

A sustainable mobility plan for the airports of tomorrow

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Abstract

In recent years, the European Commission has promoted Sustainable Urban Mobility Plans (SUMPs) to improve sustainability, accessibility and quality of life in cities. Recognising functional similarities between cities and airports as complex, multimodal transport hubs, Brussels Airport adapted the SUMP framework to develop a Sustainable Airport Mobility Plan (SAMP) within the EU Green Deal Stargate programme. This paper presents the development and implementation of the first SAMP at Brussels Airport, demonstrating how urban mobility planning principles can be translated to the airport context. The methodology combines collaborative governance, stakeholder engagement and robust data analysis to address the mobility needs of passengers, employees and cargo partners. A comprehensive baseline assessment evaluated all access modes using criteria including accessibility, environmental performance, safety and user experience. Based on this analysis, targeted measures were defined to improve hub connectivity, reduce CO₂ emissions and encourage a shift towards more sustainable transport modes, including enhanced pedestrian infrastructure, improved public transport alignment and better intermodal integration. The SAMP process also identified key congestion points and infrastructure gaps, resulting in a prioritised action plan, several elements of which are already being implemented. The paper illustrates how sustainable mobility planning at airports can support Total Airport Management by integrating landside and airside processes. The Brussels Airport SAMP provides a transferable,

*data-driven model for other airports seeking to advance sustainable mobility strategies. This article is also included in **The Business & Management Collection** which can be accessed at <https://hstalks.com/business/>.*

Keywords

sustainable mobility, airport accessibility, stakeholder engagement, multimodal transport, data-driven planning, total airport management

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THE CRITICAL ROLE OF ACCESSIBILITY FOR AN AIRPORT

Accessibility is a cornerstone of an airport's functionality and success. When passengers choose an airport, accessibility and proximity are often top considerations. An airport that is easily reachable by various modes of transport, including bus, train, taxi, private vehicles and active modes, significantly enhances the travel experience. A well-connected airport can attract passengers from a broader region, increasing its catchment area. This expanded reach not only boosts passenger numbers but also enhances the airport's appeal to airlines and creates extra employment opportunities. Consequently, airports with superior accessibility often enjoy a competitive edge.

Accessibility is equally critical for the employees who work at and around the airport, particularly those working in shifts. Airports operate around the clock, and many employees, including ground staff, security personnel and maintenance crews, work non-traditional hours. Reliable and efficient transport options are essential for these workers to commute safely and punctually, regardless of the time of day. Ensuring that employees have access to convenient and affordable transport not only supports their well-being but also enhances overall operational efficiency and staff retention.

Sustainable access is increasingly recognised as essential for the future growth of airports. As the aviation industry strives to meet sustainability goals, integrating eco-friendly transport options becomes crucial. Airports that promote and facilitate the use of electric vehicles, bicycles and efficient public transport systems contribute to reducing their overall carbon footprint.

In summary, accessibility is a critical factor in an airport's competitiveness and growth. Brussels Airport has been investing in sustainable accessibility for several years and continues to do so. The development of the first Sustainable Airport Mobility Plan¹ (SAMP) underscores the importance of this commitment. The holistic approach to accessibility used for the development and implementation of the SAMP not only supports immediate operational goals but also lays the groundwork for long-term success and resilience in the ever-evolving aviation industry.

FROM SUMP TO SAMP

In previous years, the European Commission (EC) has introduced the Sustainable Urban Mobility Plan (SUMP)² among its policies to increase sustainability and quality of life in European cities. The SUMP is a comprehensive planning tool for promoting

active mobility and public transport (PT), designed to meet the mobility needs of residents, businesses and other urban stakeholders. Each SUMP caters to a particular city and consists of a mix of policies and measures. Although often not explicitly defined, its aim is to link transport, healthy lifestyles and improved liveability of cities.

