Interreg
CENTRAL EUROPE
European Union
European Regional
Development Fund

LAirA

LANDSIDE ACCESSIBILITY TO AIRPORTS:

International best practice report

LANDSIDE ACCESSIBILITY TO AIRPORTS | International best practice report

CONTENTS

INTRODUCTION

This study is part of the Landside Airport Accessibility (LAirA) project; an Interreg Central Europe Funded project which aims to improve landside mobility planning for airports. The project has an aim of lowering CO2 emissions by changing the travel behaviour of airport passengers and employees and by developing innovative strategies with public entities. This report is divided in the same seven thematic areas as the LAirA project.

Study Method

The best practice review has been conducted via desk based research focussing on 20 case studies, across 16 airports located in Europe and North America. The desk based research was complemented with interviews with stakeholder represenatives, who assisted in providing more detail on several topic areas. Recommendations refer to best practice implementation and aimed at stakeholders with an interest in developing them.

Key Best Practice Themes

Electric Vehicles: Electric vehicles are becoming increasingly practical in terms of their range, availability, cost and specification. Provision for these vehicles in terms of charging infrastructure is increasingly common at airports for convenience for customers and to support low carbon travel.

Air-Rail Links: Easy access to a fast, frequent rail link to the local city centre is an attractive alternative to road based transport to/ from airports. Often faster services compete with cheaper slower rail or bus services so Air-Rail services need to be frequent, fast, high quality and well promoted.

Active Travel: To encourage cycling to the airport, particularly for airport employees, good supporting facilities and incentives are required. This includes good connectivity to bike paths in the wider area, on-site facilities such as secure parking and showers, and incentives such as promotions and events.

Car Pooling and Car sharing: Car pooling and car sharing offer alternatives to taxi, hire car and single occupancy car trips. Car sharing can be more economical than taxi or traditional car hire, depending on the timescale of use. The shared cars themselves are often low emission models, including electric options. Car pooling is particularly useful to reduce single occupancy commute trips.

Intelligent Transport Systems (e.g. apps): 63 percent of the world's population is estimated to have a smart phone and apps are now a key method of accessing information on travel. Traditionally airport apps have focused on parking and air-side information, however, modern best practice examples provide detailed information for passengers on landside transport options. apps can also assist airport staff to provide high quality customer services to passengers by providing travel information, particularly at times of disruption.

Wayfinding: Airport terminals are complex buildings, often on multiple layers. Airports with multiple options for landside travel can have the associated issue of providing information in a way which is intuitive to an international and transient audience. Clear wayfinding to onward transport connections is vital to ensure these options are as easy to use as possible.

Road Based Public Transport: Bus and coach services often provide opportunities for low cost, convenient links to a wider range of destinations than rail services may provide. Special airport coaches, other coach operators and local bus services can provide excellent levels of accessibility. Local bus services also provide an important option for airport staff. Ensuring attractive and easy to use ticketing options and information is important for both passengers and staff.

Overview of each airport

The table provides an overview of 16 airports considered during the best practice review. Locations, and the case studies conducted at each airport are summarised on the following slide.

Airport	IATA code	Country	Passengers numbers (2017)*	Direct modes available (see key)**	Road distance from main city center***
Amsterdam Schiphol	AMS	Netherlands	68m	R, B, C, T, EV	20.6 km
Brussels Zaventem	BRU	Belgium	24m	R, B, C, T, EV	13.7 km
Catania	CTA	Italy	9m	B, T	17.3 km****
Munich	MUC	Germany	45m	R, B, C, T, EV	38.3 km
Geneva	GVA	Switzerland	17m	R, B, C, T, EV	5 km****
Helsinki	HEL	Finland	19m	R, B, T, EV	19.3 km
Manchester	MAN	UK	28 m	R, Tr, B, T, C	15.5 km
London Stansted	STN	UK	26 m	R, B, C, T	59.5 km
Oslo	OSL	Norway	27m	R, B, T, EV	50.1 km
Paris Charles de Gaulle	CDG	France	69 m	R, B, T, EV	21.5 km
Stockholm Arlanda	ARN	Sweden	27 m	R, B, T, EV	42 km
Toronto Pearson	YYZ	Canada	47 m	R, B, C, T, EV	27.8 km****
Vancouver	YVR	Canada	24 m	R, B, C, T, EV	14.7 km****
Vienna	VIE	Austria	24 m	R, B, C, T, EV	21.7 km
New York John F Kennedy	JFK	USA	59 m	R, B, U, T, EV	47 km****
Gatwick	LGW	UK	46 m	R, B, C, T, EV	45.5 km

Key

R – Rail
Tr – Tram
B – Bus/Coach
C – Cycle
T – Taxi
EV – Electric Charging available

*   Based on airport annual reports of passenger numbers
**   Based on information from airport websites
***   Distances taken from Airport Accessibility in Europe Report (DLR/European Commission, 2010) unless otherwise indicated
****   Distances calculated using Googlemaps and suggested vehicle route

ELECTRIC VEHICLES

Background

There are immediate opportunities within the automotive sector to transition to alternatively fueled vehicles (AFVs) to decarbonise the sector and reduce the environmental impact. A key option identified by the transport sector and policy makers is the electrification of transport.

Electric vehicles are powered in part or in full by a battery that is charged by dedicated charging infrastructure from the mains electricity supply. The term electric vehicles encompasses a range of vehicles including, pure electric vehicles (PEV), plug-in hybrid electric vehicles (PHEV) and extended-range electric vehicles (E-REV).

There are benefits of efficiency of electric drivetrain compared to the internal combustion engine (ICE), as well as further benefits of energy security by diversifying the transport sectors energy sources. However, there are challenges transitioning to electric vehicles due to extensive sunk technological costs in ICE vehicles and entrenched behaviours and cultures surrounding the automobile. In order to overcome these challenges and increase the take up of EVs, many countries have introduced grants and incentives for purchasing electric vehicles and installing charging infrastructure.

Electric Vehicles and Airports

Airport access and exit by car for customers and staff, be it as a driver parking at the airport or pick up/drop off by family member, friend or taxi, is a key mode of travel for airport accessibility. In many cases the car is the most convenient option, particularly for those travelling from locations not directly connected by public transport or at times when public transport may be less frequent.

The continued development and increasing availability of electric vehicles has allowed some airports to consider opportunities to use this technology to maintain the flexibility of car and taxi travel but with a lower level of CO2, NOx and particulate emissions than those associated with traditional fueled vehicles.

Equally there are financial advantages for the adoption of EVs due to the low operating costs and consequently competitive total cost of ownership. This is particularly important for fleet procurement to assess the direct and indirect costs and create benchmarks for vehicle replacement.

AMSTERDAM SCHIPHOL

Airport context

BIOS and BBF Schipholtaxi began operating a fleet of 167 model S Tesla electric vehicles in October 2014. As a result, Schiphol now boasts the largest fleet of electrically powered taxis of any airport in the world.

In cooperation with Schiphol, Tesla also created the largest dedicated Direct Current (DC) fast charging station for a group of cooperating taxi fleets. It is not part of Tesla's public Supercharger network, but it is available exclusively for taxis serving the airport, to complement their charging with the quickest recharge available at the best possible location. More capacity is scheduled to be added to this site. It is estimated that more than 80% of taxis from Schiphol have Amsterdam as their destination.

Objectives and actions

Schiphol Airport seeks to reduce its impact on the environment, seeking to reduce carbon emissions as a result of its activities. There is a focus on expanding the use clean transport to, from and at Amsterdam Schiphol Airport. Local and national government also strongly support EVs.

Involved subjects and roles

Key stakeholders are:

- Electric Taxi: provider of electric taxi fleet. Partners include Social Ventures NL, Start Foundation, DOEN Foundation.
- BIOS-Groep: an organisation specialising in coordinating and implementing mobility services.
- Schiphol Airport: including engineering team to introduce charging infrastructure.

Timing and implementation processes

The initial electric taxi fleet was introduced in 2014.

Financing

Electric Taxi is funded as a social enterprise.

Regulatory and policy context

The Dutch Ministry of Infrastructure and the Environment offers a €5,000 subsidy on the purchase of all-electric taxis in Amsterdam. An additional subsidy of €5,000 is provided by the local government in Amsterdam.

The Clean Taxis for Amsterdam Covenant has been signed by all licensed taxi companies in Amsterdam. This covenant includes a combination of benefits and responsibilities which makes it attractive to purchase clean taxis and discourages the use of polluting taxis.

Impacts

In 2015 Schiphol Airport retained the 3+ status in Airport Council International's Airport Carbon Accreditation system. This is the highest status that can be attained and was awarded partly on the basis of working with 3rd party stakeholders.

Any critical success factors

- Vehicle type: The Tesla Models S and X are extremely well suitable for business travelers and passengers with lots of luggage (because of the additional boot space) therefore well suited for airport use.
- Policy: Supportive policy context in the Netherlands for EVs has been important at supporting introduction of electric taxi fleets.
- National characteristics: Local geography and attitudes have played a role in acceptability of EVs. The Netherlands is a small country thus "range anxiety" for EVs is less of an issue. There is a tradition of environmental activism in the country and fuel prices are high, making EVs considerably cheaper to run.

Risks

Risks include change to policy removing subsidy for EVs.

Challenges

The challenge of identifying a suitable vehicle fleet was overcome by use of the Tesla Model S and X. The challenge of meeting operational needs of an EV taxi were met by primarily charging vehicles overnight or during downtime, using regular Alternative Current (AC) chargers at their own depot. To complement their peaks in operation, an on-site DC fast charging solution is available, which can charge the cars at 60kW.

Opportunities

The taxi fleet has recently been upgraded to Model X SUVs. BIOS Groep plan to expand the fast charging station at Schiphol Airport.

Recommendations

- Working with local government to develop a supportive local policy environment for EVs;

- Where electric taxis are considered for implementation ensure vehicles are appropriate design and appropriate charging infrastructure is introduced to support specific taxi requirements.

STOCKHOLM ARLANDA

Airport context

The world's first electrified road that recharges the batteries of cars and trucks driving on it has been opened linking Stockholm Arlanda Airport to a logistics site outside the capital city. About 2km of electric rail has been embedded in a public road. Energy is transferred from two tracks of rail in the road via a movable arm attached to the bottom of a vehicle. Should the vehicle overtake, the arm is automatically disconnected. The electrified road is divided into 50m sections, with an individual section powered only when a vehicle is above it. When a vehicle stops, the current is disconnected. The system is able to calculate the vehicle's energy consumption, which enables electricity costs to be debited per vehicle and user. The "dynamic charging" – as opposed to the use of roadside charging posts – means the vehicle's batteries can be smaller, along with their manufacturing costs.

Objectives and actions

The technology aims to solve the problems of keeping electric vehicles charged, and the manufacture of their batteries affordable. The goal of the project is to generate knowledge, experience and decision data that is conducive to the creation of a platform for the electrification of larger transport routes in Sweden. The vehicle that are primarily planned to use the electrified road is an 18-ton truck that will be carrying goods for PostNord.

Involved subjects and roles

The project has been delivered by a consortium of 20 members called eRoadArlanda. This includes Swedavia Airports, Airport City, the Swedish Road and Transport Research Institute, the municipality of Sigtuna Kommun and PostNord.

Timing and implementation processes

Development of the eRoad has progressed since 2012, Procurement began in 2013. The road was opened in May 2018.

Financing

The project has been procured by the Swedish Transport Administration, the Swedish Energy Agency, Vinnova and Swedish industry.

Regulatory and policy context

eRoadArlanda is one of several projects in the Swedish Transport Administration's pre-commercial procurement of innovation for the development of electrified roads. The investment in the project is in line with the Swedish government's target of creating a fossil-free transportation infrastructure by 2030.

Impacts

It is estimated that two-thirds of truck transportation in Sweden could be carried out on electrified roads by 2030, reducing energy consumption by approximately 10 TWh or three million tons of fuel.

Any critical success factors

- An effective consortium to deliver the project.
- Supportive national government programme.
- Suitable test location.
- Development of a direct power network for full implementation.

Risks

Developments in vehicle battery technology in terms of charging time, charge capacity, size and cost may reduce the need for the eRoad concept in the longer term.

Challenges

A challenge with the new infrastructure has been issues with dirt getting into the electric rail. However with adequate traffic density, vehicles using the track keep the track clean. If the road is snowed over, a snow plow is required to clear the road which will be able to simultaneously clean the track with a special device. During periods of low traffic at night, ice can form on the conductors, forming an insulating layer. A patented solution for this problem was successfully tested during 2012 to 2013.

Opportunities

The government's roads agency has already drafted a national map for future expansion. Figures suggested by eRoads Arlanda indicate development of 20,000km of eRoads is estimated to cost SEK 80 billion, but would deliver savings of SEK 32 billion per year, meaning the cost would be paid off in three years.

Recommendations

The applicability of eRoads will be become clearer as Sweden continues to develop its pilot programme.

VANCOUVER

Airport context

Vancouver Airport currently has 19 accessible electric vehicle charging bays for public, employee and fleet use. The parking incurs a fee, however, the electric vehicle charging is free. Within the multi-story car park, if the space is used for more than four hours, drivers must inform the cashier upon exiting that they parked in the multi-story to access an electrical charging station. This then enables eligibility for a discounted daily parking rate of $30. The airport also runs a taxi incentive programme which allows discounted license fees to taxi drivers who operate fuel efficient vehicles.

