



New Mobility Now

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How to use this report

This report is an interactive PDF and is designed to be viewed with Adobe Reader and an Internet connection. The report can also be viewed offline, but any external links will not be accessible.

The Airport Landscape

Today's airports are about so much more than just catching a flight.

Airports are vibrant business centres, fueling local and national economies; they also provide the connectivity essential to the growth of the global economy.

The International Air Transport Association (IATA) projects that the number of people flying will almost double by 2036, to 7.8 billion from the 4.1 billion people who travelled in 2017.

Increasing demand from both the global air passenger and freight sectors coupled with technological advancement are shaping a dynamic period for commercial aviation not seen since the decades following World War II. At that

time, advances in technology enabled commercial air transportation to take off and become an established mode of mass transportation. Now, approaching the end of the first quarter of the 21st century, new and emerging technologies are once again creating entirely unique ways of serving passenger and operational needs, thrusting commercial aviation into an era shaped by change that is unprecedented in scope, pace and potential impact.

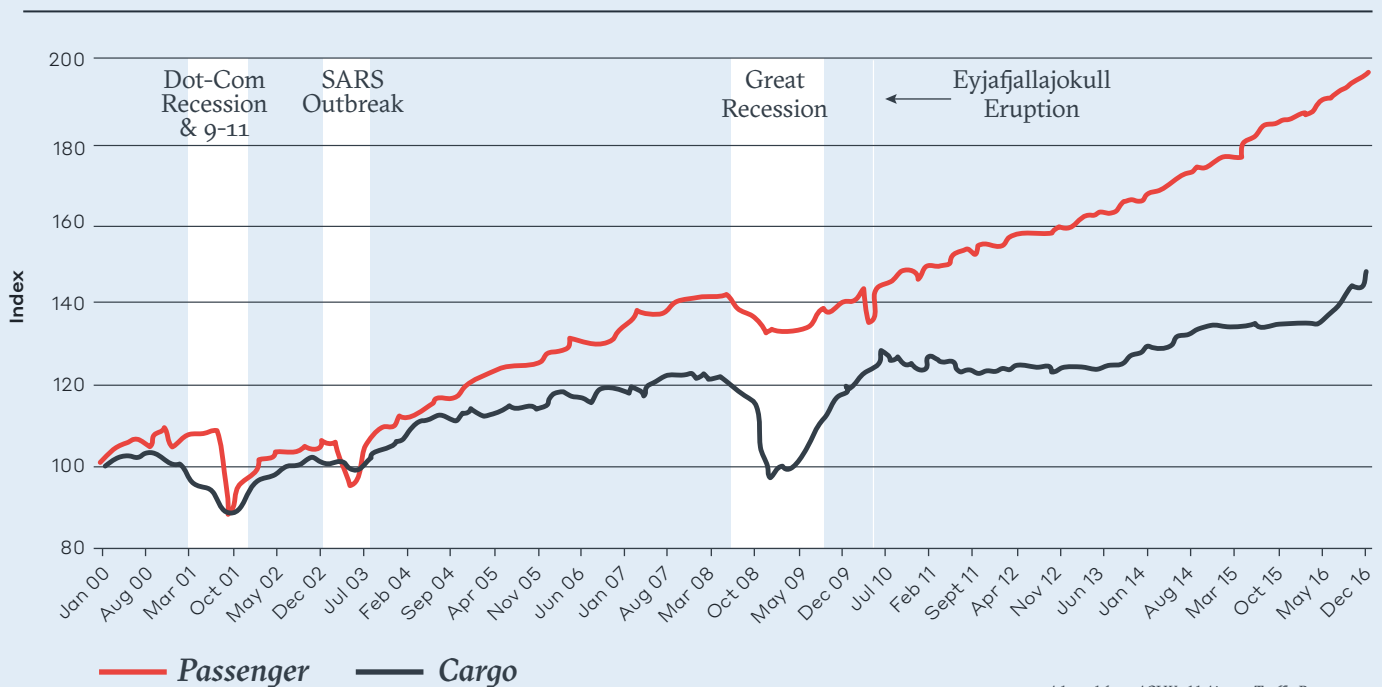
Concurrently, customer expectation for enhanced service continues on an upward trajectory, as passengers seek a door-to-door experience characterized by convenience, access and smooth travel. A major challenge for today's airports is to manage the process of digital transformation in order to continuously