The SUMP is the leading urban transport strategy in Europe, developed through coordinated policies since 2005 to promote greener, more efficient city mobility. The EC's Urban Mobility Package,³ introduced in 2013, established the SUMP⁴ concept and provided definitions and hands-on guidelines to help cities implement comprehensive

and sustainable transport solutions. These plans encourage cities to rethink mobility, aiming for competitive and resource-efficient transport systems that align with broader environmental and societal goals. Over time, the SUMP approach has gained traction not only in Europe but also globally, with guidelines periodically updated to reflect evolving best practices and emerging challenges (see Figure 1). Meanwhile SUMPs have been transformed to meet the needs of neighbourhoods, small and larger cities, metropolitan areas, rural areas and polycentric regions.⁵

For several years, the EC has financially supported and strongly recommended that cities across Europe implement



Figure 1 SUMP cycle⁶

SUMPs; however, the status of SUMP development and implementation varies widely between countries and cities. So far SUMPs have been developed in all EU member states, with the Flemish region in Belgium, Germany and Spain being frontrunners. The status reports produced by CIVITAS SUMPs-UP⁷ and PROSPERITY⁸ evaluated already more than 1,000 mobility plans.

Cities and airports both serve as critical nodes in the global transport network, each orchestrating movement of people and goods; with the development of airport business districts, airports are further evolving into cities in their own right. Both rely on complex infrastructure, multimodal connections and coordinated logistics to ensure smooth mobility, highlighting their role as dynamic hubs of activity and connectivity. Smart city development and airport city development are closely intertwined, as both leverage advanced technologies and integrated planning to create efficient, sustainable and connected environments that enhance mobility, economic growth and quality of life for residents and travellers alike.

Just as sustainable mobility plans are reshaping urban environments, their application within airports holds equally transformative potential. Airports are not isolated entities, they are deeply integrated into regional economies, employment zones and transport networks. Implementing a sustainable mobility plan can reduce carbon emissions, alleviate traffic congestion and improve air quality not just within airport grounds, but across the surrounding communities. Enhancing access to public transport, cycling infrastructure and low-emission vehicle options also promotes equitable mobility for airport workers, passengers and visitors alike. In doing so, airports can evolve into

models of sustainable transport, aligning with broader environmental goals while improving efficiency and user experience across their vast ecosystems.

Stargate sustainability programme

Within the EU Green Deal Stargate programme,⁹ and with the support of partner LuxMobility, the SUMP methodology was translated to an airport context: from a SUMP to a SAMP. The Stargate programme at Brussels Airport is a large-scale sustainability initiative funded by the EU's Horizon 2020 research and innovation programme. It brings together Brussels Airport and 21 partners including Athens, Budapest and Toulouse airports alongside airlines, mobility experts, research institutions and governments to accelerate greener aviation.

The mission of Stargate is to develop, test and deploy a set of innovative solutions that make aviation and airports significantly greener and more sustainable. In response to the climate emergency, the industry is pursuing ambitious decarbonisation while actively collaborating with local communities to enhance quality of life and encourage a modal shift.

The programme centres on three main goals: advancing decarbonisation — for instance, by promoting and blending sustainable aviation fuel (SAF); improving local environmental quality by tackling challenges such as noise hindrance and ultrafine particles (UFP); and stimulating modal shift through initiatives such as the SAMP, mobility management measures and the implementation of a journey planner. Stargate was launched in 2021 and will be finalised in October 2026.

The SAMP is a strategic plan designed to satisfy the mobility needs of passengers, employees and businesses in airports and

their functional areas for a better travel experience (see Figure 2). It builds on existing planning practices and takes due consideration of integration, participation and evaluation principles.

THE CHALLENGE OF SUSTAINABLE AIRPORT ACCESSIBILITY

Airport growth depends on strong accessibility, yet serving diverse users, from passengers and airport staff to cargo operators and service providers, makes it a highly complex task. Each user group has distinct needs, travel patterns and expectations, which must be addressed in a coordinated and future-proof way. Moreover, airports operate within a broader regional and national mobility framework, intersecting with various public and private transport systems. This complexity is further heightened by the need to reduce environmental impact and

meet climate targets, all while ensuring seamless and efficient operations.