Objectives and actions

Vancouver Airport has a Master Plan (YVR 2037) which is a 20-year strategy which aims to support sustainable growth of the airport, and an Environmental Management Plan which sets targets for 2020. The airport produces an annual sustainability report. Introduction and expansion of electric vehicle charging forms part of the approach to improving ground access, and reducing emissions. Progress is reported in the annual sustainability reports. Offering discounted license fees to taxi drivers who operate efficient vehicles also contributes to this.

Involved subjects and roles

Stakeholders include Vancouver Airport and providers of the EV charging points: GE Watt Station and Chargepoint.

Timing and implementation processes

The taxi Incentive programme was launched in 2004. The first electric vehicle charging points were introduced in 2013.

Financing

Information on financing was unavailable, however it would be expected that as charging is offered at no cost to the user, Vancouver Airport financially supports the charging infrastructure.

Regulatory and policy context

There is a range of supportive policies relating to EVs in Canada at federal, provincial and municipal level. One such policy in British Columbia is that EVs are allowed access to High Occupancy Vehicle (HOV) lanes regardless of number of passengers. The airport's environmental management plan includes a strategic priority to reduce greenhouse gas emissions with core environmental programme areas focusing on air quality and climate change. Vancouver Airport has a Level 2 accreditation through the Airports Council International (ACI) and its Carbon Accreditation Programme in 2016.

Impacts

In 2016, Vancouver Airport recorded 1,836 charges from their public and employee charging stations, an increase of 79% over 2015.

Any critical success factors

Moves by the local government to incentivize electric vehicle use increase the potential demand for electric vehicles. This is supported further by offering attractive incentives such as free charging and adequate levels of charging points to ensure availability.

Risks

There is a risk that as electric vehicles continue to develop, charging provision will not meet the need. To manage this risk, continued reviews of usage will be needed and monitoring of new trends.

Challenges

Ensuring the correct mix of charging infrastructure is provided is a challenge and balancing this with parking demands from traditionally fueled vehicles.

Opportunities

The increasing popularity of electric vehicles means there is an opportunity to expand charging infrastructure.

Recommendations

- Provide attractive incentives for public landside access by EVs vs traditional fueled vehicles e.g. paid parking but free charging;
- Provide adequate mix of charging types for different parking needs;
- Provide taxi incentive programme to encourage low emission taxis.

Table | Electric Vehicles

Aspect	Amsterdam	Stockholm	Vancouver
Airport context	Electric vehicle taxi fleet.	Electric charging infrastructure built into road on 2km test track.	Public electric vehicle charging points and free charging. Taxi incentive for fuel-efficient vehicles.
Objective and actions	Schiphol Airport seeks to reduce its impact on the environment. There is a focus is on expanding the use clean transport to, from and at Amsterdam Airport Schiphol.	To support development of fossil free transport infrastructure by 2030. The specific project will assist development of longer routes, with particular applicability to freight.	Vancouver Airport has a Master Plan (YVR 2037), which is a 20-year strategy that aims to support sustainable growth of the airport, and an Environmental Management Plan which sets targets for 2020.
Involved subjects and roles	Electric Taxi Bios Groep Amsterdam Schiphol Airport	eRoads Arlanda consortium	Vancouver Airport Federal Government GE Wattstation/Chargepoint
Timing and implementation processes	Electric vehicle taxi fleet initially introduced in 2014.	Development of the eRoad has progressed since 2012, Procurement began in 2013. The road was opened in May 2018.	The taxi incentive programme was launched in 2004. The first electric vehicle charging points were introduced in 2013.
Financing	The electric taxi fleet is run as a social enterprise.	The project has been procured by the Swedish Transport Administration, the Swedish Energy Agency, Vinnova and Swedish industry.	It is assumed Vancouver Airport financially supports the charging infrastructure due to free charging offered.
Regulatory, and policy context	Dutch Ministry of Infrastructure and the Environment. The Clean Taxis for Amsterdam Covenant.	The investment in the project is in line with the Swedish government's target of creating a fossil-free transportation infrastructure by 2030.	Vancouver Airport Master Plan and Environmental Management Plan
Impacts	In 2015 Schiphol Airport retained its 3+ status in Airport Council International's Airport Carbon Accreditation system.	It is estimated that two-thirds of truck transportation in Sweden could be on electrified roads by 2030, reducing energy consumption by approximately 10 TWh/three million tons of fuel.	Vancouver Airport recorded 1,836 charges (2016) from their public and employee charging stations, an increase of 79% over 2015.
Any critical success factors	• Vehicle type (EV suitable for taxi use) • Supportive national policy • National characteristics	• An effective consortium to deliver the project • Supportive national government programme • Suitable test location • Long term market for the solution	• Free charging offered • Government incentives for EVs
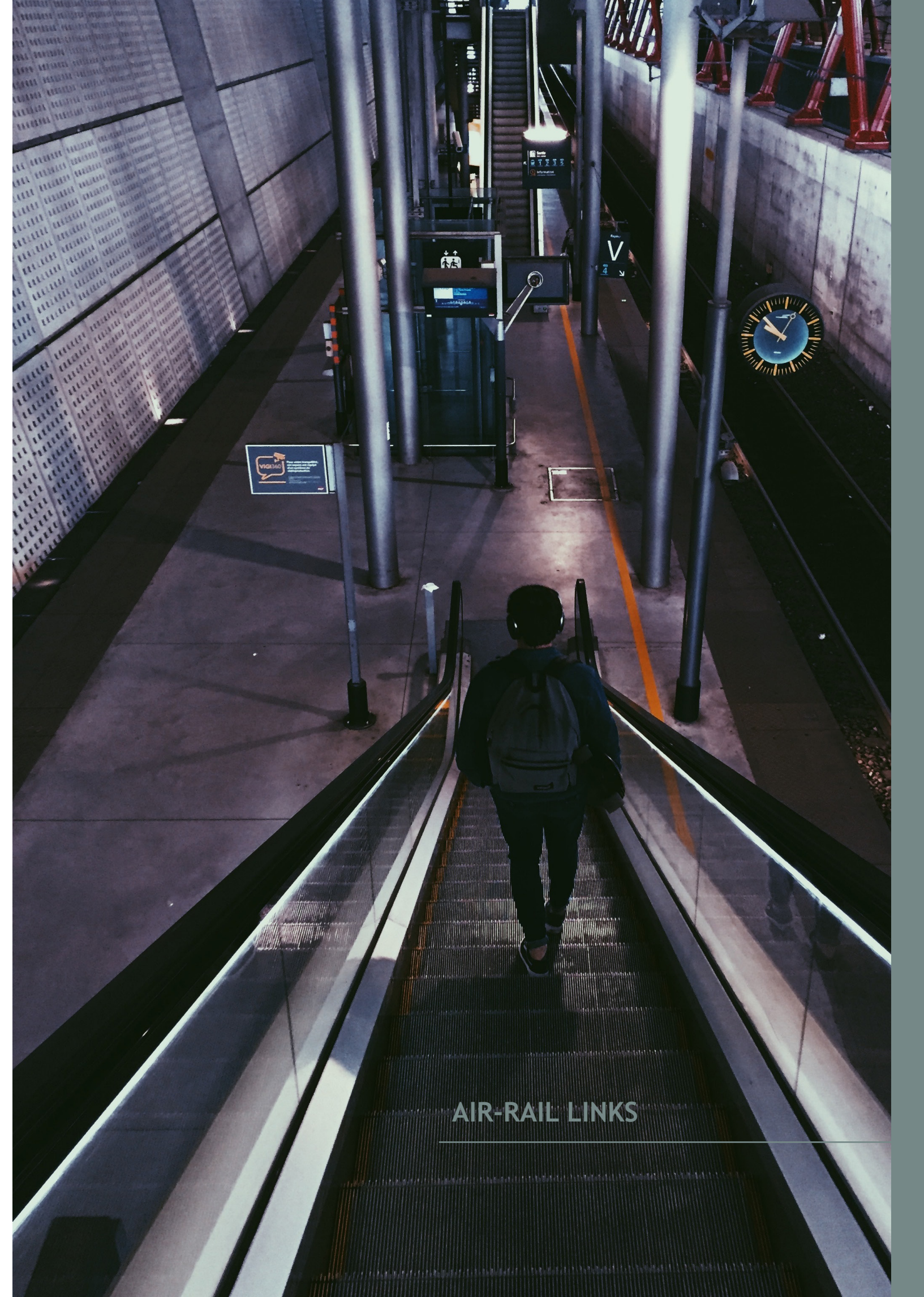
AIR-RAIL LINKS

Background

In 2016*, rail had a 7.7% mode share of trips across the EU. Mode share ranged by country from 12.1% in Austria to 1% in Lithuania and Greece. Rail services generally provide fast connections (particularly at peak time when passengers are affected by road based congestion), over long distances to key destinations.

Slower, basic commuter services complement longer distance express services which often have a wider range of facilities on board such as wi-fi, dining, and at seat entertainment. In some cases, express rail services compete for comparable short distance air travel, with rail often having an advantage of taking customers to a city centre location near their ultimate destination.

Air-Rail Links and Airports

Where available, rail links provide the opportunity for fast, efficient and attractive links to key destinations such as city centre sites. Research shows how introduction of direct air-rail services can dramatically impact mode share aware from the private car. For example at Stansted airport car mode share reduced from 69% in 1991 (when its rail link began operation) to 29% in 2013**. At a European level rail mode share for access to airports does not appear to be publicly available though research indicates an average rail mode share of around 16%***. Oslo Airport has been able to achieve an overall public transport share of 68%, the highest in all Europe, 70% of which is attributed to the "Flytoget" air-rail link.

Many airports have direct air-rail links, with the rail station either being constructed within the terminal building (such as Amsterdam Schiphol), within short travel distance of the main terminal building (such as Newark) or within a short bus journey way (such as London Luton).

Rail connections (both in terms of the rail station and rail services) that are of good quality, provide an attractive alternative to road based alternatives, particularly at congested times on the road network.

Airports may rely on standard rail services, either serving the local commuter market, national or international services serving a much wider catchment and/or dedicated express services.

Examples exist where discounted travel is available for rail-air journeys to further incentivise use of rail services to access the airport (for example Glasgow Prestwick Airport, UK, where a discount is applied to the ticket if a valid boarding pass is held).

MANCHESTER

Airport context

Manchester Airport rail station is located between terminals 1 and 2 of Manchester Airport. Trains arriving/departing the station service destinations across the north of England and southern Scotland. Unlike many airports, Manchester's predominant catchment is region wide with Manchester itself often not a final destination. Rail services focus more on regional connectivity than dedicated links to the city.

Manchester Airport Station is owned by Manchester Airport Group (MAG) and leased to Network Rail and in turn to the rail operator. The station has a Station Travel Plan (2018).

Staff working for Manchester Airport Group, or who hold a Manchester Airport security pass are eligible for a 25% discount on train tickets from their home station to the airport. Valid tickets include season tickets. Staff are required to purchase a £20 railcard which is valid for one year to secure the discount. This card is purchased at Manchester Airport rail station.

Objectives and actions

Manchester Airport is committed to improving connectivity for passengers and staff. The Manchester Airport Station Travel Plan has objectives which focus on encouraging travel to/from the station by sustainable modes and has a target to achieve a year on year increase in mode share by sustainable travel methods.

Involved subjects and roles

Key stakeholders include MAG, First Transpennine (operator), Rail North (infrastructure), Sustrans (cycling charity) and Transport for Greater Manchester (regional transport authority).

Timing and implementation processes

The rail station opened in 1993 with two platforms. A third platform was built in 2008 and a fourth opened in 2015. A tram system operating from the city centre was extended to Manchester Airport in November 2014. The Station Travel Plan updated in 2018.

---

*https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Passenger_transport_statistics#Modal_split
**http://iaro.com/sitefiles/startup2.pdf
***http://fsr.eui.eu/wp-content/uploads/14030317-Hylen.pdf

Financing

Unlike many stations in the UK, Manchester Airport Station is owned by MAG, and leased to Network Rail. The individual measures to influence travel behavior within the plan are funded by key stakeholders. Retail is considered a key revenue stream for development at the station.

Regulatory and policy context

Surface access is included in the airport's 2030 Master Plan as well as the Sustainable Development Plan. The Environmental and Corporate Social Responsibility Policies are also key drivers for encouraging sustainable access. Additionally, development regulations require MAG to create a campus travel plan. The Station Travel Plan was a requirement of the operators franchise agreement.

Impacts

MAG's Corporate Social Responsibility Report indicates passengers travelling through MAG airports during 2016/17 lowered their carbon footprint by an average of 15% compared with ten years ago.

Any critical success factors

A good relationship, and good communication between rail and airport stakeholders, is important when rail related disruption arises, particularly when longer term disruption occurs. As passengers often have anxiety around flights delays this can reduce the desirability of using rail for onward travel. Availability of Airport Advance Fares which provides a 3 hours period to make rail connection assist with this issue, while allowing cheaper fares.

Risks

Issues with rail infrastructure are outside the direct control of MAG. This is mitigated by developing good relationships with wider rail stakeholders.

Challenges

Challenges include ensuring the station can continue to meet capacity over time. Platform expansion is being considered. Making fares attractive and the interchange experience has been a challenge for families and consideration is being given for group travel. Compared with expanding the bus network, increasing access by rail needs longer to plan.