run operations, maintain passenger flow and anticipate evolving passenger needs. Actualizing technology's full potential requires integration of systems, services and processes while "cyber-securing" applied technology.

Implementing the right technologies is critical to support aviation and its contribution to the global economy. Aviation's global economic impact (direct, indirect, induced and tourism catalytic) is estimated at USD2.7 trillion, equivalent to 3.6 percent of world gross domestic product (GDP)¹. Airports represent the engine behind this figure, as they enable the physical connectivity for people and products throughout the world.

Global Passenger and Cargo Growth (2000-2016)

The index is relative to the baseline date values of January 2000.



Adapted from ACI World Airport Traffic Report 2017

¹ Aviation Benefits Beyond Borders

Technology and Mobility

Delivering an enjoyable and stress-free travel experience for passengers requires airports to integrate enterprise-wide technologies that enable them to meet their operational targets and business objectives. Transitioning from a siloed to a holistic approach focused on sharing, analyzing and leveraging data will position airports of all sizes for continued growth.

Within this technology-based landscape, transport infrastructure must be developed to meet current capacity needs and accommodate future realities and expectations.

To support their flight networks, airports continue to invest, with current global spending, planned or underway,

estimated at USD1.1 trillion for greenfield expansion, new runways and terminal buildings as well as runway and terminal extensions.² Despite capacity expansions, some regions will still require even more investment to meet capacity needs and upgrade aging facilities.


Increasing demand for air travel, particularly at the world's hub airports, has also resulted in huge pressures on the existing surface access transport systems connecting to and from these airports, with many road networks constrained by heavy congestion.

New Mobility options can support capacity needs to, from and within the airport. Evaluating these New Mobility options is an essential part of today's infrastructure planning.

Continuing the Vision of New Mobility Now



New Mobility—the bundle of transport, technology and mobility changes that are already transforming the way we move around, live and interact with each other—will become the bedrock of future transport as the 21st century continues to unfold.

In 2017, WSP published the far-reaching [New Mobility Now](#)  report, which looked holistically at how transport and digital technology will evolve to meet the needs of society.

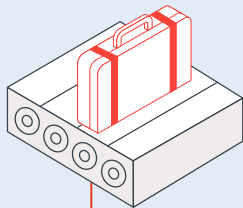
New Mobility Now established a practical framework consisting of four primary aspects—*automated, connected, electric and shared*—plus *business models and revenue generation*. The fifth aspect links together the previous four and influences the direction and speed of change for all of them.

This addendum explores New Mobility developments that can enhance aviation operations and airport capabilities toward the ultimate goal of creating a first-rate door-to-door passenger experience.

² CAPA Centre for Aviation, July 2017.

Aspects of New Mobility in Aviation

Toward a door-to-door experience characterized by convenience, access and smooth travel...



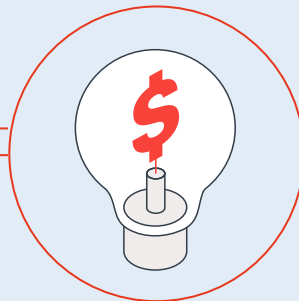
Automated

the spectrum of applied technologies that automate the production and delivery of tasks



Connected

accessing information from smartphone and tablet applications/leveraging data available from drones or mobile applications

