to have dedicated curbfronts, reducing congestion, improving safety, and enhancing the overall passenger experience by enabling smoother vehicle movements and quicker access to terminals.

Some of the key points to consider for the design and operation of curbfronts are as follows:

- Lighting,
- Bumps on pedestrian crossings,
- Crossing guards,
- Sufficiently long transition area,
- Path with a width of at least 12 meters; 15 to 20 meters preferably,
- Asphalt markings-reflective, raised (where possible),
- Ventilation at lower levels if applicable.

Volume: 08, Issue: 05 September - October 2025

ISSN 2582-0176

4.4 Recirculation roads

Recirculation lanes are essential components of transport infrastructure, typically situated at the end of each terminal, featuring wide turns and low speeds to facilitate smooth traffic flow. They are usually single-lane roads designed to manage vehicle movement efficiently around the terminal area. For two-level terminals, it is crucial to provide recirculation routes connecting each level to ensure seamless circulation between levels, thereby minimizing congestion and delays. Proper placement and design of these lanes are vital for maintaining efficient terminal operations and enhancing overall traffic management.

One of the key features of recirculating roads is to provide as much flexibility as possible. Many of the desired movements should be ensured by the recirculation of roads as follows:

- Return to the same terminal,
- Go on the same terminal, different level,
- Go to the parking lot,
- Go to the next terminal,
- Go to the previous terminal,
- Go to the airport exit.

4.5 Service roads

Transport economics examines the cost, efficiency, and impact of transportation infrastructure like airport service roads, which facilitate access to passenger-oriented facilities such as loading zones, parking, hotels, and maintenance areas. These roads typically experience low traffic volumes and speeds, resembling local streets with one or two lanes in each direction, emphasizing their role in supporting airport operations and passenger services while maintaining cost-effective and efficient connectivity.

5.0 INTERMODAL CONNECTIONS

Intermodal connections at an airport terminal are essential for enhancing mobility, efficiency, and sustainability by seamlessly integrating different transportation modes like regional trains, buses, and transit systems. The first type involves direct links with regional train or bus systems, which improve access for passengers and staff, offering flexibility and alternative routes. The second type includes dedicated rail and bus transit systems with stations and rest areas, either self-contained or part of a network with multiple terminals, designed to facilitate smooth transfers and reduce congestion. Effective planning and infrastructure development for these intermodal connections optimize the overall transportation ecosystem, benefiting travelers, reducing environmental impacts, and supporting economic efficiency.

5.1 Rail

Connecting airports to regional rail systems offers significant benefits, including reduced congestion and lower transportation costs for passengers and employees, by providing convenient, affordable access to the airport and alleviating traffic jams at terminals. Most airports feature a single regional rail station, often integrated with metro systems, which serve

Volume: 08, Issue: 05 September - October 2025

ISSN 2582-0176

as vital transit options, especially for staff commuting, although they also benefit travelers. Prominent examples such as San Francisco, Atlanta, Chicago, Washington, and Minneapolis illustrate how effective this connectivity can be in enhancing transit efficiency and supporting airport operations.

Figure 3, Airport-Rail connection in Paris

Designing an effective regional station for airport connectivity involves strategic placement to balance passenger demand, future growth, and operational flexibility. The station should ideally be located in an accessible area with high passenger flow, such as near the terminal, but space constraints may necessitate positioning it at a more distant site like GTC, with convenient walking or shuttle connections. The station and track layout must accommodate peak loads with sufficiently wide platforms, and consider ease of access, walking distances, and demand variability throughout the day. Platform configuration choices—center versus side—impact passenger flow and accessibility: side platforms offer direct access and may facilitate easier connections, while center platforms can streamline operations but require level changes for passengers. Future expansion should be factored into site selection to ensure scalability.

6.0 ARRIVAL AND DEPARTURE STOPS

To optimize transport economics at the port, it is essential to strategically plan arrival and departure stops for buses, passenger cars, and taxis near the port building, ensuring smooth passenger flow and accessibility. Additionally, designing designated parking lots for passenger cars and buses, along with parking garages for passenger vehicles, will facilitate efficient vehicle management and reduce congestion. Properly coordinated stops and parking facilities will enhance operational efficiency, improve user experience, and support economic sustainability at the port.

The number of taxi stands is expressed according to the form:

Tx= $\frac{P}{t_x}$ where:

Volume: 08, Issue: 05 September - October 2025

ISSN 2582-0176

- P - the total number of passengers in the peak hour at the terminal,
- tx - the taxi use factor, which is determined depending on the standards of passengers, i.e. residents in the gravity area of the airport.

Figure 4, Taxi stand at Skopje Airport

The number of stops for the buses of airlines and travel agencies that bring passengers to the airport is calculated according to the form:

$$B = \frac{P_0 \cdot p_B \cdot T_B}{60 \cdot C_B \cdot \mu}$$

where:

- P0 - the total number of departing passengers in international and domestic traffic during peak hours at the terminal.
- pB - percentage of passengers who use airline or travel agency buses to arrive at the airport
- TB - the time the bus stays at the stop, which is necessary for disembarking passengers and their luggage
- CB - bus capacity expressed in the number of seats, the degree of use of stops.