Opportunities

Manchester Airport is set to undergo major regeneration over the next few years, with a huge growth forecast. As part of the redevelopment of Terminal 2, Manchester Airport Group are paying particular attention to the impact on the surround road network and their car park infrastructure, and are actively looking to encourage travel to and from the airport by sustainable modes. There are plans for further expansion of the station linked to the UK's High Speed 2 rail programme which will increase Manchester Airport's desirability as a key national air hub. Interlining, where air passengers can purchase a single ticket covering air and rail is seen as an opportunity.

Recommendations

- Develop station travel plan to support sustainable access to station
- Promotion of Interline tickets
- Work with rail operator on Airport Advance Fares
- Expand direct rail services to airport

LONDON STANSTED

Airport context

Stansted has a train station located in the main terminal building directly below the main concourse. Rail services include the Stansted Express which runs every 15 minutes to Liverpool Street Station in central London. Other rail services connect the airport to destinations including other large cities in the Midlands and East England including Birmingham, Cambridge, Peterborough and Leicester. The station was built on a short brand line.

Objectives and actions

The rail station at Stansted Airport was opened to coincide with the opening of the airport's new terminal building in 1991.

Involved subjects and roles

Key stakeholders are Stansted Airport, Network Rail (infrastructure) and Abellio East Anglia (rail operator and operator of the Stansted Express service).

Timing and implementation processes

Stansted Airport's rail station opened in 1991.

Financing

The Stansted Express service is run as a franchise by Abellio East Anglia. The rail network itself is managed and maintained by Network Rail.

Regulatory and policy context

Abellio East Anglia Limited has been appointed by the Department for Transport to operate the Stansted Express service until 2025.

Impacts

In 2015 Stansted Airport had rail mode share of 22% for passengers departing. The airport's CSR summary report (2016/17) highlights a target to grow rail mode share from 22% to 25% by the end of 2019. In 2016/17 this was 28.5%.

Any critical success factors

Critical success factors for Air-Rail links to/from Stansted include:
- High frequency;
- Convenience of access direct to a key transport hub in central London;
- Special ticket deals if booked online, in advance, via Stansted Express site.

Risks

Patronage of Air-Rail services can be impacted on by demand for air travel. This has been particularly evident following terrorist and economic crisis.

Online reviews pose a risk with potential customers being put off from using a service. Online reviews are an increasingly common method of public feedback, though not necessarily representative of real levels of service. Considering the Stansted Express service there are a relatively high proportion of negative reviews e.g. 28% indicating the service to be poor or very poor on TripAdvisor.

Challenges

Journey times can vary for branded services – some services though branded "Express" may stop at intermediate stations. Managing expectations of the service from passengers through clear information and branding will manage this issue.

Opportunities

There are opportunities to further improve the Stansted Express service in terms of rolling stock and service levels.

Recommendations

- Ensure Express services offer an easy to understand level of service in terms of travel time and quality of service.
- Provide discounted ticket options.
- Provide a high frequency service.
- Provide an express service which connects to a key transport hub at the train terminus.

OSLO

Airport context

The air-rail link consists in a high-speed railway (maximum speed: 210 km/h) connecting the airport southwards with the Oslo Central Station through the "Flytoget" service. The link is integrated in the national railway network so that also long-distance direct services to other Norwegian cities are operated from the airport. The "Flytoget" service covers the almost 50 km distance between Oslo Central Station and airport in only 19 minutes, with a frequency of one train every ten minutes. The service continues beyond Oslo Central Station and serves 9 further stops within Greater Oslo, and takes up to 60 minutes. Thanks to this service, the Oslo Airport reported in 2015 a public transport share of 68%, which is the highest in all Europe.

Objectives and actions

When the Norwegian Parliament in 1992 decided on Gardermoen to be the official main airport, it was also decided that trains should be the main access means of transport. A new high-speed train was to be competitive, future orientated and an environmentally friendly alternative of transportation. The Parliament presumed that an expansion and an increased capacity would be profitable and planned to give a marginal rate of return of 7.5%.

Involved subjects and roles

The Norwegian Parliament decided on the construction of the new air-rail link and, later, on the company running the new line. The Flytoget AS is the company running the line and is owned since 2001 by the Norwegian Ministry of Trade and Industry.

Timing and implementation processes

The construction of the new line was decided by the Norwegian Parliament in 1992. Works started in 1994, allowing the line to be opened in 1999.

In June 2003, after a long period of running at 160 km/h, Flytoget was awarded permanent approval to run their Airport Express Trains at 210 km/h. The service from Oslo Central Station to Oslo Airport now became a 19-minute journey.

Financing

The Norwegian State Railways (NSB) created the subsidiary, NSB Gardermobanen AS, in November 1992 to perform the construction of the line. This company would be able to charge train operators using the railway line and could use this income to cover its down payments and interest on the debt created to pay for the infrastructure investment. It was planned to give a

profit margin of 7.5%. However, following cost soaring and lack of demand in the first years, the profit targets were not met, so the government eventually decided to nationalise both the network and the operating company.

The projected costs of the railway line were NOK 4.3 billion (€0.44 billion) ±20%. Total costs ended at NOK 7.7 billion (€ 0.79 billion), including NOK 1.3 billion (€0.13 billion) extra used on extraordinary expenditures on the Romeriksporten (rail tunnel). Together with train purchase, management improvement and financial costs, investments amounted in total to NOK 10.0 billion (€ 1 billion).

Regulatory and policy context

In 1992 the Norwegian parliament decided that Gardermoen should be the site of the new main airport. A high speed rail link was seen as important given the distance from Oslo.

Impacts

Oslo Airport has been able to achieve a public transport share of 68%, the highest in all Europe, 70% of which is thanks to the contribution of the "Flytoget" air-rail link. The objective was to attain that 50% of travel to and from Oslo Airport would be made by public transport and that trains would provide the most important mode. Both targets have been achieved a long time ago and the current Local Plan for Oslo Airport set an even more ambitious public transport target for travelling to and from the airport at 75%, to be reached by 2020.

Any critical success factors

The Flytoget service offers a connection to the Oslo city centre which is faster than travelling by car or bus and has a high frequency (6 services per hour) granting passengers an average waiting time of 5 minutes. In addition to that, a punctuality rate within 3 minutes of 96% and a regularity rate of 99% make it a very reliable and flexible service both for leisure and business travellers. Also, the possibility for passengers to further travel on the same train in the Greater Oslo urban area allows the catchment area to grow even more.

Risks

Key risks related to the ambitious nature of the infrastructure project, particularly the tunnel element. To mitigate the impact of any issues, an alternative older rail route was used to run services while construction was completed on the new route.

Challenges

The main challenge encountered was the extensive leakage during the construction of the Romeriksporten tunnel, which caused the works to be delayed and additional costs amounting to 1.3 billion NOK. In general, during the construction of new ambitious infrastructure projects it is not unlikely that unforeseen events occur, which can make construction time and costs increase.

In 2002 a government commission made it clear that the new line could not be run at a commercial profit as foreseen in 1992: The infrastructure was therefore transferred to the National Rail Administration and the Flytoget AS was set up as a separate public corporation under the auspices of the Norwegian Ministry of Transport and Communication.

Opportunities

Plans for an expansion of the high-speed line to Hamar have been launched, but have not been incorporated into any specific plans. The project may or may not incorporate a further high-speed line to Trondheim.

Recommendations

Recommendations are:
- Ensure careful risk management of new infrastructure, including contingency planning should it be needed.
- Develop suburban rail links for airports, to improved wider direct accessibility for passengers and airport employees.
- Ensure service frequencies are appropriate, particularly for peak time travel.

STOCKHOLM ARLANDA

Airport context

Stockholm Arlanda Airport is served by the high speed Arlanda Express service. The service has won many awards. The Arlanda Express serves two stations at Stockholm Arlanda Airport: Arlanda South which serves Terminals 2, 3 and 4; and Arlanda North, which serves Terminal 5. Journey time to Stockholm is around 20 minutes compared to local commuter trains (also serving the airport) which take around 38 minutes. Ticketing options include discounts for group travel, Wi-Fi is available and the service has a dedicated app. There is also a dedicated website.

Objectives and actions

The objective of the construction of the rail link was to allow the airport to grow without increasing the road traffic to the airport.

Involved subjects and roles

Key stakeholders were:
- A-Train AB, who constructed the route and financed a large part and now operate the Arlanda Express;
- Arlandabanan Infrastructure AB (AIAB), who now own the rail link itself.

Timing and implementation processes

Plans for a railway line from the city center of Stockholm to the airport started in the early 1990s and was opened in 1999.

Financing

Financing was secured by introducing Sweden's first public–private partnership (PPP), whereby a private consortium would be granted a 40-year permit to operate the line in exchange for all direct traffic and the right to collect usage fees from other train companies. The route cost approximately SEK 4 billion to construct (€0.38 billion).

Regulatory and policy context

The current contract runs for a 45-year period (until 2040) with an option for a 10 year extension.

Impacts

One objective of the Arlanda rail link was to provide benefits in the form of a better environment. More than 60 million passengers have travelled by train to Arlanda since the service started to operate. If these passengers had travelled by car or bus instead of by rail it would have entailed costs to society for carbon dioxide emissions and congestion. Thus the Arlanda rail link has brought environmental benefits in the operational phase.

Any critical success factors

Critical success factors of the Arlanda Express include:
- Strong leadership: CEO awarded as Person of the Year by The Global AirRail Alliance;
- High quality of service and punctuality: Sweden's most punctual train operator, 2011- 2015;
- Good design/marketing: Product design 2011 of the year.

Risks

The PPP arrangement allowed the operator to set high ticket prices which risked resulting in lower levels of rail patronage. This in turn would result in less contribution to the objective of emission reduction.

Challenges

The nature of the PPP contract meant that aspects of construction were tailored to the current operator. As such station specifications (such as platform length and height) are different from normal Swedish standards which could present constraints on any new operator who secures the contract in the future.

The PPP contract also presents constraints in terms of responding to increasing and decreasing demand and how the Arlanda Express service interacts with other local services.

Opportunities

Opportunities have been flagged to improve how Arlanda Express and local services operate together to ensure best utilization of the track.

Recommendations

- For PPP projects ensure procurement criteria include consideration of interaction of other services and future infrastructure and rolling stock needs;
- Ensure excellent service levels, including punctuality, speed and frequency;
- Ensure ticket pricing is set at a level that is attractive for the user.

Table | Air-Rail Links

Aspect	Manchester	London Stansted	Oslo	Stockholm Arlanda
Airport context	Direct rail air link station also serving wider employment catchment. Local and national services provided. Travel plan to manage surface access to the station itself.	Direct rail link station. Local, regional services provided. Stansted Express service provided. Ticket deals if booked online. Stansted Express App available.	Direct rail links to a range of national destinations. Flytoget express service provided.	High speed express service. Two stations within the airport. Savings available for group travel.
Objective and actions	The Manchester Airport Station Travel Plan has objectives, which focus on encouraging travel by all users to/from the station by sustainable methods.	The rail station opened to coincide with the airport's new terminal building.	Government decision to make rail the main mode of transport to the airport.	The objective of the construction of the rail link was to allow the airport to grow without increasing the road traffic to the airport.
Involved subjects and roles	First Transpennine, Rail North, Rail Delivery Group, Sustrans, Transport for Greater Manchester and Manchester Airport.	Manchester Airport Group Abellio East Anglia who manage the station and run Stansted Express service.	Owned by Norwegian Ministry of Trade and Industry. Flytoget run by Flytoget AS.	A-Train AB - constructed the route and financed a large part and now operate the Arlanda Express; Arlandabanan Infrastructure AB who now own the rail link itself.
Timing and implementation processes	Manchester Airport's dedicated rail station opened in 1993 and was extended in 2008 and 2015. Current travel plan written in 2018.	Stansted Airport rail station opened in 1991. Platforms were extended in 2011.	Works started in 1994, allowing the line to be opened in 1999. In June 2003 services began running at 210 km/h.	Plans for a railway line from the city center of Stockholm to the airport started in the early 1990s and was opened in 1999.
Financing	Manchester Airport Station is owned by Manchester Airports Group and leased to rail infrastructure body an, in turn, the rail operator.	The Stansted Express service is run as a franchise by Abellio East Anglia. The rail network itself is managed and maintained by Network Rail.	The Norwegian State Railways created a subsidiary to perform the construction of the line. Costs were NOK 7.7 billion (€ 0.79 billion)	Sweden's first PPP. The route cost approximately SEK 4 billion to construct (€0.38 billion).
Regulatory, and policy context	The Station Travel Plan was a requirement of the franchise agreement.	Abellio East Anglia Ltd appointed by the Department for Transport to operate the Stansted Express service until 2025.	The Norwegian parliament decided on the airport site. A high-speed rail link was important due to the distance from Oslo.	The current PPP contract runs for a 45-year period (until 2040) with an option for a 10 year extension.
Impacts	During 2016/17 MAG passengers lowered their carbon footprint by an average of 15% vs ten years ago	7.6 million passengers used the station in 2016/17, an increase of 1.6 million on 2015/16.	Airport has highest public transport mode share in Europe (68%) with majority (70%) using Flytoget.	More than 60 million passengers have travelled by train to Arlanda since the service started to operate.
Any critical success factors	Manchester Airport serves regional are and wider "Airport City" employment area.	"Express" branding High frequency Special ticket deals Direct access to central London	Punctuality High frequency High speed	Strong leadership High quality of service Ticketing incentives for group travel Good design/marketing

ACTIVE TRAVEL

Background

Physical activity is an important part of a healthy lifestyle. Insufficient physical exercise is the second health risk factor after tobacco and 30% of Europeans do not practice a regular and proper activity in their daily life.