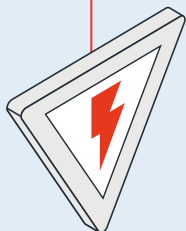


Electric

electric motor as the primary source of propulsion for aircraft

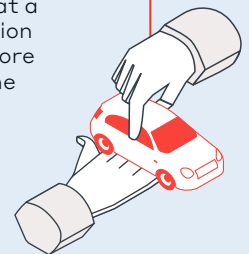
electric vehicles in airport transport

electrification of power/energy infrastructure



Shared

any transportation service that is shared by others—applies to short-term access to vehicle use by one user at a time and to a transportation service that transports more than one person at a time



Business Models + Revenues

Fair, sustainable, self-maintaining and politically acceptable operating models are key to improving growth and returns for New Mobility stakeholders. The chosen business model acts as an enabler that can link together the automated, connected, electric and shared aspects so they are mutually reinforcing.

Why Consider New Mobility Options Now?

From air hubs to ground hubs

In just over a century, airports have developed from simple airstrips/airfields to complex infrastructure sites essential for international transport. As gateways to cities around the world, airports support local communities and the world economy. A growing number are sophisticated service providers within a broad ecosystem of business and leisure offerings.

Heavily congested highways to and from airports have made a significant negative impact on travel times. To address this issue and accommodate 21st-century international passenger traffic, airports are providing multimodal mass-transit

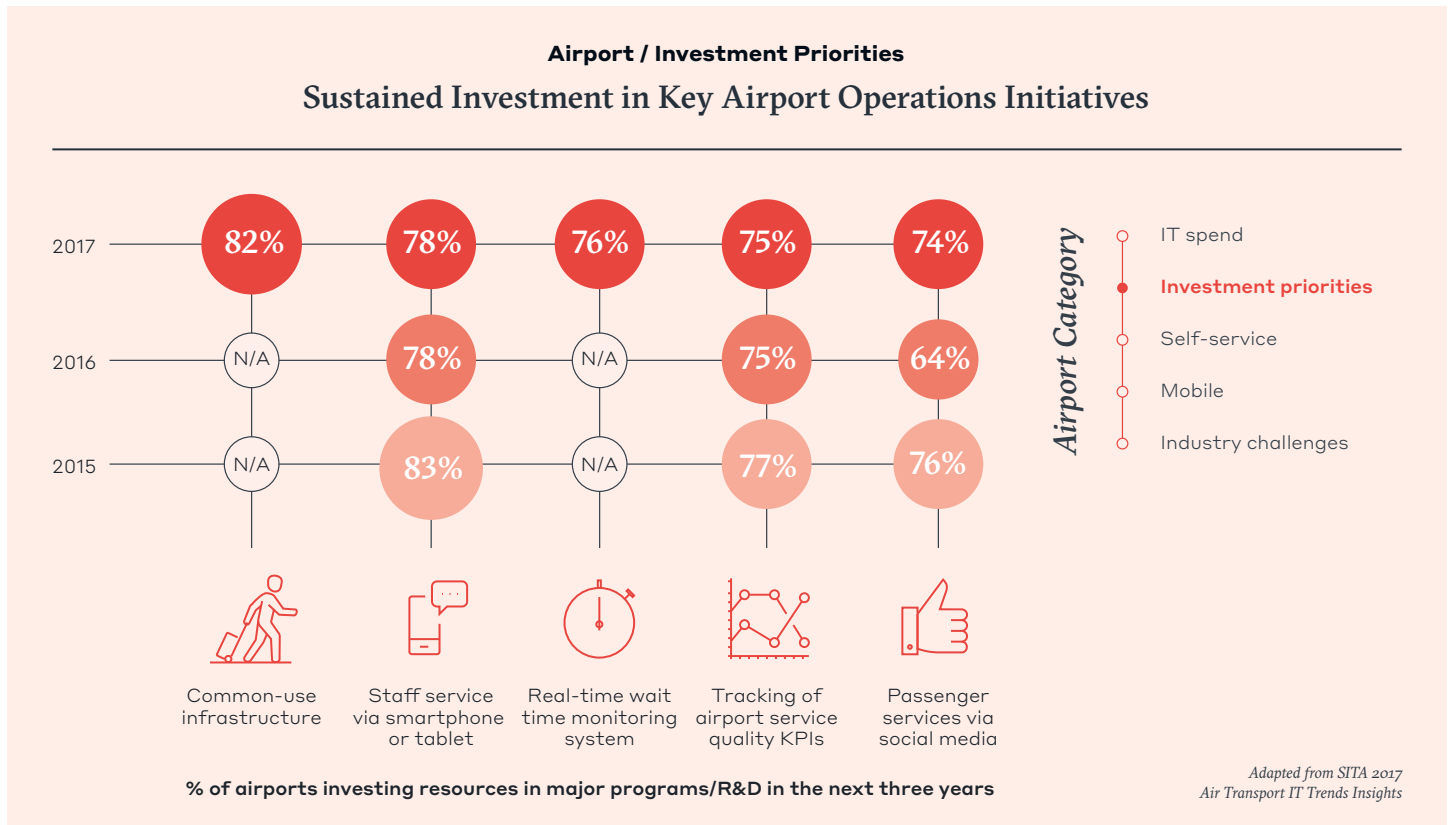
connectivity. Extending accessibility through transit connections, such as bus and train links to nearby cities and outlying regions, can be planned organically as part of airport expansion schemes. Similar timely consideration can also be given to New Mobility options in order to meet a region's evolving transport needs.