To manage these dynamics effectively, multiple stakeholders — airport operators, local authorities, transport providers, businesses and community representatives — must work together. Success requires more than isolated efforts; it depends on a shared vision, clearly defined roles and responsibilities and robust mechanisms for collaboration. Transparent communication, joint planning and mutual trust are essential to align interests and harmonise actions.

Equally important is the ability to track progress through measurable goals and data-driven evaluation. Only through committed partnerships and tangible outcomes can airports truly enhance accessibility while advancing both sustainability and economic resilience.

For example, at Brussels Airport, a close partnership with Brussels Airlines has

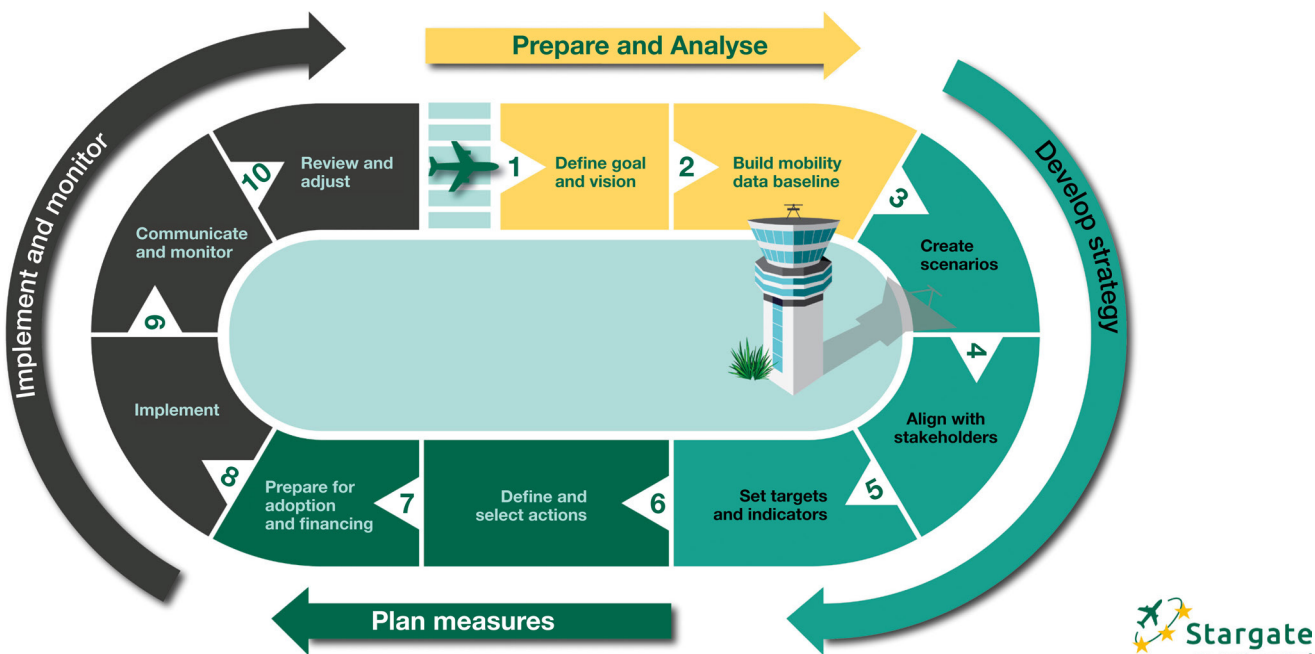


Figure 2 SAMP cycle
©Brussels Airport, 2023¹⁰

facilitated the development of multimodal accessibility solutions for both passengers and employees. During European Mobility Week 2024 and 2025,¹¹ an awareness campaign for employees was launched, featuring a competitive challenge to log the most cycling kilometres during one week by commuting to work by bike. This initiative not only highlighted the benefits of cycling to work, but also fostered collaboration within individual companies and sparked a healthy competition between organisations.