Soft mobility can help people reduce stress and their risk for chronic diseases, such as heart disease, diabetes, and some cancers, just with 30 minutes of activity 5 times a week.

Active Travel and Airports

Private vehicles play an important role in landside accessibility, with all its related negative externalities in terms of congestion, pollution, noise.

Apart from sustainable alternatives, as public transport, rail or sharing mobility, some airports, thanks to their layouts and locations, can reduce transport impacts by cycling or walking alternative modes.

These soft mobility solutions are generally addressed with reference to mobility management and the employees' systematics trips, even if this solution might impact also on passengers' behaviours.

Where it is possible, these slow modes of transport need to be encouraged by airport and territorial interventions and plans, to produce benefits for both travellers and airports themselves.

Reasons for addressing soft mobility management and intervention are:
• optimisation of parking spaces;
• reduction of budget allocated for renting and maintenance of parking spaces;
• improving employee wellness and travel experience;
• rationalise the use of private vehicles; and
• contribute to resolve environmental issues.

GENEVA

Airport context

Located 4 km from the city centre, Geneva Airport is at the centre of a cycle and pedestrian network. In order to promote active travel Geneva Airport has developed in such a way so that the majority of services are accessible by foot (restaurants, post office, etc.). Good bicycle-friendly paths, mostly dedicated, enable fast, flexible and safe travel by bike in the local area.

Many bicycle parking facilities are installed near the main entrances of the airport. The airport fosters active travel for longer and steeper journeys by providing recharging points for e-bikes. The airport also provides discounts for staff for bicycle and e-bikes sale and repair. The airport undertakes awareness activities including "Bike to Work" and an awards system for staff who cycle.

Objectives and actions

Interventions are focused on meeting the objectives of the airport and territorial plan. Main objectives are:
• reduce the private vehicles share;
• reduce noise and air pollution;
• reduce congestion in landside and nearby airport areas.

Involved subjects and roles

Key stakeholders are Geneva Airport; Geneva Municipal government, Swiss Federal government and local groups such as Genèveroule and Pro Vélo Ginevra who support cycling promotions.

Timing and implementation processes

Following a successful local campaign in 1989, a network of cycle paths were created in Geneva. Since then, the City has continued to develop the network. The airport's Environmental Management Plan considers mode share for employees and passengers.

Financing

It is assumed that on-site initiatives are funded by Geneva Airport with improvements outside this area funded by the city.

Regulatory and policy context

The Airport Mobility Plan implemented in 2004, focuses on measures and actions to promote a significant modal shift towards sustainable transportation modes (public transit, bicycles, walking, and car sharing) for both passengers and employees by 2020. Its prime objective is for 45% of airport employees and passengers to be using sustainable means of transport by 2020. There is also a commitment to actively promoting cycling as part of the Swiss federal operating concession.

Impacts

Mode share of private vehicles decreased from 60% (2007) to 48% (2017). Sustainable mode share increased to 38% in 2017. In particular, employees choose bicycle and walking modes in the 7% and 2% of cases.

Any critical success factors

Critical success factors include:
- Supportive local transportation policy;
- Award winning airport policy;
- E-bike support;
- Provision of easily accessible cycle parking;
- Provision of cycle awareness campaigns;
- Airport location.

Risks

No specific risks have been identified. Ensuring cyclists continue to have safe access by bicycle to the airport and new cyclists have appropriate skills will manage any risks of access by bike.

Challenges

A challenges for Geneva Airport is topography and geography. E-bikes have been subsidized as a way to support longer cycling trips and those that may involve hilly terrain.

Opportunities

Opportunities include:
- Increased potential for exposure to airport amenities and advertising during journeys;
- Potential for promotion of physical activity to a large and diverse population;
- Extension of the active travel network to improve accessibility to the airport and improve links to the city centre.

Recommendations

Recommendations are particularly applicable to airports located in close proximity to city centres.
Main recommendations might be:
- Promote employee campaign on sustainable mobility to improve awareness.
- Introduce an awarding system and discounts to motivate employees toward a behaviour change.
- Support e-bikes (e.g. charging points and incentives) where topography and journey length are likely to be key barriers to cycling.
- Provide a well-spread cycle network, with dedicated paths to increase safety levels.
- Provide clear information on the cycle network and cycle parking.

In May 2009, the Geneva Airport mobility plan was awarded the Prix Velo for bicycle friendly companies by PRO VELO (Swiss Bicycle Advocacy Association), and the Pan-European Workplace Mobility Plan Award (PEWTA).

VANCOUVER

Airport context

The airport is located on Sea Island which has a network of cycling routes mostly comprised of on- street bicycle lanes and paved shoulders.

The airport has its own cycling map and the airport's website provides links to local and regional cycling information. Bicycles are allowed on Canada Line trains and most TransLink buses are outfitted with front-mounted bicycle racks. Public and employee cycle parking are provided at the airport.

Vancouver Airport sponsored two one-day cycling commuter station events and organized a cycling tour to promote Bike to Work Week.

In September 2017, the airport launched its Fleet Bicycle Program, which provides six common-use bikes for all Airport Authority employees to use for business trips.

Objectives and actions

Encouraging cycling as a method of travel forms part of the approach to the airport managing carbon emissions as set out in its Environmental Management Plan.

Involved subjects and roles

Key stakeholders are: Vancouver Airport; Union Street Cycle; HUB; Translink; City of Richmond.

Timing and implementation processes

Vancouver Airport has built more than 7 km of new bicycle lanes on Sea Island since 2011.

Financing

It is assumed that on-site initiatives are funded by Vancouver Airport with improvements outside this area funded by Translink or authorities.

Regulatory and policy context

Encouraging cycling to the airport is a key part of the airport's strategy to improve ground access. Vancouver Airport has a Master Plan (YVR 2037) which is a 20-year strategy which aims to support sustainable growth of the airport, and an Environmental Management Plan which sets targets for 2020. The airport produces an annual sustainability report. The airport meets Federal regulations.

Impacts

Vancouver Airport continues to see growth in cycling. Its bike trackers recorded 87,688 cyclists on Sea Island in 2017, a 4% growth over 2016.

Any critical success factors

Critical success factors to support landside access by bicycle at Vancouver Airport include:
- Inclusion of cycling as an area of focus within the Environmental Management Plan;
- Availability of a cycle network providing access by bicycle to the airport;
- Availability of cycle parking for staff and passengers;
- Integration of cycling to other public transport modes;
- Detailed information available on cycle routes and parking locations at the airport;
- Participation by the airport in promotional activities to encourage staff to cycle to work.

Risks

Minimising safety issues amongst cycle commuters can be undertaken by providing cycle maintenance, adult cycle training and information on safer cycle routes as well as working with local stakeholders to improve key locations of particular concern in terms of cycle safety.

Challenges

Vancouver Airport is located on an island. There are a number of key junctions in the road network linking the island to local communities, which are particularly busy.

Opportunities

There are opportunities to further improve access by bike to the airport including initiatives as part of the 10-year vision and City of Richmond's Transportation Plan such cycle route improvements to bridges linking Sea Island with the mainland and wider routes within the surrounding communities.

Recommendations

Recommendations include:
- Include consideration of cycling as a key mode choice within surface access strategy/ environmental management plan;
- Development of on-site cycle routes to connect key destinations at the airport with the wider cycle network;
- Provide clear information on the cycle network and cycle parking to place emphasis on access to the airport by bike. This includes a site specific cycle map;
- Run promotional events for staff.

Table | Active Travel

Aspect	Geneva	Vancouver
Airport context	Geneva Airport has numerous dedicated bicycle-friendly paths and many bicycle parking facilities near the main entrances of the airport. Airport provides recharging points for e-bikes. Employees can take advantage of discounts for bicycle and e-bikes sale and repair and they are encouraged to participate in cycling awareness campaigns.	The airport is located on Sea Island, which has a network of cycling routes. The airport has its own cycling map and the airport's website provides links to local and regional cycling information. Bicycles are allowed on Canada Line trains and most TransLink buses are outfitted with front-mounted bicycle racks. Public and employee cycle parking are provided at the airport. The airport awareness raising activities. Fleet bikes are available for staff.
Objective and actions	Reduce the private vehicles share Reduce noise and air pollution Reduce congestion in landside and nearby airport areas	To support sustainable growth of the airport
Involved subjects and roles	Geneva Airport, City of Geneva	Vancouver Airport, Union Street Cycle, HUB, City of Richmond
Timing and implementation	2004 – ongoing.	Ongoing
Financing	Geneva Municipal government subsidise e-bike purchase.	It is assumed that on-site initiatives are funded by Vancouver Airport with improvements outside this area funded by the city and funds from Translink.
Regulatory and policy context	Airport Mobility Plan, implemented in 2004, focuses on measures and actions to promote a significant modal shift towards sustainable transportation modes (public transit, bicycles, walking, and car sharing) for both passengers and employees by 2020. Its prime objective is for 45% of airport employees and passengers to be using sustainable means of transport by 2020.	Encouraging cycling to the airport is a key part of the airports strategy to improve ground access. Vancouver Airport has a Master Plan (YVR 2037). The Environmental Management Plan (EMP) sets targets for 2020.
Impacts	For staff, private vehicles mode share reduced from 60% (2007) to 48% (2017). Sustainable mode share increased to 38% in 2017 including a 7% mode share for cycling.	Vancouver Airport continues to see growth in cycling. Its bike trackers recorded 87,688 cyclists on Sea Island in 2017, a 4% growth over 2016.
Any critical success factors	• Supportive local transportation policy • Award winning airport policy • High levels of accessibility to facilities by foot and bike • E-bike support and incentives • Provision of easily accessible cycle parking • Provision of cycle awareness campaigns	• Inclusion of cycling as an area of focus within the EMP • Availability of a cycle network providing access by bicycle to the airport • Availability of cycle parking for staff and passengers • Integration of cycling to other public transport modes • Detailed information available on cycle routes • Participation by the airport in promotional activities
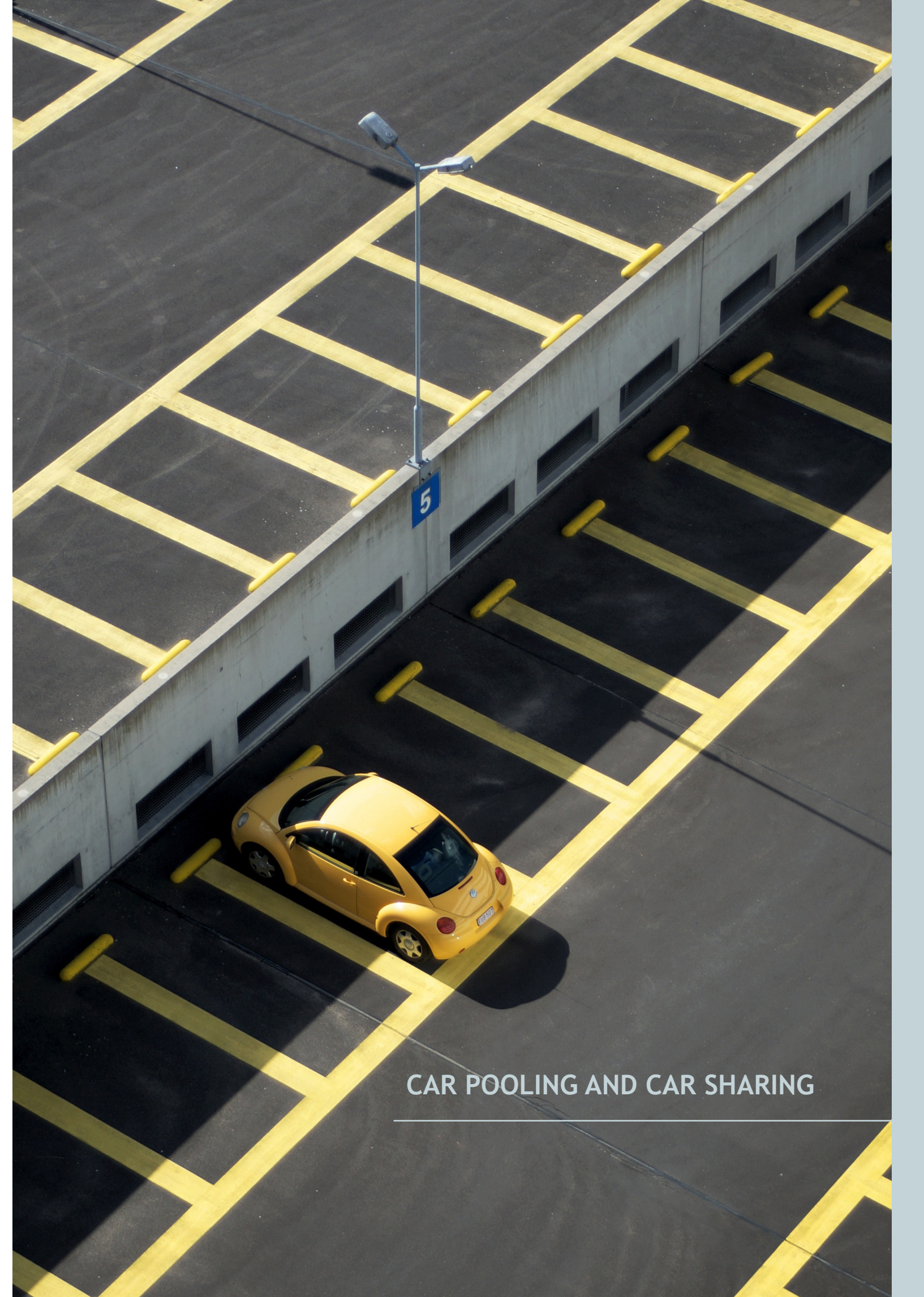
CAR POOLING AND CAR SHARING

Background

Car sharing (where a vehicle can be used on a pay-as-you-go basis) or car pooling (where an individual may share their own vehicle with others to make a specific journey) can be effective ways of reducing carbon emissions for landside access.