The described transport setup emphasizes efficiency in passenger transfer and vehicle circulation, minimizing walking distances at arrival and departure points, which enhances passenger convenience and reduces transfer times. The strategic placement of bus stops directly in front of port and pier entrances optimizes passenger flow, while the auxiliary parking lot's capacity—being significantly larger than the number of stops—ensures sufficient space for bus storage during peak tourist periods, accommodating the fluctuating demand from charter flights. This setup reflects a well-planned integration of port and city transport logistics,

Volume: 08, Issue: 05 September - October 2025

ISSN 2582-0176

balancing passenger convenience with operational flexibility, which is crucial for managing high-volume tourist traffic efficiently.

Figure 5, Bus stop at Ohrid St. Paul the Apostle Airport

In large airports, there are parking lots for passenger cars in front of the terminal building, which are intended for different users and:

- parking lot for official cars (which see off or welcome business partners or team members)
- parking lot for cars of tourist offices, various agencies and vehicles of Rent-a-car offices.
- open parking space for short-stay passenger cars whose owners see off or welcome passengers. Parking services are provided through parking machines for a certain length of time.

The number of parking spaces in the open parking area for passenger cars is calculated according to the form:

$$N_{pA} = \frac{P}{p_A}$$

where:

- P - the total number of passengers in the peak hour at the terminal,
- pa - passenger car usage factor, which is determined depending on the degree of motorization in the gravity area of the airport, passenger standards and statistical data.

Controlled parking area for passenger cars of passengers staying on the road for one to three days. The number of parking spaces in the controlled parking area for passenger cars of passengers staying on the road for 1-3 days is calculated according to the form:

Volume: 08, Issue: 05 September - October 2025

ISSN 2582-0176

$$K_p = \frac{\sum P_d \cdot p_i}{D_i \cdot \mu}$$

where:

- Pd - daily number of departing passengers on a peak day,
- pi - the percentage of passengers who stay on the road "i" days,
- Di - the maximum number of days the vehicle can be kept in the parking lot,
- μ - level of parking lot utilization.

Underground multi-storey garages, often automated and with capacities of 300-450 spaces, are strategically built in airports with limited free space, good ground conditions, and low water table, to maximize land use efficiency. Despite their high construction and operational costs, they are typically located beneath business facilities, hotels, parking lots, or green spaces, and occasionally under port buildings, to optimize space utilization and support passenger convenience for parking durations of 7-30 days.

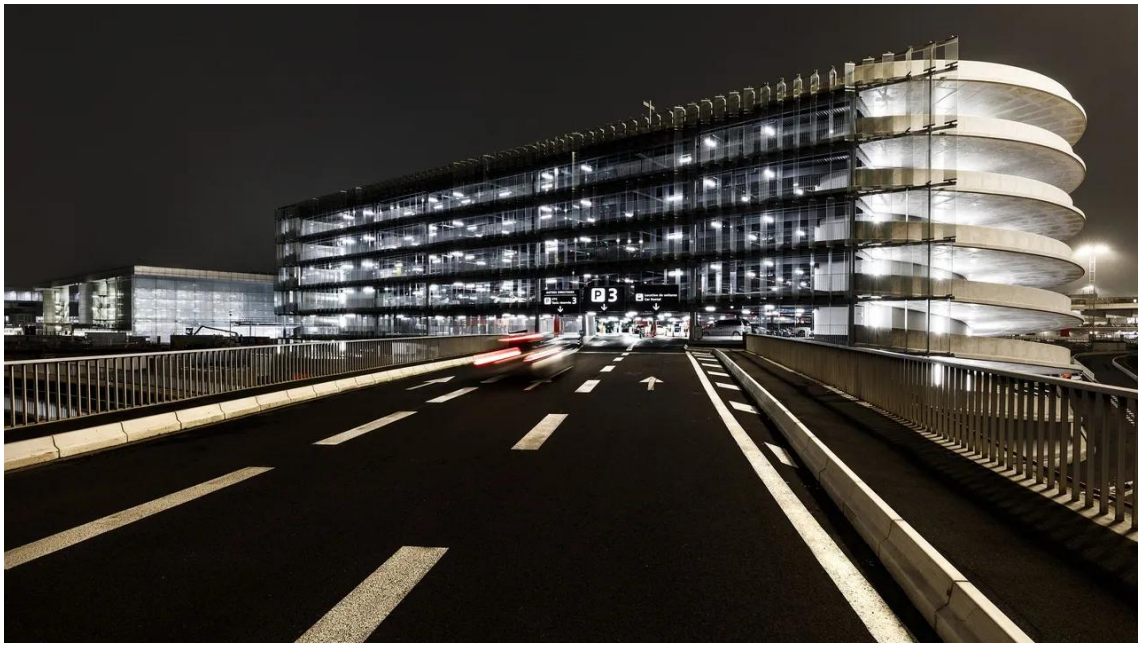


Figure 6, Paris- Orle Airport Garage

Transport economics plays a crucial role in shaping efficient transportation systems, especially as airports evolve through generations driven by passenger demand and technological advancements. The development of seventh-generation airports involves adapting existing infrastructure to current trends, while the future eighth-generation airports will likely integrate innovative facilities for enhanced functionality. Multi-storey above-ground garages, with their cost-effectiveness and practicality, are well-suited to meet the high-density parking needs of these modern airports, offering a strategic solution for managing space and operational costs without the complexities associated with underground parking systems.

