GTAA

Toronto Pearson International Airport

Master Plan

2017–2037

GROWING RESPONSIBLY

Toronto Pearson

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1. Executive Summary

Our Economic Impact

Toronto Pearson is more than an airport – it's one of Canada's vital economic engines.

Our impact is national: we're the hub that connects lobster fishers in Atlantic Canada with seafood lovers in China; lentil growers in Saskatchewan with customers in India; the small fashion house in Brampton, Ontario, with its design and manufacturing teams in South Asia; and oil-sands workers from Venezuela with jobs in Alberta – among many other links that create jobs and opportunities. We also connect residents of the Greater Toronto Area (GTA) – one of the most diverse city-regions on Earth – with business opportunities, with adventures abroad, and with family and friends across Canada and around the globe.

We estimate that 49,000 jobs are directly associated with operations at Toronto Pearson. Hundreds of thousands more people, throughout Southern Ontario and beyond, enjoy livelihoods made possible by the connectivity we provide. Our airport also boosts the productivity of industries across the country by linking Canadian firms with vibrant markets, commercial partners and investors worldwide.

Our aspiration is to become the best airport in the world. As we evolve into a top-tier global hub, we expect to connect Canada to more than 80 per cent of the global economy – creating additional jobs, fuelling exports and attracting foreign investment.

This Master Plan presents a rigorous assessment of the demand we expect to face over the next 20 years. It also describes the operations and facilities we'll need, within the planning horizon, to support the continued growth and dynamism of our region, province and country. Lastly, this document culminates with a detailed Land Use Plan, which we present for the review and approval of the federal Minister of Transport.

A Lot Has Changed in the Last 10 Years

Since the last Master Plan for Toronto Pearson was completed in 2008, our world has changed. The global economic balance has shifted markedly: growth in emerging economies such as China, India, Brazil, Russia and others has outpaced growth in many parts of Western Europe and North America. Since the introduction of the iPhone in 2007, people and organizations have become mobile and connected like never before. At the same time, the sharing economy has developed with remarkable speed. A decade ago, most people would not have used their own cars to offer transportation services to strangers, or rented rooms in their homes for short-term stays; now Uber, Lyft and Airbnb have made these common behaviours and transactions.

Ten years on, a million more people call the GTA home – within a regional population that is steadily aging. And amid all these changes, our appetite for air travel continues to grow.

As stewards of Toronto Pearson International Airport, the Greater Toronto Airports Authority (GTAA) has also changed in the last 10 years. We've enhanced our business practices, reduced costs, increased revenues, improved returns on investment and paid down debt. Together, these changes have strengthened our financial position and established a solid foundation for the development of our airport over the next 20 years. That development will in turn deliver significant value to residents, businesses and visitors across the region.

We're More Connected

The GTAA has become more outward-looking in many respects over the past decade. We've built relationships with other regional airports in Southern Ontario. And we've worked to better understand and activate the relationships connecting us to the social and economic fabric of our surrounding communities. Our decisions are now more deeply informed by our awareness that the air connectivity we provide is part of a longer, multi-modal trip: a "home-to-home" journey for our passengers, and a supply-chain journey for the goods we help to move. We collaborate with governments to advance important issues, and we engage actively with a large and diverse group of stakeholders.

Regional Collaboration. We project that 94 million passengers and close to one million tonnes of cargo will flow through Southern Ontario's airports in 2037 – up substantially from the 49 million passengers and 470,000 tonnes of cargo we collectively accommodate today. The best way to meet this forecast increase in demand is to harness the collective resources and capabilities of all airports across the region.

In other large metropolitan areas around the world, airports coordinate to offer complementary services that benefit an entire region. For example, Los Angeles International Airport is a primary hub and international gateway for the region it serves, while nearby Orange County Airport focuses on origin-and-destination travel (as opposed to connecting passengers) from the southern part of the region, and Van Nuys Airport accommodates general aviation.

We envision a future in which Toronto Pearson will continue to be the main hub for air connectivity in Southern Ontario – and indeed will evolve into a top-tier international airport – while accommodating less regional passenger traffic. In this scenario, other airports will offer more non-stop service to smaller centres across Southern Ontario and the U.S. Northeast, offering travellers more choice and shortening air passengers' ground journeys.

As a step toward that vision, since our last Master Plan, Toronto Pearson and 10 other airports – Hamilton, Niagara, Windsor, downtown Toronto (Billy Bishop), London, Kitchener-Waterloo, Lake Simcoe, Oshawa, Peterborough and Kingston – have formed the Southern Ontario Airport Network. (Other airports, including Burlington and Downsview, also play a role.) Our shared goal is to provide more options and deliver superior service to air travellers, carriers, cargo shippers and aircraft owners, while collaborating on improved ground access, effective policy advocacy and the sharing of best practices.

The Heart of a Thriving Area. Toronto Pearson is in effect "downtown" to the Airport Employment Zone (AEZ), the second-largest concentration of employment in Canada after Toronto's downtown core. The AEZ has gained prominence in recent years as a leading centre of growth in the regional and national economies. One sign of the importance of our airport – and the connectivity we provide – is the increase in commercial property values in the areas surrounding our lands. The Province of Ontario's updated land use policy reflects a growing awareness among policymakers that places like the AEZ have a unique role to play in the provincial economy. The government is placing greater emphasis on multi-jurisdictional approaches to planning key employment areas, and on creating holistic and sustainable communities that support both quality of life and economic vitality.