Car sharing is increasingly common in cities across the world, with a number of providers often operating in the same city. Methods of operation include: fixed bays, where users can access a vehicle at a designated location but must return it to a specific car share bay elsewhere; and free floating schemes, where the car can be left anywhere within a designated geographical location. Increasingly car share operators provide a range of vehicle types for different purposes. Lower emission vehicles are the norm, and electric vehicles are now a common option.

Car pooling arrangements are common measures within employer strategies to manage travel demand. Effective car pooling programmes can reduce pressure on limited car parking resources, reduce carbon emissions from commuting journeys, and reduce the cost of commuting for car pool groups. An additional benefit can be of improving access for those who do not have access to transport, but someone local is able to provide a lift.

Car Pooling/Car Sharing and Airports

Car share services complement more traditional car rental companies and taxis by providing a cost effective and convenient option for those who require access to a vehicle for more than one single journey (where a taxi may be most convenient) but do not require long term car hire.

Car pooling within an airport context can be challenging due to a range of shift patterns that staff work, which may limit the potential for matching with other staff. However, car sharing can also support access for those working shifts where alternative transport options are not available e.g. nightshifts or where public transport provision is poor. Car pooling services now increasingly offer more dynamic matching options for more ad-hoc journeys.

BRUSSELS

Airport context

Car sharing facilities are provided via two providers, DriveNow and Zipcar, at Brussels Airport. DriveNow also offers a car sharing service at Brussels airport located at P3 Holiday Parking (long stay) and ZipCar has parking spaces in Car Park 2 Car Rentals. Both schemes operate as free-floating car share schemes, where users can end their journey at any location in the DriveNow or Zip Car zone of operation in Brussels, as opposed to a requirement for a designated car share parking bay.

Users must pre-register with the app for DriveNow or ZipCar, and pre-book their vehicle using the app. DriveNow operate BMW and Mini vehicles. The fleet includes the electric BMWi3, providing an electric vehicle option. ZipCar operate the Peugeot 206 Allure, with petrol engine.

Objectives and actions

Brussels Airport has an objective of reducing dependence on fossil fuels, postponing depletion of oil reserves and greening its energy policy.

Involved subjects and roles

Key stakeholders are:
- Zip Car/AVIS
- BMW/DriveNow
- Brussels Airport

Timing and implementation processes

Brussels Airport set its targets in 2010 to reduce its emissions. In 2018 the airport committed itself to permanently reducing its CO_2 emissions and offsetting residual emissions.

Financing

It is assumed the car share providers finance their services privately. It is unclear if the airport provide the parking spaces free/discounted to attract the car share operator or can charge a fee to the operator due to desirability of the location.

Regulatory and policy context

Car Sharing complements wider activities undertaken by Brussels Airport to reduce emissions from mobility.

Impacts

In 2010, Brussels Airport set an ambitious target: to reduce its CO_2 emissions by 20% by 2020. By 2017, it had already reduced

its emissions by 34%. Brussels Airport's wider green mobility project is a key element in this process.

It is difficult to attribute the specific impact of car share schemes within wider programmes, however, research undertaken in the UK for CoMoUK revealed that British car club vehicles emit over 33% fewer CO_2 emissions per kilometre than the average British car.

Any critical success factors

Critical success factors for car sharing include:
- Availability of vehicles that meet users needs;
- Demand for use from passengers;
- Ease of booking and use;
- Location of car club vehicles at airport terminal;
- Availability of parking at destinations.

Risks

As car sharing is generally provided by a private company there is a risk that the car share operator may withdraw at short notice or relocate vehicles to another location where demand is greater if the vehicles are not well utilised at the airport.

Challenges

There is a challenge for car sharing when accommodating peaks in demand. This may result in car share vehicles being unavailable for potential users at the time they are needed. Modern car sharing schemes are effective at catering for demand and approaches to this are improving.

Opportunities

DriveNow already includes the BMWi3 electric vehicle in those available to book. The airport is already expanding facilities for electric vehicles.

Recommendations

- Ensuring car share vehicles can meet the needs of airport passengers e.g. room for luggage, free-floating parking at the final destination;
- Ensure car share operator is able to provide a high quality service, and able to meet the needs of passengers in terms of vehicle availability and type;
- Consider potential for inclusion of electric vehicles in the vehicle offer dependent on how progressed electric vehicle charging is within the airport's catchment area.

LONDON STANTSED

Airport context

Staff working with employers based at Stansted Airport can register with the car pool scheme online. The website allows users to find potential car pool partners making similar commuting journeys. The car pool is made up of those working for employers based at Stansted airport. The Commuter Centre website provides information about how to car pool safely. A cost calculator is also provided, so users can calculate financial savings.

As well as the personal benefits of reduced travel costs, participating staff can benefit from 50 car pool priority parking spaces, an Emergency Ride Home scheme where a employees can get a taxi ride home in case of emergency. Members are also able to take advantage of a range of discounts including opticians, local leisure attractions and breakdown cover.

Objectives and actions

The car pool scheme's objective is to support and encourage car pooling with a view to reducing impacts (including carbon emissions) from staff commuting.

Involved subjects and roles

Key stakeholders were: Stansted Airport Commuter Centre whoich fund and promote the car pool; Liftshare which supply the car pool database; and discount providers.

Timing and implementation processes

Stansted's car pool programme has been in place for over a decade.

Financing

Stansted Airport Commuter Centre funds the car pool website. In the past funding for sustainable transport initiatives has come from parking charges.

Regulatory and policy context

The car pool scheme is part of the airport's wider program to manage the demand for commuter travel. This has been influenced by national and regional transport policy.

The Public Passenger Vehicle Act (1981) outlines the rules that govern car sharing and state passenger contributions should be arranged before travel and should not exceed the running costs (including wear and depreciation) of the vehicle for the trip.

Impacts

In 2017, the car pool programme had approximately 2,000 members.

Any critical success factors

Critical success factors for the car pool scheme include:
- Provision of a good level of incentive for participating staff e.g. priority spaces and additional discounts;
- Provision of an Emergency Ride Home scheme;
- Provision of a private car pool group for Stansted Commuter Centre (including a range of employers at the airport site, allowing a secure but wider group of potential matches);
- Active promotion by the commuter centre.

Risks

A key risk around car pooling relate to personal safety. This is managed by the Stansted Airport scheme being open to staff only. Guidance is provided on how to safely make a car pool arrangement work.Another risk relates to unforeseen issues with the car pool arrangement such as one of the partners needing to leave work early. Emergency ride home is provided in case required.

Opportunities

There are now a range of car pool operators offering innovative sharing options. Opportunity exists for updating car pool software and management to take account of new technology and processes.

Challenges

The car pool process at Stansted requires users to register on the website and then create a formal group (a BUDi) to ensuring car pool priority spaces are not abused. Joining a BUDi group may seem off- putting to users (especially if already in an informal arrangement). To incentivise BUDi creation, car share priority space passes and discounts are only provided to BUDi group members. Priority spaces are managed on a self-policing basis. Staff must show their car pool passes on their dashboard. At least two staff must be in the car on arrival and departure. A valid car parking pass is also needed.

Staff at airports work a range of shifts which can mean finding a car pool match that works a similar pattern can be challenging. A larger pool of registered users can assist in finding a suitable match. This is supported by allowing a wide range of employers, based at Stansted to be members of the private group.

Recommendations

- Provide a full package of car pool incentives and support e.g. priority parking and emergency ride home;
- Balance need for security with need for large potential car share population to maximise possibilities for matching.

VIENNA

Airport context

Car sharing facilities are provided via two providers, DriveNow and Car2Go, at Vienna Airport. Schemes operate as free-floating car share schemes, where users can end their journey in the zone of operation in Vienna. Users must pre-register with an app Car2Go has a dedicated web page for Vienna Airport. However, there is an additional "airport fee" to travel between Vienna and the airport or vice versa.

Vehicles available include the Smartfortwo, and Mercedes A, CLA and GLA. Payment is per minute, though packages are also available which are time and mileage based. Car2Go also provides an option for setting up a business account. The same Car2Go account can be used in the other European countries where Car2Go operates. A new account is required for use in the US or China. Car2Go have an arrangement with Austrian Airlines where Austrian Airlines customers do not have to pay a registration fee and get additional credit. Car2Go has a similar arrangement with Lufthansa. DriveNow works in a very similar way, though the vehicle options include BMWi3 electric car. DriveNow and Car2Go schemes are in the process of being combined by BMW and Daimler. Car sharing is popular throughout Vienna.

Objectives and actions

Vienna international Airport also participates in the Airport Carbon Accreditation System (ACAS).

Involved subjects and roles

Key stakeholders are: Vienna Airport, Daimler/Car2Go, BMW/DriveNow, Austrian Airlines.

Timing and implementation processes

Car2Go began operating in Vienna in 2011.

Financing

It is assumed the car share providers finance their services privately. It is unclear if the airport provide the parking spaces free/discounted to attract the car share operator or can charge a fee to the operator due to desirability of the location.

Regulatory and policy context

Vienna international Airport participates in the Airport Carbon Accreditation System (ACAS). In 2016 VIE was able to reach Level 3 which requires third party engagement in carbon footprint reduction. Third parties include consideration of surface access modes with authorities and users.

Impacts

It is difficult to attribute the specific impact of car share schemes within wider programmes, however, research undertaken in the UK for CoMoUK revealed that British car club vehicles emit over 33% fewer CO_2 emissions per kilometre than the average British car.

Any critical success factors

The following critical success factors are evident:
- Partnership of car share operator with airline for additional incentives (as with Austrian Airlines);
- Corporate account for business use;
- Consistent services available at many key European destinations allowing use of a familiar car share option at start and end of journey;
- Flexible parking locations.

Risks

The situation in Vienna highlights the rapidly changing car share environment where operators may alter their business. This risks reducing confidence in the car share offer.

Challenges

There is a challenge for car sharing when accommodating peaks in demand. This may result in car share vehicles being unavailable for potential users at the time they are needed. Modern car sharing schemes are effective at catering for demand and approaches to this are improving.

Opportunities

As the popularity of car sharing grows larger fleet sizes and fleet-management techniques will be better able to better predict patterns of fleet utilisation will help car sharing operators provide services that better meet customer need in an efficient way. As electric vehicles become more commonplace this too will support carbon reduction.

Recommendations

- Encouraging partnerships with airlines to act as an additional incentive for car sharing;
- Ensure car share offer is tailored to key passenger markets e.g. make corporate accounts for business use available where there are high volumes of business travellers;
- Ensure car share operator is able to provide a high quality service, and able to meet the needs of passengers in terms of vehicle availability and type.

Table | Car Pooling and Car Sharing

Aspect	Brussels	London Stansted	Vienna
Airport context	Car share services provided for the public located within airport parking facilities and provided by DriveNow and ZipCar	Car pool scheme provided for employees working at the Stansted airport site. Incentives provided to encourage participation in the scheme.	Car share services provided by DriveNow and Car2Go. Discounts available for Car2Go for Austrian Airlines passengers. DriveNow and Car2Go in process of merging. Car sharing is popular throughout Vienna.
Objective and actions	Brussels Airport has an objective of reducing dependence on fossil fuels, postponing depletion of oil reserves and greening its energy policy	The car pool scheme's objective is to support and encourage car pooling with a view to reducing impacts (including carbon emissions) from staff commuting.	The car pool scheme's objective is to support and encourage car pooling with a view to reducing impacts (including carbon emissions) from staff commuting.
Involved subjects and roles	Zip Car/AVIS BMW/DriveNow Brussels Airport	Stansted Airport Commuter Centre Liftshare - car pool database; Discount providers	Vienna Airport Daimler/Car2Go/BMW/DriveNow Austrian Airlines.
Timing and implementation processes	Brussels Airport set its targets in 2010 to reduce its emissions. In 2018 the airport committed itself to permanently reducing its CO_2 emissions.	Car pool programme established for over a decade.	Began operation in 2011 in Vienna.
Financing	Assumed to be private operation with Airport providing car pool bays for vehicles.	Historically, funding for sustainable transport initiatives has come from parking charges.	Assumed to be private operation with Airport providing car pool bays for vehicles.
Regulatory and policy context	Car Sharing complements wider activities undertaken by Brussels Airport to reduce emissions from mobility.	The car pool scheme is part of the airports wider program to manage the demand for commuter travel. The Public Passenger Vehicle Act (1981) outlines the rules that govern car sharing.	The airport participates in the Airport Carbon Accreditation System (ACAS).
Impacts	Specific impacts cannot be found however UK research indicates car club vehicles emit over 33% fewer CO_2 emissions per kilometer than the average UK car.	In 2017, the car pool programme had approximately 2000 members.	Specific impacts cannot be found however UK research indicates car club vehicles emit over 33% fewer CO_2 emissions per kilometer than the average UK car.
Any critical success factors	Availability of vehicles that meet users needs; Demand for use from passengers; Location of car club vehicles at airport terminal; and Availability of parking at destinations.	Provision of incentive for participating staff Provision of an Emergency Ride Home scheme Provision of a private car pool group for Stansted Commuter Centre Promotion by the commuter center.	Partnership of car share operator with airline for additional incentives Corporate account for business use Same car share provider available at many key European destinations allowing use at start and end of journey Flexible parking locations.