Extending connectivity for passengers and operations

Within the airport, the aviation industry has been quick to recognize and implement digital solutions to help improve efficiency of travel for passengers, through the implementation

of online check-in, automated document authentication, smart baggage tracking systems, wayfinding and other similar initiatives. To varying degrees, airports around the world are leveraging technology to support operations and meet passenger needs. The ability to successfully integrate new technologies, utilize scalable infrastructure that accommodates change, and apply analytics to learn from and leverage the wealth of generated data is essential to meet current passenger needs and anticipate heightened expectations.

▼ The diagram shows sustained investment in technology-related initiatives and demonstrates the need for agility in planning to accommodate new considerations and shifts in priorities.



The Evolution of Flight



1900-1939

WWI, Aviation Pioneers

Advances in engine technology and aerodynamics make powered flight possible for the first time.

1903-the Wright brothers: first recorded powered, sustained and controlled flight in a heavier-than-air flying machine

1927-Lindbergh: first solo non-stop trans-Atlantic flight

1939- the first jet-propelled aircraft

1940-1979

WWII, the Space Race, Commercial Aviation

Wide-scale development and production of the jet engine

Rapid military technological advancements

1980-1999

Digital Age

Advancements in avionics, aircraft design, and manufacturing techniques

Deregulation of airlines, among other factors, leads to unstable financial environment

Community pressure limits the utilization of small airports and heliports

2000-2020

Increasing Air Traffic

Continuous and exponential growth in commercial aviation, both cargo and passenger

Introduction of new large aircraft into terminal planning

Proliferation of drones as they transition from military to commercial applications, aided by advancements in battery technology and in composite materials

2021-2040

The Changing Mobility Landscape: the Next Generation of Aircraft Innovation

The International Civil Aviation Organization (ICAO) works alongside national aviation regulators to continue to harmonize and expand systems across the globe through initiatives like "No Country Left Behind"

People spend more time at airports, creating a new need to focus on amenities and non-aviation services

Introduction of new types of aircrafts, including electric, hydrogen based, and hybrid

Urban air mobility and new forms of low-altitude aviation that can offer low-emission, low-noise alternatives

Aviation Trends and Innovation

Outcomes

Development of the airshow or passenger trip as a novelty

The rapid growth of commercial aviation
Space Race—Development and proliferation of aerospace and aviation technology

Rapid increase in utilization of aviation services for cargo and freight
Increased access to/democratization of air travel

Airport development leads to self-contained cities (aerotropolis)
Emphasis on safety and airspace deconfliction, resulting from geopolitical events (9/11) and introduction of new low-altitude aircraft, e.g. drones

New Mobility trends impact revenue at airports, especially relating to parking and amenities that affect the passenger experience
Simultaneous advancements (AVs, EVs) in the mobility system create opportunity to leverage electrification.