In the planning choices we make – and those we support outside Toronto Pearson's boundaries – our goal is always to provide world-class connectivity while helping the region's employment areas and residential communities continue to thrive. We've developed this Master Plan to be consistent with the policy priorities and objectives of Ontario's Greater Golden Horseshoe Growth Strategy. It's also closely aligned with the official plans of the Region of Peel and the cities of Mississauga and Toronto.

A Lot Will Change in the Next 10 Years

In preparing this Master Plan, we've gathered as much trend data and other relevant information as possible and used a comprehensive, probability-based forecasting model to generate the most realistic future scenarios.

Looking forward from today, we project that the number of people wanting to fly to, from and through Toronto Pearson will grow at 3.1 per cent per year – higher than forecast in our last Master Plan. The most likely scenario for 2037 is that Toronto Pearson will serve about 85 million passengers, up from 47 million today. We estimate that this will represent about 91 per cent of all passengers flying into and out of airports in Southern Ontario in 2037.

Our forecasting work has also generated high and low scenarios in which between 100 million and 60 million people will fly in and out of Toronto Pearson in 2037. Within our extensive planning horizon, we continually monitor demand trends, accelerating or deferring our capacity-expansion plans as necessary.

Our forecasts indicate that while the GTA's population is expected to grow by about 33 per cent during our planning horizon, air passenger traffic at Toronto Pearson during the same period will increase by 81 per cent. There are several reasons for this disparity. First, in addition to population growth, there are economic and demographic factors – such as our region's service-oriented economy and highly educated population – that also affect demand for air travel. Second, Toronto Pearson is well connected to emerging markets where demand for air travel is surging. And finally, our status as Canada's primary global hub airport means that we serve many more domestic and regional travellers than solely those based in our own city-region.

In addition to rising demand for air travel, the pressure for increased cargo shipments will also continue to grow quickly. Our analysis indicates that Toronto Pearson should expect to handle 958,000 tonnes of cargo in 2037, up from 450,000 tonnes today. This reflects an annual growth rate of 4.1 per cent.

Because of an industry-wide shift to larger, high-density and more fully occupied aircraft, over the next two decades, proportionally fewer flights will move greater volumes of people and goods. We therefore project faster growth in passenger and cargo traffic than in aircraft movements – which we expect to grow at about 1.5 per cent annually. Our most likely scenario for 2037 suggests that aircraft movements (takeoffs and landings) will increase to 632,000 from today's 478,000. At the same time, the average number of passengers on a plane passing through Toronto Pearson will be 140, compared to 108 today. This represents a 30 per cent increase in the productivity of our runway system. Where our 2008 Master Plan anticipated the need for a new runway, we now expect to be able to meet demand with existing capacity throughout our 20-year planning period.

Also by 2037, our projections suggest that people flying internationally and connecting through our airport will make up a larger share of Toronto Pearson's overall traffic than today. Both categories are significant indicators of increased connectivity, an important driver of economic growth.

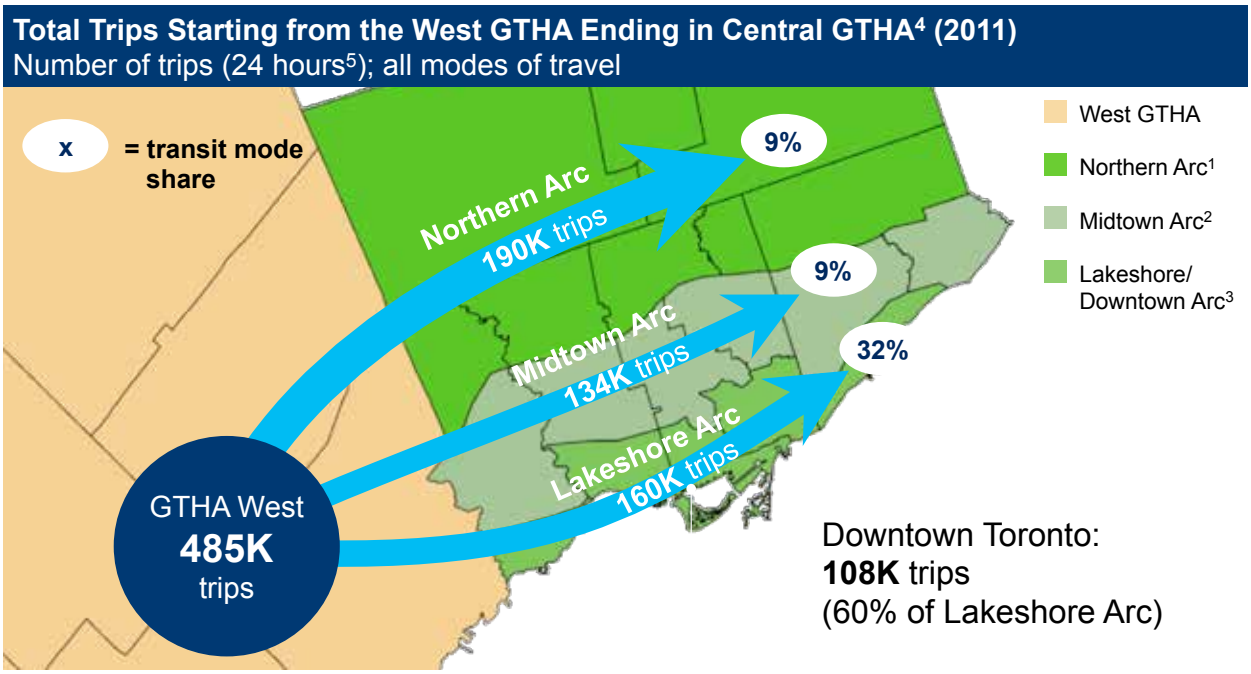
It's certain that technology will change our operating environment over the course of this Master Plan, probably at an accelerating rate, although specific changes are difficult to predict. Developments in artificial intelligence (for which Toronto is a global centre of excellence), robotics, big data, autonomous vehicles and biometrics are all expected to advance dramatically during the planning horizon. These changes may have profound implications for Toronto Pearson and aviation generally, offering opportunities to increase productivity, customer satisfaction and employee engagement as well as providing a potential test-bed for local technology firms.