INTELLIGENT TRANSPORT SYSTEMS

Background

The number of mobile phone users in the world is expected to pass the five billion mark by 2019. In 2016, an estimated 62.9% of the population worldwide already owned a mobile phone. The mobile phone penetration is forecasted to continue to grow, rounding up to 67% by 2019.

People are therefore relying more and more on digital channels when they need to gather information about a product. In addition to that, the spread of smartphones and other mobile devices is increasing the number of contacts between brands and consumers, by giving consumers new opportunities to connect to media content wherever they are, at any time in the day. Some of these contacts take the form of paid advertising in third-party content, but mobile technology is also enabling broader brand experiences, such as branded content and social media engagement.

The development of good quality apps is therefore of crucial importance when it comes to conveying customers real-time information. In addition to that, they also offer marketing and advertising opportunities.

Intelligent Transport Systems and Airports

Airport apps allow travelers to have real-time information about flights (gate, delays or cancellations), shopping opportunities, car parking and accessibility via public transport, car or taxi on their smart phone.

MUNICH AIRPORT

Airport context

Munich Airport has a focus on developing itself as a digital hub and works closely with related industries to progress digital research and development.

Munich Airport has a well developed travel information section within its website. The travel information section includes information on public transport, car sharing as well as rental cars and parking. A key feature of the website is the 'travel assistant' which provides a journey planner tailored to Munch Airport. The travel assistant combines and compares different means of transportation including waiting times at the airport, e.g. at check-in or at the security check. This is how to travel stress-free to your gate. Costs are also shown.

The airport is involved in developing an app (Passngr) with wider functionality, including Mobility as a Service (MaaS).

Objectives and actions

One end vision is to create a platform that enable seamless travel across multiple modes and allow travelers to buy a single ticket for their end-to-end journey, regardless of how many taxis, buses, trains or aircraft are involved.

Involved subjects and roles

Key stakeholders are: Munich Airport and Siemens Mobility which have entered into strategic partnership. Other stakeholders include MVV, DriveNow/Car2Go and IsarFunk (a taxi company).

Timing and implementation processes

The "travel assistant" website is already functioning within the main Munich Airport website.

The Passngr app appears to be in an advanced testing phase, having been available on iOS and Android, though at the time of writing cannot be accessed.

Financing

Continued development appears to be financed by a range of organisations including Munich Airport and Siemens Mobility.

Regulatory and policy context

The improvements to information provision for passengers are part of the airport's Innovation Strategy "Strategy 2020". App development and data sharing will be governed by GDPR.

Impacts

The website already provides full journey planning information, removing the necessity for different journey planners and websites (e.g. ticket costs information).

Any critical success factors

The website is integrated with travel information provided by MVV – the transit authority for the city of Munich. This information is incorporated directly into the airport's website, providing a seamless offer for the customer. The travel assistant allows an extra level of detail over and above usual journey planners by considering internal time at the airport and also planning for specific flight departures/arrivals.

Continued improvements e.g. the app rely on excellent relationships with transport and IT stakeholders.

Risks

The travel assistant includes a caveat that all information is subject to change and is provided without warranty as to its accuracy or completeness. Using MVV as the key data source reduces the risk that information provided is inaccurate however.

Challenges

The app is the first of its kind meaning that finding and selecting the right partners was challenging. Where multiple modes are considered there are numerous stakeholders. Integration had to be handled at contractual, process, business and technical levels. Getting the IT infrastructure correct was essential for the project and to provide flexibility in the set-up and potential scalability of the solution.

Opportunities

MVV's own website allows online ticket purchase. The Munich Airport travel assistant does not appear to have this functionality (though does provide information on costs). Introducing this functionality would improve the 'travel assistant' even more.

Functionality from the website is being included in an app which will expand functionality over and above the travel assistant to include MaaS functionality.One benefit will be an ability to further improve airport services from the data collected.

Recommendations

- Consideration of how Munich's "travel assistant" and app can be applied to other airports.
- Short term recommendations would be to greatly raise the profile of dynamic landside multi-modal travel information within airport websites and apps.

LONDON GATWICK

Airport context

London Gatwick's has a customer facing app and one for staff. The customer facing app supports landside access in the following ways:
- Direct links to Google's journey planner;
- Links to public transport timetable information;
- Live train times;
- Airport announcements (these include updates about landside transport issues).

The app was developed by Gatwick Airport Ltd. The staff app was developed by Airport Labs and provides a mechanism for all airport staff to be able to be kept up to date on airport issues, including any disruption to landside access such rail service interruptions.

Objectives and actions

The objective of the apps is to improve information provision to passengers and staff.

Involved subjects and roles

Key stakeholders were:
- Gatwick Airport Limited
- Airport Labs

Timing and implementation processes

The current Gatwick app was introduced in winter 2017/18 and most recently updated in summer 2018.

Financing

Gatwick Airport financed the development of the Gatwick app. The Airport Labs app is in use by a number of airports across Europe.

Regulatory and policy context

Much of the regulation and policy context around apps relates to data protection and privacy. In the EU, GDPR applies to app development, to ensure users are aware how their date is being used and stored. Apps must be compliant with these regulations.

Impacts

Information is limited on the impact of apps on travel patterns and how these apps support reductions in carbon emissions from landside access. The app itself seems well received with a rating of 3.9 out of 5 on the App Store.

Any critical success factors

- Dynamic information connected to real-time journey information.
- Linkage with Google maps journey planning facility.
- Well designed, intuitive app.

Risks

Customers may access information via a range of apps in addition to the Gatwick Airport app. Where information is drawn from inconsistent sources or where dynamic links are not used, this can result in conflicting information and confusion for the customer.

There is a risk that messaging may not be consistent across all media used by passengers e.g. airport media, airline media especially at times of disruption to the landside transport network.

Challenges

Adoption of the preferred app by the public may be a challenge. However, the app is promoted on other media such as on the Gatwick Airport website to raise its profile.

Opportunities

- Include transport information as a key feature of the app in promotion (e.g. promoted on Gatwick website);
- Improve awareness and use of the Airport Labs app to support staff provide customer service advice relating to landside transport especially during times of disruption;
- Ensure the app is updated as journey planning technology and services improve e.g. MaaS.

Recommendations

- Ensure airport app incorporates landside journey planning options;
- Ensure the landside travel information is consistent across all media e.g. airport app, airport website, operators information and other key journey planning options;
- Invest efforts to integrate airport apps more fully with key landside travel information and/or journey planning apps.

Table | Intelligent Transport Systems

Aspect	Munich	Gatwick
Airport context	Munich Airport has a well-developed travel information section within its website and is involved in developing an app (Passngr) with wider functionality, including Mobility as a Service (MaaS).	London Gatwick's has a customer facing app and one for staff which supports landside access in the following ways: links with national journey planner and timetables and updates about landside transport issues. The app won Mobile Innovation of the Year Award 2018 and Mobile app of the Year at the Real IT awards 2018. There is also a staff App that allows staff to be kept up to date with information such as landside rail disruption.
Objective and actions	The objective is to support seamless travel across multiple modes.	To provide airport customers with information about the airport, including landside travel information and information on disruptions.
Involved subjects and roles	Key stakeholders are Munich Airport and Siemens Mobility.	Gatwick Airport Limited for public app Airport Labs for staff app
Timing and implementation	The travel assistant is now a core part of the Munich Airport Website. The Passngr app has been available but currently cannot be downloaded.	Apps updated/launched in winter 2017/18.
Financing	Development appears to be financed by a range of organisations including Munich Airport and Siemens Mobility.	Gatwick Airport financed the development of the Gatwick app.
Regulatory and policy context	The programme links to the airport's Innovation Strategy "Strategy 2020". app development and data sharing will be governed by GDPR.	GDPR is a key piece of EU legislation relating to apps, and the storage and use of personal data.
Impacts	The website already provides full journey planning information, removing the necessity for different journey planners and websites (e.g. ticket costs information).	The Gatwick Airport app has a rating of 3.9/5 (from 60 ratings) on the Apple App Store.
Any critical success factors	The critical success factor is the close relationship between the airport, public transport agencies and technology companies.	• Dynamic information connected to real-time journey information. • Linkage with Google maps journey-planning facility. • Well-designed, intuitive app.

Background

Wayfinding is more than just signs, it is a physical extension of a brand; a reflection of a destination's physical character; and an information system. It is important to understand there are a number of factors that influence how users interact with a wayfinding system. These factors can be broadly grouped into three different types: people; environmental; and information factors.

Effective wayfinding and information design will: better connect users to destinations; use consistent nomenclature; maintain a safe movement; be predictable; disclose information progressively; help users learn; keep information simple; and be accessible.

Wayfinding and Airports

The provision of effective wayfinding and intuitive information design for users forms a fundamental part of the airport user experience. It provides passengers with more control over their journey and this in turn results in direct benefits not just for the passenger themselves, but also for the airport. For the traveler, simply knowing where they are, where they need to be and how to get there gives them more control over their journey and reduces stress. For the airport, having a passenger who is in control of their journey leads to increased satisfaction levels, an important benchmark for airport efficiency.

A passenger's journey does not stop once they exit the airport, on-ward and post journey information are important elements of the user's journey and should be considered part of the responsibility of the airport operator. It is essential to consider the importance of a user's journey on approach to the airport, and the ease of access to and ability to use information allowing passengers to complete their journeys.

CATANIA

Airport context

The intervention included the optimization of both internal and landside wayfinding and signage systems to improve passengers experience and vehicular flow within airport areas.

The project provided design guidelines and technical maps with details on signage locations, dimensions and contents for pedestrian and vehicular viability.

Objectives and actions

The project aimed at optimising viability and passengers' awareness during airport surface transits.

Both internal and landside wayfinding and signage systems were developed according the following tasks:
- Pedestrian and vehicle flows analysis;
- Detection of decision points;
- Definition of structure and content of the signage;
- Final design and positioning of the system.

Involved subjects and roles

Key stakeholders were SAC, the airport operator.

Timing and implementation processes

Wayfinding and information system design took approximately 8 weeks.

The new wayfinding system for pedestrians and vehicles was implemented in a couple of months. Part of the new pedestrian wayfinding has not been implemented yet as new terminal areas (Terminal B) are refurbished.

Financing

The project was funded by SAC – airport operator.

Regulatory and policy context

The intervention was part of a project of re-naming of visible brand from SAC (operator) to Catania Airport (passenger-facing brand) and an optimisation of parking areas. A clear and recognisable airport brand enables the creation of long-term relationships with passengers and commercial clients.

A brand applies to all contact points between the brand and users, understanding how users interact with the infrastructure and services, and how branding influences their behaviours and choices.

Impacts

No impacts have been recorded to date.

Any critical success factors

The analysis of the access viability system, users flows and decisioning points, to identify the quality of the information provided within internal and landside areas and improve users experience.

Risks

The approach requires further implementation in Terminal B. To reduce the risk of inconsistent delivery the design guidelines will be used.

Challenges

The project needed to optimise and improve a context characterized by numerous issues, such as: confusing or absent signage from the main access points to airport parking areas, indirect and no signalized pedestrian paths from car parks to terminals and outdated and unlit signage.

Besides the signage, system provided obsolete information with no hierarchy, highlighting a likely difficulty in keeping the system updated.

Opportunities

The successful design of optimized signage system and wayfinding within internal and landside areas could improve accessibility levels and increase users experience.

Recommendations

- Creation of an airport brand, distinct from the operator;
- Consideration of the whole surface transit offer – from the main access points reaching the parking areas, to the pedestrian paths inside the airport;
- Focuses on parking information system, that represent the first contact point between users and the brand, in order to guarantee a direct and clear path for passengers;
- Consider different type of users that could present different needs and behaviours inside and outside the airport.

TORONTO PEARSON

Airport context

Travel information was presented in a poster that included information for all four transit agencies providing bus services to Pearson (TTC, GO, MiWay and Brampton Transit). Information primarily covered trip planning and fare payment. The poster also included secondary information on schedule and stop location.

Objectives and actions

The primary object of the project was to better connect passengers to surface transit for all onward journeys from the airport.

The aim of the Pearson airport surface transit poster was to develop a simple and clear spider map showing all the bus lines that serve the airport, including a simple directory of destinations and connection information.

Involved subjects and roles

In order to provide accurate transit information relating to time tabling and routes all four transit agencies providing bus services to Pearson (TTC, GO, MiWay and Brampton Transit) were consulted during the project.

Timing and implementation processes

The project duration was seven weeks, this included design through to implementation.

The poster was located at the "transit hub" located in Terminal 1 Service Level. A number of improvements such as updated bus stop poster cases (agency specific) and multiple transit info screens were being implemented in the area and complemented the poster.

Financing

The project was funded by the airport operator - Greater Toronto Airports Authority (GTAA).

Regulatory and policy context

The poster adhered to the Accessibility for Ontarians with Disabilities Act, or AODA, which aims to identify, remove, and prevent barriers for people with disabilities. The AODA became law in 2005 and applies to all levels of government, nonprofits, and private sector businesses in Ontario that have one or more employees (full-time, part-time, seasonal, or contract). The AODA is made up of five parts, or Standards, and deadlines for compliance began as of January 1, 2010.

Impacts

No qualitative research was undertaken as regards the impact of the poster, however positive feedback was received from GTAA.