In this context, sustainable mobility planning becomes not just a necessity, but a strategic advantage for future-oriented airport development. The cross-collaboration emphasises the mutual goal of modal shift and increase in passengers for all transport providers, including the airport.

The solution: A strategic approach to mobility

The solution to the complex challenge of airport accessibility and sustainability lies in developing a SAMP, which adapts the proven framework of the SUMP to the unique airport context. This strategic approach begins with establishing a collaborative governance model that encompasses all relevant stakeholders — airport authorities, local government, transport operators, businesses and community groups — to ensure inclusive decision making and shared commitment.

Brussels Airport adopted a two-phase governance model for its SAMP. Initially, an internal stakeholder governance structure was established, bringing together representatives from passenger experience, parking management, human resources (HR), strategy, sustainability and energy departments to align

on a common vision and mission. This internal alignment on shared goals for mobility, accessibility and sustainable growth proved highly successful and provided the momentum for advancing the SAMP.

In the second phase, the airport organised external stakeholder sessions, expanding the collaborative governance to include both internal and external stakeholders. Early meetings focused on identifying bottlenecks and both positive and negative aspects of airport accessibility from each participant's perspective, while subsequent sessions encouraged participants to propose solutions for the issues raised. This process fostered a strong sense of ownership, responsibility and accountability among all involved. Although the stakeholder group now meets less frequently, it remains active through ongoing information sharing and joint initiatives, with Brussels Airport continuing to act as the main driver and initiator of these efforts.

An example of committed partnerships is the close working relationship Brussels Airport has developed over the last years with public transport providers, private bus companies and mobility service providers for shared mobility (see Figure 3). This has led to new services such as a direct train connection between the airport and a major Belgian city (Liège) that was missing previously. As part of the collaborative governance, meetings were organised with the different surrounding municipalities and regional governments, resulting in Brussels Airport being acknowledged as a strategic partner within the regional transport council and now officially an advisory member of the council.

The SAMP baseline is founded on comprehensive data gathering that encompasses a wide array of assets and



Figure 3 Ringtrambus
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services related to airport accessibility for both people and goods. This process involves mapping out all mobility services available to passengers, commuters and visitors, ensuring a holistic understanding of current conditions and needs. Data collection and data-driven insights are not limited to the initial planning phase; they are integral and ongoing throughout the development and implementation of the SAMP, allowing for responsive and adaptive mobility strategies.

Some critical data, such as entry point counts, is collected automatically using advanced tools such as ‘Telraam’¹³ sensors, automatic number plate recognition (ANPR) cameras and Bluetooth connections. These technologies provide real-time insights and are used to populate a mobility dashboard that is accessible to various airport departments,

fostering transparency and informed decision making. In parallel, other key data, such as cycling patterns among airport commuters, is gathered through targeted surveys and interviews with companies based on the airport premises. The findings have already led to tangible improvements, such as the installation of new bicycle parking facilities and enhancements to cycling paths, directly responding to the needs identified through data analysis.

The mobility dashboard itself is evolving into a shared environment, with its initial implementation featuring collaborative data sharing on truck movements between the cargo community and regional government. This collective approach enables stakeholders to address mobility challenges together and promotes a culture of

data-driven decision making. Through this structured use of data, Brussels Airport is able to launch targeted proof of concepts and implement effective mobility solutions, ensuring that actions are both evidence-based and aligned with broader strategic goals. These insights enable the creation of a well-supported action list that prioritises measures based on feasibility, impact and stakeholder consensus.

Fostering shared ownership and clearly defining roles and responsibilities within this governance structure are critical to maintaining momentum and accountability throughout implementation. This collaborative framework encourages innovation, facilitates resource pooling and aligns objectives across the wide airport ecosystem.

Ultimately, the SAMP drives coordinated and effective mobility improvements that enhance connectivity, reduce environmental footprints and improve the overall travel experience for passengers, employees and freight operators alike. By embedding sustainability at the core of transport planning, airports can evolve into more resilient, accessible and future-ready hubs within the global mobility network.