Priorities for Success

Ground Access. As Toronto Pearson prepares to meet strong growth in demand over the course of this Master Plan, the most pressing challenge we face – in both the short and long term – is ground access. To fulfill our potential as a catalyst for regional job creation and economic prosperity, we must make it easier for more people and goods to reach our airport – and all parts of our region – more quickly and efficiently by road and rail.

Improving access will require sustained effort over several years and will challenge us to remain flexible and adaptable as transportation options evolve and new technologies emerge. We continue to analyze shifts in urban mobility patterns, including the decline in propensity for car ownership, particularly in metropolitan areas, and the advent of autonomous vehicles. Toronto Pearson's ground access system will have to be agile in adapting to the possibilities of new technologies, as well as both ride-sharing and vehicle-sharing business models. These offerings, combined with high-occupancy vehicle (HOV) lanes, may encourage more travellers to shift from single-occupancy transportation. But agility and incremental adaptation to emerging technologies and business models won't be enough on their own to solve our ground access challenges. That will require a fundamental shift in how passengers and employees get to Toronto Pearson.

In February 2017, the GTAA announced plans for a Regional Transit Centre integrating Toronto Pearson with existing and proposed rail and bus networks that will ultimately link much of Southern Ontario. Working with ground transportation agencies and all levels of government, we've proposed a multi-modal hub to provide easier airport access for travellers. The transit hub will also offer greener, more economical and less stressful options for the hundreds of thousands of airport-area workers who currently use our region's traffic-clogged roads.



1 Vaughan, Richmond Hill, Markham, Etobicoke North, York-Downsview, Willowdale, Don Valley-Hillcrest, Scarborough North; 2 Etobicoke Central, York-Crosstown, Midtown Toronto, Don Mills, Scarborough Centre, Scarborough East; 3 Etobicoke South, West End Toronto, Downtown Toronto, East End Toronto, Scarborough Southwest; 4 Includes only trips that have a final destination in Central GTHA; i.e., does not include trips passing through Central GTHA; 5 Approximately 70% of trips occur during AM/PM peaks, across all three arcs.

Source: University of Toronto - Transportation Tomorrow Survey (2011 trip data, by planning district)

Figure 8.5: Distribution of Trips from GTHA West to Central GTHA

We face immediate challenges, however, with congestion on our airport's entrance roads and curbs. These will need to be addressed well before the realization of the Regional Transit Centre. A largely bus-based transit hub could be created in the relatively near term. Such a facility would provide new travel options for passengers and employees while delivering regional benefits well beyond Toronto Pearson. And it would provide a platform to which higher-order transit service could be added over time.

We believe the proposed Regional Transit Centre has the potential not only to substantially improve access to our airport, but also to support greater productivity throughout the region by connecting Toronto, Mississauga and Brampton, and by facilitating faster, more convenient movement across the high-traffic Northern Arc of the GTA. Reducing highway congestion by introducing more appealing transit alternatives will also ease cargo movement – to and from our airport, and more generally across the 400-series highway system.

Airside System and Passenger Terminals. We expect that airside systems and passenger terminals will be able to accommodate the demand we forecast over the course of this Master Plan. Both critical elements of our operations, they largely have sufficient capacity to meet demand over the next two decades – and where this is not the case, they can be expanded or made more productive.

We expect that our current five-runway airside system will be sufficient through 2037, and that a sixth runway will likely not be needed. This conclusion differs from the one presented in our 2008 Master Plan, which anticipated the need for a sixth runway during its planning horizon. A number of changes have given rise to our new projections. First, an industry-wide shift to larger, fuller planes will mean that greater demand for passenger travel can be met with fewer aircraft movements. Second, over the next 20 years we expect other regional airports in Southern Ontario to serve some of the needs Toronto Pearson currently accommodates. Third, improved rail service across our region will divert some air passengers onto trains. Lastly, advances in aircraft and air traffic control technology will increase capacity – without compromising safety – in our existing airspace, runways and taxiways.