Volume: 08, Issue: 05 September - October 2025

ISSN 2582-0176

Airports will be reviewed in this part of the seminar based on their size as well as their status in the global rail network. According to this parameter, the railway port is ranked as:

a) international airports
b) regional airports
c) local airports
d) general aviation airpor

Some of the most important central international airports in the world are:

- Changi International Airport Singapore
- Charles- de- Gaulle International Airport, Paris, France
- Chek Lap Kok International Airport, Hong Kong
- Frankfurt International Airport, Frankfurt, Germany
- Heathrow International Airport, London, England,
- John F. Kennedy International Airport, New York, USA
- Kuala Lumpur International Airport, Kuala Lumpur, Malaysia
- Schiphol International Airport, Amsterdam, Holland
- K) Zurich International Airport, Zurich, Switzerland.

Some of the most important regional airports in the world are:

- Dallas Fort- Worth International Airport, Dallas- Fort Worth, Texas, USA
- Hamburg International Airport, Hamburg, Germany
- Kansai International Airport, Osaka, Yapan
- Koln/ Bonn International Airport, England
- Stuttgart International Airport, Stuttgart, Germany.

The most important local airports in Bosnia and Herzegovina are:

- Sarajevo International Airport
- Banja Luka International Airport
- Mostar International Airport
- Tuzla Airport

Other airports in the Balkan region:

- Belgrade,
- Skoplje,
- Zagreb

Transport economics plays a crucial role in shaping the future of airport development, as it emphasizes efficient resource allocation, infrastructure investment, and technological advancements to meet growing demand. As passenger planes evolve in capacity and complexity, airports must adapt by expanding runways, enhancing maneuvering areas, and upgrading facilities to accommodate larger, more sophisticated aircraft. This continuous progression toward a seventh, eighth, and even beyond, generation of airports reflects an

ongoing pursuit of higher service levels, efficiency, and sustainability, driven by innovations in aircraft design and increasing global mobility needs.

7.0 CONCLUSION

Effective integration of airport systems with surrounding settlements is essential for ensuring accessible, sustainable growth, requiring comprehensive planning that anticipates future traffic increases and infrastructure expansion. This involves balancing road transport's flexibility, especially for air freight, with environmentally friendly options like rail and subway systems, particularly in developed countries such as Japan, highlighting the importance of multimodal connectivity. Coordinated development plans between airports and local communities are vital to prevent disruptions and optimize infrastructure investments, emphasizing long-term strategic planning aligned with urban growth to support efficient, sustainable, and accessible air travel. During the planning phase, efforts focus on predicting future traffic demands and designing access systems with capacity for expansion, ensuring that infrastructure can be upgraded to accommodate increasing passenger and freight flows. Rail transport offers significant advantages over road transport, especially in terms of economy and environmental impact, such as reduced atmospheric pollution and lower fuel consumption per unit of transport, making it a crucial mode for sustainable development in well-developed countries like Japan. Its efficiency is particularly evident in urban passenger transit, where subways eliminate the need for extensive parking infrastructure and effectively connect airports with metropolitan areas, reducing congestion and pollution. To maximize these benefits, it is essential to develop and coordinate airport and local community infrastructure plans well in advance, ensuring seamless connectivity and long-term efficiency, which requires strategic planning and investment in modern road and rail networks that integrate airport development with urban growth.

LITERATURE

Aerodromes- Annex 14 to the Convention on International Civil Aviation Volume 1- Aerodrome Design and Operations, International Civil Aviation Organization, July 1999

Airport Passenger Terminal Planning and Design; Transportation research board of national academies; Washington d.c.(2010)

Airport Ground Access Planning Guide; Mr. Lee Chimini; Washington

http://en.wikipedia.org/wiki/Airport_rail_link

Aerodromi; dr. Fadila Kiso, dr. Fahrudin Kiso

https://tripjive.com/navigating-skopje-airport-to-city-center-travel-guide/

https://sarajevo-airport.ba/?lang=eng/oc10bnv85.html

https://www.igh.hr/projects/zagreb-international-airport-franjo-tudman/

Volume: 08, Issue: 05 September - October 2025

ISSN 2582-0176

https://www.paristoolkit.com/airport/paris_orly.htm

https://ohd.airports.com.mk/mk-MK/passenger-guide-mk

https://www.parisaeroport.fr/en/passengers/transport-parking/by-car/parking/map/ory

https://www.webohrid.com/prv-let-od-varsava-za-ohrid/