"We've received great feedback on the transit poster. Providing the transit information in a unified format for all the transit providers has been very beneficial for our passengers."

Alex de Lorimier – Manager, Passenger Navigation Toronto Pearson International Airport.

Any critical success factors

Providing the transit information in a unified format that is easily accessible to the variety of user types passing through the airport and making onward connections.

Risks

The primary risk to the project was the provision of the transit data collected from the four agencies, which was not provided in a consistent format. Additional time was allowed to coordinate the collection of the data and its analysis.

Challenges

The key challenge was to make the map clear for transit users at the airport, many of whom are unfamiliar with Toronto and its transit system.

Opportunities

The successful implementation of the transit information poster could lead into the development of a fully integrated 'transit hub' at the airport as well as potential digital application for journey planning. In a majority of airports onward travel options are often not presented to passengers as a unified offer, the emphasis is placed on the passenger to do the work. A integrated 'transit hub' operated by the airport authority could lead to increased passenger satisfaction levels.

Recommendations

Development of travel information that summarises information on all transit agencies.

NEW YORK JFK

Airport context

The three New York airports of John F. Kennedy, Newark Liberty, and LaGuardia operate separately and have over time developed separate, inconsistent styles for wayfinding.

Initial programming and implementation were developed and applied to JFK Terminal 4 resulting in an approach that provided all information necessary to travel smoothly through the airport – from curb to plane and back.

An Airport Standards Manual for Pedestrian Signage and Wayfinding, for use across New York and New Jersey airports including JFK was developed based on the research conducted by Bureau Mijksenaar.

Objectives and actions

The challenge was to develop one master system that could be applied to all airport terminals, roadways, and parking facilities, and which had the sophistication to direct passengers from all over the world within an environment of hundreds of possible destinations.

Involved subjects and roles

Key stakeholders were:
• The Port Authority of New York and New Jersey
• Bureau Mijksenaar
• Chermayeff & Geismar

Timing and implementation processes

The Airport Standards Manual for Pedestrian Signage and Wayfinding was published in 2013, the Airport Roadway Sign Design Manual (2013) was created at the same time.

Financing

Port Authority of New York and New Jersey Aviation Department financed the programme.

Regulatory and policy context

The outcome of the process was a manual providing guidance on pedestrian wayfinding and signage.

Impacts

A J.D. Power and Associates survey of the new system at LaGuardia Central Terminal confirmed "significantly improved consumer satisfaction" when compared with the prior system.

Any critical success factors

Color-coding increases visibility and information comprehensibility, allowing passengers to follow only signs that are relevant to them at a given moment.

Risks

Risks relate to ensuring wayfinding approaches for multiple sites are applied consistently. This risk is managed by production and application of guidance.

Challenges

Ensuring a seamless journey for users as they interact with multiple transit providers. This means developing a strategy for how brands can maintain their identity as they intersect with one another.

Each transit provider has a unique identity that includes a distinct visual language. However, within the airport itself the emphasis needs to be on providing clear wayfinding for users to access all of the transit providers, with equal presence given to each transit service.

Opportunities

The application of a standardized approach to wayfinding and signage across key airports in New York and New Jersey highlight the opportunity for wider standardisation across multiple transport hubs. This ensures effective best practice approaches to signage and wayfinding is rolled out across a number of locations.

Recommendations

A recommendation would be that application of best practice approaches to wayfinding and signage across multiple airports is achieved by development of guidance which is applicable to a range of locations and takes into account styles and information from the full range of landside transport options.

Table | Wayfinding

Aspect	Catania	Toronto Pearson	New York JFK
Airport context	The project provided design guidelines and technical maps with details on signage's locations, dimensions and contents for pedestrian and vehicular viability with the objective of optimizing internal and landside wayfinding and signage.	The project developed a poster that included information for all four of transit agencies providing bus services to Pearson (TTC, GO, MiWay and Brampton Transit). Information provided included trip planning, fare payments, schedule and stop location.	The three airports of John F. Kennedy, Newark Liberty, and LaGuardia developed separate, inconsistent styles for wayfinding over time. An approach that provided all information necessary to travel smoothly through the airport was developed followed by a manual on pedestrian signage and wayfinding, for use across New York and New Jersey airports.
Objective and actions	The project aimed at optimizing viability and passenger's awareness during airport surface transits.	The primary objective was to better connect passengers to surface transit for all onward journeys from the airport.	The challenge was to develop one master system that could be applied to all airport terminals, roadways, and parking facilities, and which had the sophistication to direct passengers from all over the world within an environment of hundreds of possible destinations.
Involved subjects and roles	SAC – airport operator, Steer	All four transit agencies providing bus services to Pearson (TTC, GO, MiWay and Brampton Transit), Greater Toronto Airports Authority (GTAA), Steer	Key stakeholders were The Port Authority of New York and New Jersey and Bureau Mijksenaar
Timing and implementation processes	Wayfinding and information system design took 8 weeks to develop and was implemented in a couple of months.	The project duration was seven weeks; this includes design through to implementation.	The manual for Pedestrian Signage and Wayfinding was published in 2013.
Financing	The project was funded by SAC – airport operator.	The project was funded by the airport operator - Greater Toronto Airports Authority (GTAA).	Port Authority of New York and New Jersey Aviation Department.
Regulatory, and policy context	The intervention was part of a project of re-naming of visible brand from SAC.	The poster adhered to the Accessibility for Ontarians with Disabilities Act, or AODA, aims to identify, remove, and prevent barriers for people with disabilities.	The outcome of the process was a manual providing guidance on pedestrian wayfinding and signage.
Impacts	None available	Positive feedback was received from GTAA	Survey of the new system at LaGuardia Central Terminal confirmed "significantly improved consumer satisfaction"
Any critical success factors	A critical success factor was the analysis of the access viability system, users flows and decision points, to identify the quality of the information provided within internal and landside areas and improve users experience.	Providing the transit information in a unified format that is easily accessible to the variety of user types passing through the airport and making onward connections.	Color-coding increases visibility and information comprehensibility, allowing passengers to follow only signs that are relevant to them at a given moment.

ROAD BASED PUBLIC TRANSPORT

Background

Road based transport forms the core public transport mode for cities around the world. Mode share for bus use varies across Europe. In 2016* Cyprus had the highest mode share for bus (18.6%) and Netherlands the lowest (3%). Average mode share for bus across the EU was 9.4% in 2016.

Though buses provide a lower carbon alternative to private car travel, many cities have experienced issues with pollution resulting from concentrations of bus services and associate particulate and Nitrogen Dioxide emissions from diesel engines. However, technological progress has resulted in cleaner diesel engines and hybrid and electric buses becoming more mainstream.

Road Based Public Transport and Airports

Road based public transportation can provide direct connections between an airport and surrounding destinations. Local buses, dedicated airport links and bus/coach services serving hotels and tourist markets provide connection to city centres. Coach services provide options from locations further afield.

Road based mode share for access to airports do not appear to be compiled at the European level though research indicates an average European mode share of around 17%**. Road based mode share varies from airport to airport. Taking five UK airports (Heathrow, Gatwick, Stansted, Luton and Manchester) as an example***, road based transport ranges from 9% at Heathrow, to 37% at Gatwick.

Dedicated bus services often provide a high level of quality, with service frequencies high, vehicles being modern, spacious with ample luggage space, services running across a 24hr period, Wi-Fi, and easy to purchase ticket options. Increasingly these can purchased via apps in advance.

Local services provide an important travel option for commuters also.

Often road based transport competes with rail services covering similar routes though road based transport options are usually lower cost. Where bus services share road space with private cars, congestion can be challenging particularly at peak times when routes from city centres to airports may suffer from congestion.

HELSINKI

Airport context

Bus services to Helsinki city centre include the Finnair CityBus and Line 615.

- **Finnair City Bus** – This branded bus service runs every 20 minutes, 24hrs a day with a journey time to Helsinki city centre of approximately 35 minutes. The single adult ticket price is €6.20 and tickets can be purchased online, from the driver and at the bus station. The bus has free wi-fi. Tickets can be bought online or from the driver. Those using the MyHelsinki sight-seeing card get a €1.80 discount on their bus ticket.
- **Line 615** – this services departs every 30 minutes and runs 24 hours a day. It takes approximately 45 minutes to reach the city centre. A single ticket costs €3.20 though tickets can be purchased via a mobile app providing a discount to €2.20.

There are a range of other services connecting the airport to other destinations in the city, usually to metro stations providing good connectivity to the wider public transport network. Other direct bus destinations include Lohja, Turku, Kotka, Tampere and Nummela.

Helsinki Airport's website includes information on the next departing bus. The airport is undergoing an extensive redevelopment programme.

Objectives and actions

As part of Helsinki Airport's work to achieve a carbon neutral rating with the Airport Carbon Accreditation programme, the airport works with wider stakeholders including Pohjolan Liikenne, the operator of Finnair City Bus.

Involved subjects and roles

Key stakeholders were Pohjolan Liikenne (operator of Finnair City Bus) and Helsinki Regional Transport Authority/Private operators of other services e.g. Line 615 and Finnair, sponsor of the Finnair City Bus. The EU is a key stakeholder in the new travel centre which is under development.

---

*http://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do
**http://fsr.eui.eu/wp-content/uploads/14030317-Hylen.pdf
***https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/661933/tsgb-2017-report-summaries.pdf

Timing and implementation processes

The airports redevelopment programme began in 2013. It is expected to continue until 2022 at which point a new multimodal travel centre will be in place.

Financing

The multimodal travel centre has received EU funding of approximately €10m.

Regulatory and policy context

Finavia's Energy and Climate Programme was launched in 2007.

Impacts

The carbon footprint of Helsinki Airport is zero and it has received the international Airport Carbon Accreditation (ACA) certificate for this achievement.

Any critical success factors

Multiple services are available:
- High quality premier bus service with good frequency, travel time, 24hr operation, travel time and facilities e.g. Wi-Fi;
- Low cost fares available on HSL (Helsingin seudun liikenne - Helsinki Region Transport authority) services, especially with app, also providing 24 hour operation;
- Direct bus connectivity to other nearby cities.

Risks

Competition between premier bus, rail and local bus services. Customer feedback suggests there may be limited perceived benefit of using premium bus compared with rail.

Challenges

Some customers assume that the Finnair branded bus can be used by Finnair customers only. Road congestion can impact on journey time.

Opportunities

The airport is undergoing a development programme. It is indicated that between 2020 and 2022 a new entrance to Terminal 2 will be created which will include a multimodal travel centre which will further improve landside access.

Recommendations

Recommendations are as follows:
- Provide low cost fares;
- Provide fares via app;
- Provide high quality premier bus service that is high

frequency, provides 24hr service and modern facilities such as wi-fi; and
- Provide a high quality transport interchange.

LONDON STANSTED

Airport context

Stansted Airport have a commuter centre located adjacent to the main terminal building. Employees travelling to Stansted airport are eligible for several discounted public transport ticket options:
- Airport Saver Tickets: Tickets come in books of twenty, and can be used on six local bus services when the employee wishes. This flexibility means that those employees who do not work every day, or who may have opportunity to use bus services on certain days but not others, to make use of discounted tickets.
- Airport Travel Card: The airport travel card allows employees to get up to 80% off the cost of their commute by public transport and is valid on certain bus, coach and rail services. The exact discount provided is calculated by considering the employees home postcode.

Objectives and actions

Road based transport options are measures within the Airport's Travel Plan.

Involved subjects and roles

Key stakeholders were:
- Stansted Airport Commuter Centre;
- Bus operators;
- Coach operators.

Timing and implementation processes

The Airport Saver Tickets were launched in 2007.

Financing

In the past funding for sustainable transport initiatives has come from parking charges. It is assumed ticketing discounts are supported either in this way or by through financial support via public transport operators.

Regulatory and policy context

The Airport's Travel Plan is a policy contained within the airport's wider Sustainable Development Plan (2015).

Impacts

The Airport Travel Card has seen an increase in demand by 25% year on year. Over 1,400 Airport Travel Cards are sold per month generating over £1 million of annual revenue for bus, coach and rail operators.

The airport's 2016/17 CSR report highlights a target to maintain at least 50% mode share to public transport to the end of 2019. In 2016/17 public transport mode share was 51.9%. With rail at 28.5% this indicates that bus and coach have an approximate mode share of 23%.

Any critical success factors

The Commuter Centre and Commuter Centre Coordinator facilitate the promotion of Travel Plan measures such as the Airport Saver Ticket and Airport Travel Card. The Commuter Centre Coordinator role is a part time role.

Risks

There are a range of local bus services, with different operators serving the airport. Staff require accurate and up to date information. To minimise the risk of out of date information being provided, the airport includes basic information on routes, but direct staff to operators' own websites to ensure the most up to date information is available.

Challenges

Though Stansted Airport is a key airport serving London, it is located approximately 68km north, with a more dispersed local population. Ensuring public transport meets the needs of workers effectively can be challenging.

London's Oyster travel card system is also not valid meaning ticketing can be more complex than in London, especially for visitors.

Opportunities

Stansted airport continues to work to increase awareness and take-up of the discount offers to maximise awareness and participation amongst those working at the site.

Recommendations

Recommendations are as follows:
• Provide discounted ticket options for staff;
• Within the discount options include both season tickets for full time staff and multi-journey tickets for shift workers who may be encouraged to use public transport occasionally;
• A Commuter Centre Coordinator can facilitate promotion of these ticketing discounts and work to encourage take-up;

• Ensure accurate bus information is promoted by linking to operators own information.