It's possible that during our current planning horizon, climate change will begin to increase the incidence of extremely hot summer days. This prospect is significant to our capacity planning work because hot weather makes it more difficult for aircraft to gain altitude on takeoff. In such conditions, aircraft either need longer runways or must carry less weight – i.e., fewer passengers and/or less baggage and cargo – to be light enough to take off within existing runway constraints. Removing passengers and baggage or cargo from departing flights is disruptive to travellers and supply chains. Therefore lengthening our runways would be the better of the two potential solutions – and we have enough space to do so if necessary.

At the same time, we expect that our existing passenger terminal facilities, with some adaptation and expansion, will be able to accommodate much or all of the increased demand projected for the next two decades. Technological advances are making it possible to accommodate a greater flow of traffic through a given passenger terminal area. At Toronto Pearson, some of these technologies are already in place, while others are on the near horizon. Self-service check-in and bag drop have become routine for many travellers. We've also made significant improvements to our baggage-handling systems, and more are on the way. Technology-enabled enhancements are likewise making security screening and border control processes more efficient. We expect other advances – such as seamless boarding and security procedures made possible by biometric identification – to further speed the flow of people and bags through our terminals in the near to medium term.

In addition to planning for increased traffic volume at Toronto Pearson, we're also anticipating qualitative changes in passengers' needs and expectations. For instance, as our population ages we expect to accommodate a greater proportion of travellers requiring mobility support. Accessibility has become an increasingly important component of providing a top-tier experience for travellers through our airport.

Overall, we anticipate a greater need to work in partnership with research institutions and other innovators to effectively plan future airport systems and services.

A Key Link in the Supply Chain. Toronto Pearson represents one critical part in a wider logistics and transportation network. Our airport is a primary node in a multi-modal supply chain that supports Canadian exporters while expediting the distribution of imported goods – in both respects driving economic growth. Since our last Master Plan, we've seen a continued trend toward the shipping of air cargo in the bellies of wide body passenger jets as opposed to freighters. We expect belly cargo to account for most of what we handle over the course of this new plan.

Toronto Pearson's cargo volume is relatively small, measured as total weight shipped per square metre of land. Our existing facilities are capable of meeting the demand we forecast over the course of this plan – but to do so, we'll need to increase the productivity of our cargo facilities. We've begun to map the necessary operational changes. And the proposed Regional Transit Centre will also be part of the solution, in as much as it will free up road capacity, facilitating the movement of goods to and from the airport – especially on the 400-series highways that surround Toronto Pearson.

As for the supply of aviation fuel, as well as the services of key utilities, we believe that with appropriate planning and collaboration, these can be increased to keep up with projected demand for air connectivity from businesses across our region.

Effective Stewardship of Our Land. Toronto Pearson has enough land to function effectively as a top-tier international airport. Indeed, some of the world's most active airports function on less land than we have access to. But to meet the demand we expect during our planning horizon, we'll have to use our footprint more intensively. We can do this in several ways: by developing higher-density facilities, by preserving airside space for the operations that need it most, and by having end users such as cargo handlers move to common-use facilities from the current exclusive-use model – to cite just a few examples.

As Toronto Pearson becomes a top-tier global hub airport, we need to ensure that land use decisions are rigorously tested against key strategic priorities. We've therefore developed a hierarchy that considers first the operational value of a given use, then its economic value and finally its implications for traffic flow. This clear, consistent framework will also be used in our sub-area plans, helping ensure we make land use choices that deliver the greatest value to our customers and partners, and to the entire region.

Mitigating the Impact on Communities

Noise Management. The reality is that aircraft arriving and departing from Toronto Pearson create noise, which can annoy our neighbours. The good news is that aircraft have grown quieter and continue to do so. Also, air navigation technology is becoming more precise. However, it's not necessarily helpful to talk in terms of averages, as few people experience "average noise." Within our powers, the GTAA is committed to measuring, minimizing, mitigating and ameliorating adverse noise impacts on communities in the most effective manner possible.

The regulatory requirement for an airport Master Plan in Canada is to produce Noise Exposure Forecasts (NEFs). Such forecasts produce noise contours defined by noise levels at various locations surrounding an airport. Generally, residential development is not permitted within the 30 NEF contour. We acknowledge that the NEF is not the only or best measure of noise impacts, but it does serve a function in land use planning. Consistent with best practice for airports today is to run a series of scenarios based on potential runway operating patterns, aircraft fleet mixes, stage lengths, and day and night operations to create a Multiple Scenario Envelope NEF contour or

MSE NEF. The GTAA is in the process of producing a new MSE NEF contour for 2037; we're engaging with our neighbouring municipalities and other interested stakeholders regarding its implications. Once this consultation process is complete, a final MSE NEF will be issued.

Minimizing Our Environmental Footprint. From the Etobicoke Creek Trail to our Green Commuter Rebate program, at Toronto Pearson we take both large and small steps to minimize our environmental impact and protect the natural areas and resources surrounding our airport. For example, a key driver of our investment in the Regional Transit Centre is our commitment to reducing emissions from ground transportation on the currently congested roads around Toronto Pearson.