Toward the Next 100 Years of Flight

In the first century of flight, many pioneering individuals transformed commercial aviation through their innovative contributions. Similarly today, diverse research from the private and public sectors is informing and driving aviation advancement. A differentiator in the process now is the ubiquity of technology and the pace at which major advancements can happen. Thirty-plus years passed from the Wright Brothers' pioneer flight in 1903 to the first jet-propelled flight in 1939. In the 21st century, innovative technologies can quickly render existing methods of operation obsolete.

In a digitally-based environment, airports must adopt a new approach to address infrastructure needs. Proactive planning that embraces agility is key in order to accommodate new technologies that work contextually in each airport. It is impossible to know the exact technologies that will exist and what the impact will be on the aviation landscape over the next 20 years. What is clear: Technology will underlie all facets of the airport, from operations to the terminal and to the airfield.

The design of airports, from fundamental space and lighting to materials used, is becoming more aesthetically sophisticated and pleasing. The types of terminal concessions offered are also changing to reflect shifting passenger buying patterns. In turn, passengers will increasingly have a brand new airport experience—one that reflects their tastes, satisfies their preferences and meets their increasingly higher expectations. How can New Mobility work to advance these processes when New Mobility itself is still evolving?

The challenges posed by New Mobility are presenting infrastructure investment opportunities to produce improved efficiencies and support the new airport experience for passengers. Here is a look at how New Mobility will make a positive impact in the airport landscape on the horizon.

Turning Challenges into Opportunities with New Mobility Developments

Challenges = Opportunities

Airport planning has traditionally been siloed from infrastructure and mobility planning processes at the metropolitan level.

As cities consider New Mobility options, airports can integrate their infrastructure planning with broader metropolitan investments in New Mobility, especially as communities are built around transportation.

Airports must develop their infrastructure capacity to meet growing traveller demand.

New Mobility can develop on-site transport capability and alleviate congestion issues on roads to and from airports by offering alternative options for travel to and from airports.

Disruption to existing airport operations

Operational enhancements and deployment of new business models to accommodate increased demand and mitigate risks of a potential downturn (Aviation is vulnerable to geopolitical uncertainty and economic volatility.)

Policy/Regulatory hurdles

Influence new regulatory/policy environment to understand implications and needs

Re-imagining the airport environment; ensure business strategy and operations are aligned toward the same goal.

New Mobility developments are coinciding with market forces driving «green technology» development and adoption.

Revenue streams, as traditional sources of non-aeronautical revenue shrink

Airports can take advantage of New Mobility requirements by offering complementary products and services on airport facilities (e.g. electric vehicle charging).

Exploring the Five Aspects of New Mobility

Airport / Investment Priorities

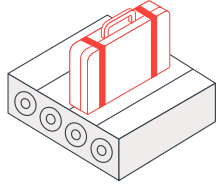
Big Leap in R&D Focus on Biometric Identity Management and Artificial Intelligence



● 2017 ● 2016

% of airports planning to trial/R&D in next five years

Adapted from SITA 2017 Air Transport IT Trends Insights



Automated – the spectrum of applied technologies that automate the production and delivery of tasks

Progress regarding the integration of automated processes to advance operational efficiency is also shaping the seamless travel experience that passengers seek, no matter where they are or what type of flight they board.

Applying AI to operations

Interactions with passengers will increasingly be transformed as automation coupled with artificial intelligence (AI), or machine intelligence, becomes common in most, if not all, airports throughout the world. Automated digital tools, such as virtual agents and chatbots that can converse with customers and answer their questions in real-time, demonstrate AI's potential in the passenger realm.