PARIS CHARLES DE GAULLE

Airport context

Paris Charles de Gaulle is served by bus and coach services with a total of 8 lines that connect directly airport terminals to Paris city centre and other main destinations (Disneyland Paris and Paris-Orly airport). The airport also provides six on-demand bus services, known as Filéo, which complements other traditional bus routes to provide 24hr access to the airport. Routes are shown on a map.

These services allow employees who work shifts better access to the airport at the times they need to travel and also improves accessibility for those living in an area which has traditionally been less well served by public transport.

Objectives and actions

The objective of Filéo is to provide a demand responsive service which improves accessibility both for existing staff living in its area of operation, as well as opening employment opportunities for others who may not have been able to work the required shift patterns. The low cost and demand responsive nature of the service also encourages switch to lower emission travel from car drivers.

Involved subjects and roles

Key stakeholders are: Keolis (Filéo operator); the Ile-de-France region; the general councils of Val d'Oise and Seine-Saint-Denis; Aéroports de Paris; Tremblay-en-France; the EU.

Timing and implementation processes

Filéo, formerly Allobus, began operating at the airport in 1998.

Financing

Aéroports de Paris (ADP) has been financing the on-demand initiative, a complement to the Ile-de-France's regular transport services, since 1999.

Regulatory and policy context

Filéo links with the ADP's Corporate Social Responsibility Plan, most notably in relation to supporting access to employment from those in communities near where the airport is located.

Impacts

The reliability and versatility of the Filéo service attracted 1/3 of passengers from car users.

Any critical success factors

Use of small capacity vehicles allow the service to operate efficiently and access narrow streets.

Risks

On-demand services rely on financial support. Cuts in the level of financial support would impact on the service. Complexity of the airport layout might represent an issue for efficient services.

Challenges

Charles de Gaulle Airport is undergoing expansion increasing passengers numbers and staff.

This may result in increasing levels of demand for these services and a need to service new communities. Continuing to respond to these changes, potentially with new on-demand services, will be challenging.

Opportunities

The technology used to operate on-demand services is changing rapidly. The Allobus/Filéo scheme itself has modernized and is bookable by phone, app and web.

New demand responsive pilots have been launched elsewhere include Slide (Bristol, UK), Arriva Click (Liverpool and Sittingbourne, UK) and Citymapper Smart Ride (London UK). These app-based on demand bus services indicate opportunities for further development of demand responsive travel.

Recommendations

- Consider application of emerging best practice with app-based on demand bus services;
- Consider need for on demand services to improve access for employees to the airport site in locations or at times when traditional services are unavailable.

Image courtesy of Filéo

Table | Road Based Public Transport

Aspect	Helsinki	London Stansted	Paris Charles De Gaulle
Airport context	Branded express bus service runs provides high frequency, high quality 24hr service. Local service option also 24hr with option for discounted ticket purchase via App. A new travel centre is due by 2022.	Airport saver ticketing option provides flexible ticketing option for shift workers. Airport Travel Card provides option for discounted travel. Commuter Centre enables promotion to employees.	The airport provides several on-demand bus services, known as Filéo, which complement other traditional bus routes. Filéo operates six routes to the airport.
Objective and actions	Helsinki Airports works to achieve a carbon neutral rating with the Airport Carbon Accreditation programme.	Road based transport options are measures within the Airport's Travel Plan.	The objective is to provide improved accessibility for staff and those seeking employment who may otherwise have problems accessing the airport.
Involved subjects and roles	Pohjolan Liikenne – operator of the Finnair City Bus Finnair – sponsor of the Finnair City Bus Helsinki Regional Transport Authority/ Private operator of other services e.g. Line 615.	Stansted Airport Commuter Centre; Bus operators; Coach operators.	Filéo operator (Keolis); the Ile-de-France region; the general councils of Val d'Oise and Seine-Saint-Denis; Aéroports de Paris; Tremblay-en-France; the EU.
Timing and implementation processes	The airports redevelopment programme began in 2013. It is expected to continue until 2022 at which point a new multimodal travel center will be in place.	The Airport Saver Tickets were launch in 2007.	The service began operating as Allobus and started services to the airport in 1998.
Financing	The multimodal travel centre has received EU funding of approximately €10m.	Historically, funding for sustainable transport initiatives has come from parking charges.	Aéroports de Paris (ADP) has been financing the initiative, since 1999.
Regulatory and policy context	Finavia's Energy and Climate Programme was launched in 2007.	The Airport's Travel Plan is a policy contained within the airport's wider Sustainable Development Plan (2015).	Filéo links with the ADP's Corporate Social Responsibility Plan, in relation to supporting access to employment.
Impacts	The carbon footprint of Helsinki Airport is zero and it has received the international Airport Carbon Accreditation (ACA) certificate for this achievement.	Travel Card has seen an increase in demand by 25% year on year. Travel Cards generating over £1 million of annual revenue for public transport operators.	The reliability and versatility of Allobus initially attracted 1/3 of its passenger from car users.
Any critical success factors	• Express service has good frequency, travel time, 24hr operation and Wi-Fi. • Local service has cost fares via App. • Direct bus connectivity to other cities.	• The Commuter Centre and Commuter Centre Coordinator facilitates the promotion of Airport Saver Ticket and Airport Travel Card.	• Flexible demand responsive service. • Bookable online, App and via phone. • Attractive to those previously using private car.

ELECTRIC VEHICLES

Recommendations:
- Work with local and national government to develop a supportive policy environment for EVs;
- Where electric taxis are considered ensure vehicles are appropriate design and that appropriate charging infrastructure is introduced to support specific taxi operational requirements;
- Provide Taxi Incentive programme to encourage low emission taxis;
- Consider wider EV infrastructure needs e.g. observe the outcomes of the eRoads programme;
- Provide attractive incentives for public landside access by EVs vs traditional fueled vehicles e.g. paid parking but free charging;
- Provide adequate mix of charging types for different parking needs for public parking.

Opportunities:
- EVs provide the opportunity for the same level of convenience as private car or taxi;
- Many countries in the EU have policies to support adoption of EVs which would be expected to increase level of demand for charging infrastructure. Having facilities to meet that demand is an opportunity to meet customer need and reduce CO2;
- EV vehicles can now fulfil the needs of private users and taxi companies.

Challenges:
- Passengers may opt to use EVs than other forms of sustainable surface access;
- EV use would not reduce wider transport issues such as congestion or parking pressure;
- There is a risk that government policy may change at some point reducing support for EVs.

AIR-RAIL LINKS

Recommendations:
- Develop station travel plans to support sustainable access to stations;
- Promotion of ticketing incentives such as Interline tickets, Airport Advance Fares for air passengers;
- Provide discounted ticket options for staff;
- Develop suburban rail links for airports, to improved wider direct accessibility for passengers and airport employees;
- Ensure Express services offer an easy to understand level of service in terms of travel time and quality of service;
- Ensure that air-rail services are high frequency, reliable, provide modern facilities (such as Wi-Fi) and provide direct connections to city centre transport hubs;
- Where new infrastructure is built ensure careful risk management, including contingency planning should it be needed;
- For PPP projects ensure procurement criteria include consideration of interaction of other services and future infrastructure and rolling stock needs;
- Ensure ticket pricing is set at a level that is attractive for the user so not to suppress demand and maximise opportunities for CO2 reduction.

Opportunities:
- Air-Rail Stations can be developed to improve landside access through station travel planning measures (for example improved wayfinding and travel information);
- Interline ticketing and Airport Advance Fares show opportunity for better integration of air and rail tickets;
- Rail services are a key mode of access for airport staff, and ticketing discounts can encourage travel by rail by airport employees.

Challenges:
- Introduction of new rail services can take considerable time;
- Existing rail and station infrastructure may constrain expansion to accommodate additional services either to improve access or due to increased demand;
- Disruption to rail infrastructure can impact on air-rail services;
- Construction of new rail infrastructure is complex and unforeseen issues can arise.

ACTIVE TRAVEL

Recommendations:
- Promote employee campaigns on sustainable mobility to improve awareness and participation;
- Introduce an awards system and discounts to motivate employees toward a behavior change;
- Support e-bikes (e.g. charging points and incentives) where topography and journey length are likely to be key barriers to cycling;
- Include consideration of cycling as a key mode choice within surface access strategy/environmental management plan;
- Development of on-site cycle routes to connect key destinations at the airport with the wider cycle network;
- Provide clear information on the cycle network and cycle parking to place emphasis on access to the airport by bike, including a site-specific cycle map;
- Develop relationship with local transport/highways authority to ensure wider cycle networks support airport access from the local community.

Opportunities:
- Case studies show that travel by bicycle can be a key method of access to airport sites and should be seriously considered in surface access strategies;
- There is opportunity for E-Bikes to support travel by bike where topography or distance from work may otherwise be a barrier;
- Airports are often large employment sites. This presents opportunity to lobby highways authorities to support wider cycle infrastructure improvements in the areas surrounding the airport;
- Awareness raising activities and incentives can support cycling.

Challenges:
- Where cycling is not seen as the "norm" and where cycling infrastructure is less developed, encouraging mode shift to bike may be challenging;
- Improving local cycle infrastructure to create safe, connected route networks may take considerable time.

CAR POOLING AND CAR SHARING

Recommendations:
Car Sharing
- Ensure car share vehicles can meet the needs of airport passengers e.g. availability, room for luggage, free-floating parking at the final destination;
- Consider potential for inclusion of electric vehicles in the vehicle offer dependent on local wider context of EV adoption;
- Encourage partnerships with airlines to act as an additional incentive for car sharing;
- Ensure car share offer is tailored to passenger demographic e.g. make available corporate accounts for business travelers if these are a core demographic.

Car Pooling
- Provide a full package of car pool incentives and support e.g. priority parking and emergency ride home;
- Balance need for security with need for large potential car share population to maximise possibilities for matching.

Opportunities:
Car Sharing
- Partnerships are in place between airlines and car share providers. There are opportunities to expand this;
- There are opportunities to integrate car share services into web services as evidenced in Munich.

Car Pooling
- Car pooling has been a key measure within the wider workplace travel plan field for many years and case studies show the applicability of the approach and associated incentives in an airport context also;
- There are opportunities to consider new car pooling technology which cater for more dynamic matching.

Challenges:
Car Sharing
- Car sharing schemes may still experience issues with availability.

Car Pooling
- Effective car pooling can be challenging where staff work a range of shifts. The larger the potential car pool the more likely matches can be made;
- Fears of personal security and convenience can still be challenging to overcome.

INTELLIGENT TRANSPORT SYSTEMS

Recommendations:
- Consider how Munich's "travel assistant" and app can be applied to other airports including MaaS;
- In the shorter term, greatly raise the profile of dynamic landside multi-modal travel information within airport websites and apps;
- Ensure the landside travel information is consistent across all media e.g. airport app, airport website, operators information and other key journey planning options.

Opportunities:
- ITS is rapidly developing and will potentially provide mechanisms for greater integration between air travel and landside access sustainable modes.

Challenges:
- Complex stakeholder relationships present a challenge, including commercial agreements in case of ticket selling.

WAYFINDING

Recommendations:
- Create an airport brand, distinct from the operator;
- Consider the whole surface transit offer – from the main access points reaching the parking areas, to the pedestrian paths inside the airport;
- Include a focus on parking information systems as these represent the first contact point between users and the brand;
- Consider different type of users that could presents different needs and behaviours inside and outside the airport;
- Develop travel information that summarises information on all transit agencies;
- Ensure best practice approaches are applied across multiple sites through development of guidance applicable to a range of locations.

Opportunities:
- Wayfinding projects provide opportunity to also develop or link with airport branding;
- Wayfinding projects provide the opportunity to integrate information on all landside modes in way that is easy to understand by all passengers.

Challenges:
- Ensuring a seamless journey for users as they interact with multiple transit providers. Developing a strategy that maintains various brand identities across transit providers but provides seamless wayfinding is challenging. Emphasis needs to be on clear wayfinding;
- Keeping a wayfinding system updated over time as an airport develops can be challenging, but can be supported by clear guidance.

ROAD BASED PUBLIC TRANSPORT

Recommendations:
- Provide low cost fares for passengers;
- Provide fares via app;
- Provide high quality premier bus service that is high frequency, provides 24hr service and modern facilities such as wi-fi;
- Provide a high quality transport interchange facilities;
- Provide discounted ticket options for staff which include both season tickets for full time staff and multi-journey tickets for shift workers;
- Provide a Commuter Centre Coordinator to facilitate promotion of ticketing discounts and work to encourage take-up by staff;
- Ensure accurate bus information is promoted by linking to operators own information;
- Consider need for on demand services to improve access for employees to the airport site in locations or at times when traditional services are unavailable;
- Consider application of emerging best practice with app based on demand bus services.

Opportunities:
- High quality express bus services provide lower cost alternatives to rail links;
- Bus fare discounts can support bus use by staff;
- Discount multi-journey tickets can encourage occasional sustainable travel choices e.g. bus for day shifts/car for nights;
- On demand services provide an opportunity to improve access to staff outside of core working hours, supporting CSR as well as environmental objectives;
- On demand services are developing with the advent of new technology presenting opportunities for this option to become more common.

Challenges:
- Bus services may change more frequently than rail services. Ensuring information is accurate can be challenging thus direct links to operators information may be the most effective method;
- Bus services can be impacted on by congestion on the road network, particularly at peak times.

Designed by   Coordinated by   Prepared by