The GTAA is committed to ensuring all activities at our airport are carried out in an environmentally responsible manner, even as we respond to steadily rising demand for air travel. We've adopted a robust Environmental Management System (EMS) to help us pursue continuous improvement in our sustainability practices. Its key areas of focus are to reduce our contribution to climate change and to mitigate the environmental impact of our operations – which includes tracking all of the resources we use and the waste we generate. Our environmental program will guide our decision-making as we move forward with the various projects and practices outlined in this Master Plan.

Consultation

This Master Plan has been informed – and improved – by an extensive process of stakeholder consultation. Our stakeholders represent a complex network of highly engaged groups and organizations, including business partners, governments, community groups, labour unions and individual customers and area residents. All play critical roles in helping us maintain and improve Toronto Pearson's connections to local communities while delivering best-in-class customer service, operating our airport safely and addressing the concerns and priorities of those who are affected by our operations.

We're constantly at the table with our diverse stakeholders. They help us stay alert to the latest changes, challenges and opportunities affecting Toronto Pearson. They keep us connected to our surrounding neighbourhoods, to the regional and national economies, and to the global aviation industry. Throughout the development of this Master Plan, we've engaged in a wide range of discussions, including meetings with key business partners, public workshops, open houses, surveys and gatherings of standing committees such as the Community Environment and Noise Advisory Committee (CENAC).

Planning Principles

At the GTAA, we embrace our obligation to manage growth sustainably, and we view long-range planning for Toronto Pearson as a continuous, adaptive process. Recognizing that the trends we describe and the changes we anticipate may not materialize at precisely the scale we expect – or according to the timelines we anticipate – we've made the proposals in this Master Plan modular and flexible. In planning for the next two decades, we're not making a commitment to expand certain facilities at specific times; in a rapidly changing world, we clearly can't know for sure whether the levels of demand we project today will materialize and necessitate all of the projects we've outlined. Rather, we've designed this Master Plan to let us respond and adapt to the needs of our stakeholders as conditions evolve.

We'll continue to monitor the changes that affect Toronto Pearson's operating environment – from economic, environmental and social realities to emerging technologies and industry trends – to ensure our processes and facilities consistently match the needs of the people, communities and economies we serve.

In summary, our planning for the next two decades will be guided by the following core principles:

- Maximize economic benefits to communities while minimizing greenhouse gas emissions and other potentially negative impacts.
- Recognize that rapid technological change will demand ongoing adaptation and require us to be innovative.
- Coordinate our planning with that of our neighbours and partners.
- Divide our 20-year planning horizon into shorter increments of detailed study and action.
- Develop flexible plans that help us respond in a timely way to changes in our environment.

Conclusions and Recommendations

1. Maximize the economic benefits our airport delivers to the city, region and nation while minimizing greenhouse gas and other emissions, and mitigating and ameliorating as effectively as possible the impact of aircraft noise on surrounding communities.
2. Work with our partners in the Southern Ontario Airport Network to ensure all users of our collective services – passengers, carriers, cargo shippers and other aircraft owners – have a range of convenient and efficient airports to choose from.
3. Fundamentally change ground access patterns for passengers and airport employees in favour of higher-occupancy, lower-emission vehicles. We aim to achieve this through a combination of supply-and-demand and land use policies, anchored by the proposed Regional Transit Centre, as well as continued adaptation to new technologies and business models in urban mobility. The Toronto Pearson transit hub would be served by emerging regional rail services, providing another access option from more distant parts of Southern Ontario and preserving valuable runway capacity for long-haul flights.
4. Leverage the Regional Transit Centre to improve mobility for people in surrounding communities (especially along the GTA's Northern Arc), boosting the region's productivity and competitive advantage while supporting collaboration among all levels of government on land use and transportation throughout the Airport Employment Zone.
5. Implement short-term measures to address current challenges affecting ground access and curb congestion, including examining ways to reduce the number of intra-airport vehicle trips.
6. Harness the trend towards larger, high-density, more fully occupied aircraft, as well as advances in air navigation technology, to potentially divert some short-haul demand to ground-based modes of transport, maximizing the productivity of our existing runway system.

7. Work, in collaboration with air carriers, government agencies and other business partners, to respond to their strategies to build a global hub at Toronto Pearson and serve a projected 85 million passengers in 2037.

8. Continue to be responsible and effective stewards of our relatively limited land assets, securing sufficient space to meet the projected demand for airside, passenger terminal and ground access facilities. And with respect to the residual lands set aside for other airport development, allocate and develop these assets to maximum strategic benefit by adopting a hierarchy of operational, economic and locational priorities and related sub-area plans.

2. Retrospective

"We always overestimate the change that will occur in the next two years and underestimate the change that will occur in the next ten." – Bill Gates, *The Road Ahead* (1996)

The First Eight Decades

Toronto Pearson's origins extend back to 1937, when the federal government acquired nine farms in the Malton area to create an airport for the City of Toronto – then a municipality of less than 650,000 people. The same year marked the founding of Trans-Canada Airlines, the crown corporation that would become Air Canada. The new airport's major source of earned revenue was the first-ever contract for airmail services from what is now Canada Post.