Developing an airport mobility strategy

An effective SAMP aims to reduce the environmental impact of airport operations by prioritising energy efficiency, minimising emissions and promoting sustainable transport options while taking into consideration the airport business model. The defined main goal of the SAMP of Brussels Airport is to guarantee optimal, sustainable and multimodal accessibility of the airport for all target groups. As a result, the SAMP

for Brussels Airport has the following objectives:

1. *Improving hub connectivity*: Enhancing the quality of Brussels Airport's network for both passengers and cargo, increasing accessibility and improving connectivity with ground transport.

- *Better accessibility*: Smoother transport to, from and within the airport for passengers, employees and visitors. Freight transport is also organised more efficiently, with attention to accessibility at all times.
- *Increased safety*: Safer roads and transport options in and around the airport.
- *Improved travel experience*: A more pleasant experience for both passengers and employees.

We measure the quality of our network for passengers and freight by opening new routes and destinations and increasing frequency.

2. *Reducing CO₂ emissions*: Overall Brussels Airport has set the goal to become CO₂ neutral by 2030. The SAMP measures will contribute to this goal.

The SAMP monitors the reduction of CO₂ emissions, both from the airport's own activities and from the transport of passengers and goods. The focus is on lowering emissions and promoting more sustainable transport choices.

- *Active contribution to European climate goals* by reducing emissions, air pollution and noise pollution.
- *Full electrification of the vehicle fleet* at the airport and installing sufficient charging facilities (see Figure 4).

The SAMP contributes to emission reduction for Scope 1 with the

electrification of the vehicle fleet and to Scope 3 with regard to commuting emissions and emissions related to cargo surface access, passenger surface access and airport partner surface access. Since 2024 Brussels Airport has received the ACA4+ accreditation.¹⁴

3. *Achieving a modal shift*: Encouraging a shift in transport choices towards more sustainable modes of transport to improve accessibility and reduce congestion.

Each month, we assess the modal split of passengers through interviews. In total, 60,000 interviews are conducted annually to measure overall satisfaction and gather information about travel patterns to and from the airport.

The SAMP provides a description of the current situation. A mobility

and accessibility baseline describes in detail all existing mobility services and means of access to the airport — namely walking, cycling, trains, public transport buses, intercity buses, carpooling, rental cars, shared mobility, ordered transport/cars, private motorised transport — in order to assess the following aspects:

- sustainability/accessibility;
- integration;
- customer experience;
- safety and security;
- sense of place;
- future proofing;
- inclusivity; and
- share of modal split.

This assessment, which rates from ‘poor’ to ‘good’ the above factors, also evaluates the level of investment currently being made for each mode of transport, and provides recommendations that lay the necessary foundation for the realisation of an intermodal hub that efficiently interconnects and optimises the flow of traffic at the airport.

Through collaborative governance and in alignment with stakeholders, future scenarios, targets and key performance indicators (KPIs) have been formulated as part of developing an action list. Some of the key measures to be planned include:

- *Increased investment in sustainable walking solutions (last mile)*: Vertical circulation infrastructure for pedestrians needs to be enhanced, particularly for connections to public transport. This is in line with the scope of the intermodal hub, which covers first to last mile travel.
- *Matching public transport schedules to airport’s rhythm*: Establishing a coherence between the airport’s operation with bus and train schedules



Figure 4 e-charging facilities promote more sustainable transport choices

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will further incentivise passengers to use public transport modes and accelerate the modal shift.

- *Improving the integration of mobility solutions:* Ensuring clear wayfinding and ease of transferring from one means to another. This is particularly relevant for intercity buses, which are disconnected from the airport terminal.

Additionally, an analysis was performed on the current state of mobility at the airport through consultations with internal and external stakeholders, which helped pinpoint areas for improvement. This highlighted the need to resolve airport operations congestion and bottlenecks on the road network, the demand for a high-speed train (HST) connection, a luggage solution, and the importance of optimised and adapted public transport facilities.