Harnessing the full power of business-critical AI in decision-making will result in better managed spaces and more hospitable travel environments. By applying predictive analytics to real-time data in order to gauge traffic flow, queues can be monitored and managed to avoid congestion.

Biometric scanning and recognition methods in identity management as well as automated baggage screening and tagging are also decreasing passenger congestion and expediting passenger flow throughout airports. The installation of self-boarding gates using biometrics with ID documentation represents another promising step forward, with 63 percent of airlines having implementations or plans by 2021.³

Adding blockchain to the equation, using biometrics, can streamline the passenger identification process by reducing the number of ID checks.

Automated Vehicles (AVs)

Automated processes are only desirable if they can provide the right services for passengers and the needed efficiencies for airports. Airports were among the first locations worldwide to implement automated transport to move passengers between airport terminal buildings, thereby reducing congestion in key areas. Automated transport has traditionally been used for fixed route linkages between airport terminals and other key locations, such as car parks, car rental facilities and hotels, often utilizing dedicated infrastructure corridors. New Mobility developments can often work within existing transport networks, enabling the flexible application of transport infrastructure and precluding the need to construct high-cost dedicated corridors. Offering AV alternatives also aligns with the provision of multimodal public transport options (bus and train) available at many hub airports.

AVs also have the potential to ease passenger travel to and from the airport, introducing predictability and reliability in the first and final stages of each journey.

On the airfield, automated guided vehicles (AGVs) will be applied to multiple functions, including runway snow removal and pushback plus other routine apron movements for large aircraft.



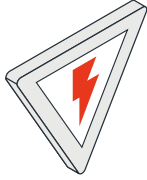
Connected – accessing information from smartphone and tablet applications/leveraging data available from drones or mobile applications

As people increasingly rely on their smartphones to access information and make travel plans, they can immediately access relevant flight updates and product/service offers. Traveller connectivity also creates a well of location-based data to use toward improving operational efficiency and building business relationships with vendors, and to further personalize the passenger experience.

New Mobility connectivity on the airfield can enable better maintenance and operations. Unmanned aerial vehicles (UAVs), aka drones, are among the cutting-edge technologies that offer widespread use. As regulations around the world allow drones to operate in airspace around airports, the challenge is of course to use drones responsibly—safely and without disrupting airport operations. In the 24/7 complex processes at airports, UAVs, which can be controlled remotely, offer the potential for time savings and cost savings; drones support asset management by capturing details difficult to spot with the naked eye, such as cracks in runways, and providing accurate comparable data over time.

On-runway drone delivery for aircraft parts, construction monitoring, perimeter security and traffic monitoring will become commonplace as the technology advances and regulatory frameworks embrace drone use.

³ SITA, IT Review



Electric – electric motor as the primary source of propulsion for aircraft / electric vehicles in airport transport / electrification of power/energy infrastructure

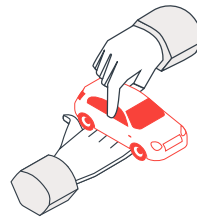
R&D and piloting efforts focused on future-focused materials and power sources will eventually shape a new airscape and landscape, including aircraft designed and constructed with lighter materials powered by electric propulsion systems. Such smaller, lighter and cleaner aircraft, some capable of vertical take-off and landing (VTOL), will not only reconfigure our skies and airfields, especially at intra-regional airports (point-to-point travel), they will also support global industry efforts to reduce carbon emissions and foster smooth, fast travel. VTOL also means using a fraction of the land that is typically used for take-off.

On the ground, battery-electric (zero-emission) vehicles, both driver and driverless, are enabling airports to transport passengers within existing airport infrastructure. They provide a swift, smooth ride for passengers between airport locations. The only rest stop is the charging stations/points, to maintain their on-the-go mode.