Eighty years have transformed both the aviation industry and the region around Toronto. Today those former Malton farms are home to a global hub whose catchment area has a population of about seven million. As Canada's largest and busiest airport, Toronto Pearson is one of the country's most significant pieces of transportation infrastructure and is on track to join a handful of top-tier international airports. As a key centre of air connectivity, we play a unique role in the global movement of people and goods.

Planning for the 21st Century

The GTAA's mandate is to ensure that Toronto Pearson's air services and facilities match the needs of a growing population and a dynamic economy. To deliver on that mandate – and to give our diverse stakeholders opportunities to engage with our planning and strategic priorities – in 1996 the GTAA launched a 30-year vision for the development of Toronto Pearson. That vision has helped us lay the foundations for an airport whose connectivity and capabilities will match Southern Ontario's scale, diversity and growth in the decades ahead. We've replaced outdated infrastructure with state-of-the-art facilities and equipment; optimized our policies, processes and technologies; built a robust program to promote social and environmental responsibility; and fostered strong working partnerships regionally, provincially, nationally and globally.

Toronto Pearson Master Plans

1999 Master Plan *Timeframe: 2000–2020*

Toronto Pearson's first Master Plan defined a long-term vision to maximize our airport's development potential, with a particular focus on creating terminal facilities that would meet growing passenger demand over the next two decades.

2008 Master Plan *Timeframe: 2008–2030*

Our second Master Plan built on the vision articulated in the first. Soon after its publication, however, the global financial crisis caused a significant downturn in the aviation industry. This dramatic change in economic conditions prompted us to optimize the utilization and capacity of Toronto Pearson's existing infrastructure rather than moving forward with new development. As a consequence, over the past decade our focus has primarily been on improving processes and flow – for passengers, baggage and aircraft – and on enhancing the overall airport experience.

2017 Master Plan *Timeframe: 2017–2037*

The current Master Plan presents passenger and cargo transportation forecasts through 2037 and describes the airport infrastructure changes that will be necessary to meet steadily rising demand. We expect Toronto Pearson, as it is currently configured, to approach maximum capacity over the next two decades. Our new plan lays out a range of development options we can pursue, individually or in combination, as we work to accommodate the constantly growing appetite for air connectivity across our region and throughout Canada.

Key Changes Since 2007

Characteristic	2007	2017	Key Takeaway
GTA population	5.9 million	6.9 million	The GTA has grown by 17% in a decade, and that pace continues.
Ultra-long-haul nonstop (>6,000 mi.) destinations served by Toronto Pearson	5	13	Our airport's global connectivity has been growing.
Average airfare (2017 dollars) from Toronto to Vancouver	$284	$215	Flying has become cheaper.
Total Canadian cellphone users	19.9 million	30.4 million	Canadians are more mobile and connected than ever.
Median age of Ontario resident	39	41	Our population is aging.
G7[1] nations' share of global GDP	53%	47%	Emerging economies are growing faster than established ones.
BRIC[2] nations' share of global GDP	16%	21%	
MINT[3] nations' share of global GDP	4%	5%	

[1] Canada, France, Germany, Italy, Japan, United Kingdom, United States.
[2] Brazil, Russia, India, China.
[3] Mexico, Indonesia, Nigeria, Turkey.

Table 2-1: Key Changes Since 2007

3. Guiding Principles and Processes

A global hub airport operates with a much longer time horizon than most enterprises. The GTAA develops annual and five-year business plans within a 20-year strategic framework that positions Toronto Pearson to keep pace with rising demand by optimizing existing facilities before investing in new infrastructure. At the same time, we must remain agile in the face of accelerating change – whether we're responding to uncertainty in the economic and political context or embracing new technologies such as artificial intelligence and autonomous vehicles. The same factors have shaped this Master Plan, which assesses the capacity we'll need to support anticipated growth while operating safely, efficiently and sustainably – and delivering the best possible passenger experience.

Guiding Principles

Our planning for the next two decades will be guided by the following core principles:

Maximize economic benefits to communities while minimizing negative impacts to communities.

We understand that our airport's growth – and how we manage it – affects people, businesses, communities and the environment. We're committed to minimizing the negative effects of our operations on local communities. We're equally dedicated to ensuring that the economic benefits of Toronto Pearson are widely shared. Many of the mechanisms for engaging with our neighbours and other stakeholders during the timeframe of this Master Plan are already in place. These include:

- our Noise Management Program, which includes technical and operational noise mitigation measures, as well as regular public consultations and feedback sessions with residents and elected representatives from neighbouring communities.
- our Environmental Program, which includes efforts related to stormwater management, waste management, the responsible handling of runoff from our deicing facilities, energy conservation and the mitigation of greenhouse gas and other emissions.
- our Community Investment Program, which (as of 2015) allocates 1 per cent of our pre-tax profits to charitable initiatives that create pathways to employment and build stronger communities.

The GTAA's evolving sustainability framework explicitly considers the economic, environmental and social dimensions of all decisions and strategic initiatives shaping the future of Toronto Pearson.