When working towards sustainable airport mobility and accessibility, airports can measure progress using KPIs such as the share of travellers using public transport, cycling or walking instead of private vehicles; the synchronisation rate of public transport schedules with airport operations; user satisfaction with pedestrian infrastructure; minimum connecting times between transport modes; reduction in congestion; effectiveness of wayfinding; compliance with accessibility standards; and level of stakeholder engagement. These indicators help guide airports in creating efficient, inclusive and environmentally responsible transport systems.

During the process of developing the first version of the SAMP, dialogue with the stakeholders (internal and external) helped to list a range of measures and prioritise them based on the overall goal: to provide and support comfortable, reliable, smart and sustainable transport

options and mobility solutions for all stakeholders of Brussels Airport, including passengers, staff, commuters, cargo partners and visitors.

The first implementations of the measures have started, and others are well on their way to be deployed over the coming years. Developments at the airport are pointing in the right direction: toward an environmentally, socially and customer-friendly mobility.

Transport planning is clearly not only about organising transport, it is also:

- A structured and data-driven process to plan and build a community through data gathering, sharing, learning and integrating insights.
- A way to realise improvements in the short and long term with shared responsibilities ensuring commitment, from small-scale changes to long-term ambitions, dedicated awareness raising, and continuous monitoring and evaluation.

The SAMP at Brussels has stimulated a taste for more. A mental shift has occurred as more measures and improvements are implemented.

Templates have been developed for data collection, and a clear methodology has been established to assist other airports in creating their own SAMP. Building on the successful experience at Brussels, airport experts are now collaborating with Airport Intelligence to provide guidance and support to additional airports in developing their respective SAMP initiatives.

THE GAINS: A UNIFIED PATH FORWARD

Implementing a SAMP delivers significant benefits by fostering a shared vision

and common goals across the diverse and often fragmented airport ecosystem. By bringing together stakeholders from various sectors — ranging from airport management and transport providers to local authorities and community groups — the SAMP builds a connected mobility community united by a clear purpose.

This collective approach ensures that accessibility and mobility are no longer afterthoughts but are firmly embedded in the strategic agenda of the airport. It elevates surface transport — encompassing public transport, cycling, walking and road networks — as a vital component of comprehensive airport planning (see Figure 5). Recognising and integrating these elements enhances operational efficiency, reduces congestion and improves the overall passenger and employee experience.

Beyond immediate operational gains, the SAMP sets the foundation for

long-term sustainable growth by aligning mobility solutions with environmental targets and evolving travel behaviour. It encourages innovation, resilience and inclusivity, ensuring that accessibility improvements benefit all user groups while minimising ecological impact.

In essence, the SAMP transforms airport transport planning from isolated efforts into a coordinated, forward-looking strategy — one that supports economic development, environmental stewardship and social well-being in tandem. This unified path forward empowers airports to meet the challenges of today while proactively preparing for the mobility demands of the future.

The SAMP in the broader perspective of TAM

To achieve an even more holistic impact, the development of a SAMP is to be



Figure 5 Bicycle highway – part of the integrated sustainable transport strategy
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integrated in the broader context of initiatives taken by airports globally to optimise the performance of their overall ecosystems. Indeed, airports are a complex network of processes and stakeholders that all need to be perfectly aligned to deliver efficient and performant functioning. In this context, multiple airports have embarked on a journey to implement Total Airport Management¹⁷ (TAM).

TAM is a philosophy and mindset whereby airport operations are considered in a much more holistic and transversal way. By building bridges between the often siloed processes of passenger, baggage, cargo and aircraft, the aim is to optimise the performance of the entire airport system through next-level predictability, focusing not only on operational performance but also on the impact these operations have on other key performance metrics such as commercial and environmental. Rather than looking at individual flights or passengers, TAM takes into account all parameters and involves stakeholders proactively to optimise the entire flow. For example, this may mean that, as a community, the decision will be taken to cancel a number of flights to mitigate an overall capacity reduction due to adverse weather in order to safeguard the remaining flight schedule, thereby offering passengers smooth journeys with acceptable waiting times.