Airside, the tasks associated with the landing and take-off of aircraft can be supported by the use of electrically-powered vehicles, from refuelling airplanes to transporting equipment, baggage carts and food trays.

Electrification of ground-support vehicles translates into environmental and economic benefits, including reduced maintenance costs, decreased fuel costs and lower life-cycle costs.⁴

For example, when recharging, AVs can be linked together to transfer power from one AV to another, or to act as a local battery pack providing newly generated electricity.



Shared – any transportation service that is shared by others—applies to short-term access to vehicle use by one user at a time and to a transportation service that transports more than one person at a time

In the context of travelling to and from airports, shared transportation is commonplace in cities around the world, from shuttle or taxi services to transportation services that offer shared use of vehicles.

Within transportation networks, AVs offer the potential for convenient and predictable door-to-door travel for passengers, either as a group or individually in one vehicle. The outcomes of pilot projects and trials designed to prove a specific technology, currently underway for AVs, can be considered for potential application within a multimodal transport ecosystem designed to ease access on our roads leading to and from airports.



Business Models – Fair, sustainable, self-maintaining and politically acceptable operating models are key to improving growth and returns for New Mobility stakeholders. The chosen business model acts as an enabler that can link together the automated, connected, electric and shared aspects so they are mutually reinforcing.

Airports around the world are undergoing change both in terms of their physical space and how they serve customers. Many are still in transition, shifting from service-focused facilities to passenger-centric ecosystems with a broad spectrum of services.

Supporting more passengers and meeting their ever-increasing expectations requires looking holistically at how airports can make necessary advancements and generate new non-aeronautical revenue streams, which have traditionally included food and retail concessions, advertising and car parking.

As parking revenues decline, for example, with the use of AVs, electric vehicle charging has the potential to boost revenue. With the opportunity to tap into relatively inexpensive electricity at airports, drivers of electric vehicles will have the incentive to drive to the airport and either leave their cars to board a flight or drop off someone else. Airports may choose to charge station fees instead of the standard parking rate, or perhaps a combination of the two.

Digitally-enabled amenities, such as way-finding applications and on-demand deliveries inside airports, have fee-for-service and advertising revenue potential.

⁴ Electric Power Research Institute

Conclusion

New Mobility is already helping airports move forward, particularly with automated and connected services that facilitate the seamless travel experience passengers seek. Further progress depends on a collaborative approach involving multiple stakeholders—government, airlines, and third-party solution providers—to define the physical, digital, and organizational infrastructure to support New Mobility. Such a process must also identify the roles and responsibilities of the various stakeholders in sharing the investment needed to create infrastructure that can adapt to change. Ongoing partnerships are also key toward generating new revenue streams in the context of New Mobility developments.

Key Contacts



Marco Mejia
Canada

marco.mejia@wsp.com @



Mattias Frithiof
Sweden

mattias.frithiof@wsp.com @



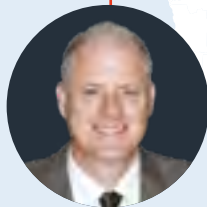
Frank Lin
Asia

frank.lin@wsp.com @



Tina Millán
United States

tina.millan@wsp.com @



Tim Morrison
United Kingdom

tim.morrison@wsp.com @



Mark Boone
Australia

mark.boone@wsp.com @

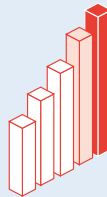
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48,000

Employees



5.4B

2017 Net Revenues* (CAD)

*Non-IFRS measure

Our Guiding Principles

We value our people and our reputation.

We are locally dedicated with international scale.

We are future-focused and challenge the status quo.

We foster collaboration in everything we do.

We have an empowering culture and hold ourselves accountable.





WSP Global Inc.
1600, René-Lévesque Blvd. W.
16th Floor
Montreal, Quebec
H3H 1P9

wsp.com

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