Recognize that rapid technological change will demand our ongoing attention and adaptation.

Transformative developments such as robotics, machine learning and heightened cyber-security add a new dimension of uncertainty to any long-term planning process. What is certain today is that we must be alert to emerging developments and thoughtful about their implications for our work. Just a few examples of recent trends that could have significant implications for Toronto Pearson:

- Advances in air traffic control technology already allow aircraft to fly closer together, thus increasing the capacity of our existing airfield (and associated airspace) without compromising safety.
- As passenger-processing technology continues to advance and more travellers make use of options like self-service check-in and bag drop, terminals will be able to serve more people in less space.
- The advent of self-driving vehicles – already being piloted in many parts of the globe – could have a profound effect on Toronto Pearson's ground access facilities and traffic management in the coming years.

In short, new technologies are already changing the physical requirements of our airport, and the interplay between innovative capabilities and existing infrastructure will no doubt alter our idea of what's needed – and possible.

Integrate our planning with that of our neighbours and hosts.

Toronto Pearson anchors the Airport Employment Zone (AEZ) – with more than 300,000 jobs, the second-largest employment cluster in Canada after downtown Toronto[1]. Our planning work must be mindful of the priorities of the nearby communities we're here to serve: Mississauga, Toronto, Brampton and Peel. Aligning our plans with those of our municipal, regional and provincial government partners is the best way to ensure shared success in the future.

Be an active, collaborative participant in a network of thriving regional airports.

To achieve our full potential over the course of this Master Plan, Toronto Pearson must grow and develop in concert with other airports across Southern Ontario. Taking advantage of existing capacity elsewhere in the region will spread the economic benefits of aviation more broadly while enabling our airport to excel at offering the global connectivity and range of services we're uniquely equipped to deliver.

Develop flexible plans that help us respond in a timely way to changes in our environment.

This Master Plan consciously avoids concrete pronouncements about specific infrastructure changes we'll need to implement at particular points in time. Instead, we offer evidence and analysis of the evolving conditions we expect to face in the future. And we identify what we view as the triggers – including demand levels and technological advances – that will require changes to Toronto Pearson and its associated facilities. In looking forward two decades, this plan also recognizes that certain conditions may materialize sooner – or later – than today's projections suggest.

Divide our 20-year planning horizon into shorter increments of detailed study and action.

This Master Plan identifies and articulates desirable end-states for 2037: the facilities, operations and relationships that will allow Toronto Pearson to perform effectively as a top-tier international airport and drive prosperity across our region and beyond. As we navigate toward our vision for 2037, we'll also develop shorter-term plans allowing us to pivot and adapt in response to actual trends, technologies and demand levels.

1 *"Unlocking the potential of the airport megazone", Neptis Foundation*

Processes

Many of the issues discussed in this Master Plan require extensive, multidisciplinary analysis and input from a wide range of stakeholders, including technical experts, business partners, local communities and all levels of government. While relevant considerations will vary depending on the topic under review, we'll rely on the following framework in shaping a comprehensive view of the implications of any given project or decision:

Economic	Environmental	Social
Capacity	Greenhouse gas and common air contaminant emissions	Aircraft noise impacts on nearby communities
Operational efficiency	Energy consumption	Vehicle traffic impacts on nearby communities
Impacts on customers	Water consumption	Economic opportunities for challenged communities
Impacts on business partners	Water quality	Recreational opportunities (e.g., Danville Park)
Impacts on government agencies	Land use efficiency	Our population is aging
Capital costs	Impact on habitat	Impacts on Indigenous communities
Operating costs		
Revenue		
Delivery time		
Flexibility		
Risk		
Redundancy		

Table 3-1: Process Considerations

4. Overview and Strategic Context

All airports must plan and invest for the future on a larger scale than most enterprises. By definition, we have a broader reach, whether measured by physical infrastructure, catchment area or international connections. What's more, our planning timelines tend to be exceptionally long, for a number of reasons: Our operations are integrated with other public infrastructure. Our actions are subject to diverse regulatory requirements. And, put simply, our airport is a complex multi-modal operation that is harder to reshape than another type of transport hub, or even a sophisticated industrial facility.

Introduction

In this chapter we look at the wider socioeconomic context in which Toronto Pearson operates. While focusing primarily on the immediate GTHA region, we also consider our airport's role in Southern Ontario and the entire province. In addition, we look at our current strategic direction in terms of the planning frameworks and organizational commitments that inform and complement this Master Plan. The expectations built into our planning are grounded in the belief that the vibrant region on our doorstep is likely to continue growing – in population, economic dynamism and social diversity – over the next 20 years and beyond.

Moving from Today to Tomorrow

Toronto Pearson sits at the centre of one of North America's most prosperous regions. As Southern Ontario has grown over the past two decades, so has the international airport that provides connections to the rest of Canada and destinations around the globe. Indeed, our region's strong economic performance has been reflected in, and driven by, Toronto Pearson's emergence as one of the world's fastest-growing hubs.