To realise this aim, TAM not only focuses on real-time monitoring and resolution of issues that have already occurred, but also integrates targeted planning to ensure high-performing operations in the long term to alleviate potential future issues. As a consequence, TAM triggers airports to work on the following time domains:

- *Strategic*: Under TAM, airports look at performance in the long term, from

months up to years in advance, to develop and plan the capacity that will be required to meet the anticipated demand within acceptable service levels.

- *Tactical*: Any event that may affect performance will be proactively analysed; impact analysis will define the mitigation actions to be taken to ensure smooth operations on the day itself.
- *Operational*: In real time, airports keep a proactive outlook on anything that may affect performance and will immediately take any action needed to restore balance.
- *Post-ops*: Targeted performance reviews and root cause analysis ensure lessons are learned from the past and fed into planning or process optimisation.

Critical elements to realise TAM are:

- Open and transparent data sharing, as a base to reach data-driven decision making, performance target setting and priority definition.
- Extended and reinforced stakeholder engagement that ensures a clear vision of what is optimal for all involved.

From this, it is clear that the principles of SAMP are very closely aligned with the principles applied to realise TAM; however, there is more. Mobility is an essential — but sometimes forgotten — element of the passenger/baggage/cargo/employee journey to and from the airport. Overall airport performance is thus driven not only by terminal and aircraft processes, but equally by any event that can affect the punctual arrival of any of these at the airport.

Proper planning, tactical review of disruptions and real-time monitoring

and mitigation of mobility flows is thus an intrinsic part of TAM. In this way, a SAMP can bring a focused solution to strategically plan for smooth arrival flows and hence performance of the airport system.

CONCLUSION

The development and implementation of SAMPs represents a critical evolution in how airports address the growing challenges of accessibility, sustainability and operational complexity. By adapting the well-established SUMP framework to the unique context of airports, Brussels Airport has demonstrated the transformative potential of a strategic, data-driven, collaborative approach to mobility planning.

A successful SAMP goes beyond infrastructure and transport modes; it builds a shared vision among diverse stakeholders and fosters a governance model that ensures clear roles, joint ownership and continuous engagement. This collaborative foundation enables airports to balance growth ambitions with environmental commitments, improving connectivity for passengers, employees and cargo operations while reducing carbon emissions and congestion.

Importantly, the SAMP at Brussels Airport demonstrates how the strategic integration of sustainable transport solutions such as public transport, cycling, walking and optimised road networks into airport planning can significantly improve the travel experience for passengers and employees alike. By embedding accessibility and mobility into its strategic agenda, Brussels Airport is continuing to work on enhanced operational efficiency, reduced congestion and elevated safety standards. This approach also promotes inclusivity by ensuring

that mobility improvements benefit all user groups, including those with diverse needs, thus strengthening the airport's resilience and readiness for future demands.

The collaborative governance model established through Brussels Airport's SAMP, which brings together stakeholders from airport management, transport providers, local authorities and community groups, has proven effective in fostering joint ownership and continuous engagement. These successes and valuable lessons are now being extended to other airports via the Airport Intelligence network, encouraging broader adoption of this forward-looking mobility planning model that aligns operational efficiency with environmental and social objectives.

As airports continue to evolve as complex multimodal hubs within global transport networks, sustainable mobility planning will be essential for meeting both current and future demands. SAMPs provide a strategic roadmap for airports to align their operational efficiency with broader social and environmental goals, ultimately contributing to healthier, more accessible and economically vibrant regions. Moreover, the development and implementation of a SAMP contributes to the ambitions of airports to implement TAM, allowing airports to take holistic airport performance management to even higher levels.

By embedding sustainability at the heart of airport mobility, the path forward becomes clear: airports can thrive as dynamic, responsible gateways that support a cleaner, smarter and more connected future for all.

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