Today, as the nation's largest airport, Toronto Pearson plays a vital role in Canada's social and economic life. Both the opportunities and the demands that come with this role will only grow in the years ahead. Our region's diverse, well-educated residents will continue to explore the world and strengthen ties with friends and family abroad. Our increasingly connected economy will drive further demand for business travel and cargo services. Toronto Pearson's geographic location and global links will draw increasing numbers of international and connecting passengers. And the economic activity in our immediate area will continue to gain momentum – notably in the Airport Employment Zone (AEZ), which is already a thriving workplace for more than 300,000 people in a wide range of sectors.

This Master Plan outlines how we intend to adapt Toronto Pearson's land and facilities in the years ahead as we address the needs of the people and businesses that rely on us. And it maps out how we aim to serve an increasing number of passengers, move growing volumes of freight and support an expanding team of airport employees and partners – all while managing our growth responsibly.

The GTAA's Strategic and Business Planning Tools

The GTAA is a not-for-profit corporation that has managed Toronto Pearson since 1996. We support our operations and capital investments with revenue from commercial activity; our airport is not subsidized by taxpayers. About 70 per cent of the GTAA's revenue comes from aeronautical sources, such as landing fees paid by air carriers, while 30 per cent comes from non-aeronautical activities like parking, retail shops and concessions. In 2016, the GTAA generated $85.5 million in net income from $1.3 billion in total revenues.

Over time, the GTAA has achieved a strong record of revenue growth, operational efficiency and customer service. We've also remained competitive in our aeronautical rates: landing and terminal fees paid by our air carriers have fallen by between 25 per cent and 30 per cent since 2006. And critically, we've made more than $850 million in capital investments between 2010 and 2016 to meet the growing demand for air connectivity in our region and beyond.

Strategic Framework

Long-term planning at the GTAA is aligned with our 20-year strategic framework, the current version of which was approved by our Board of Directors in 2015. Within this framework, we develop one-year and five-year business plans, as well as annual budgets.

Our 20-year strategic framework sets out six key priorities that inform all of our business activities and organizational decisions:

Safety. Focus on the safety and security of everyone who visits or works at our airport.

People. Develop a talented, high-performing workforce to achieve our vision.

Passenger and Customer Service. Pursue operational efficiency while providing a superior travel experience.

Financial Sustainability. Generate sufficient returns to support our day-to-day operations and invest in infrastructure, customer service and debt reduction.

Aviation Growth. Expand connectivity to benefit the surrounding region, Ontario and all of Canada.

Corporate Responsibility. Work with our stakeholders to preserve the environment and support thriving communities.

These six strategic priorities are also integral to the Master Plan, which makes concrete their implications for how we will deploy, modify and manage Toronto Pearson's facilities and lands. Our planning process must consider any adaptations that will likely be necessary to keep pace with growing demand for aviation services. Within the horizon of this Master Plan, we anticipate investing more than $6 billion to renew existing facilities and accommodate expected growth. Specific areas for investment include delivering superior customer service, enhancing passenger amenities and improving passenger, baggage and aircraft processes.

Background

Toronto Pearson's vision is to become the best airport in the world. We already function effectively as a global hub. Our goal now is to evolve into a top-tier international airport – one of a handful of facilities worldwide offering exceptional connectivity to the global economy. When airports attain top-tier status, they deliver significant benefits to the local and regional economies in which they operate, supporting more jobs, more exports and more investment.

In pursuit of our goal, we plan to extend Toronto Pearson's reach with daily non-stop flights to at least 80 per cent of the global economy. As we expand our service, the volume of connecting passengers – already accounting for nearly a third of total traffic – will steadily grow. This growth, in combination with new aircraft technology and fuel efficiency, will allow carriers to fly greater distances to more destinations, and to add more frequent flights than our local market alone could support. Together, these changes will stimulate yet more traffic.

Connectivity leads to more connectivity. For example, if it becomes easier to reach Toronto from Madrid, then Toronto will receive more tourists, students and investors from Spain. And as connections among people and

organizations grow, Canadian businesses will find it easier to export to Spanish markets, creating more jobs here at home. As momentum builds around Toronto Pearson's increased service reach and frequency, we anticipate that economic activity linked to our airport will support a projected 700,000 jobs – direct, indirect and induced – across the region. Our aspiration to become a top-tier international airport is strongly aligned with our mandate to grow Ontario's transportation capacity and generate economic activity.

Demographic and Economic Profile of Catchment Area

Because local populations and economies are key drivers of demand for air travel, airport planning relies on an understanding of the people and activities in the immediate catchment area. Stated simply, the amount of air travel to or from a region is a function of three factors:

- *The size and composition of the local population.* A large cosmopolitan centre with high levels of income and education will create strong demand for personal travel to a wide range of destinations. Moreover, as a population ages – irrespective of wealth or education – the propensity for air travel also increases.
- *The scale, vitality and composition of the local economy.* A large and active economy – particularly one that is internationally connected and has a strong service sector – drives demand for business travel and the movement of cargo.
- *The attractiveness of the region to visitors.* They may be drawn to the area as a place to vacation, invest or study.

Toronto Pearson's catchment area extends well beyond the GTA. About 80 per cent of passengers who start their trips within a 300 kilometre radius drive to our airport.

Figure 4-1 maps the postal codes of passengers who started air journeys at Toronto Pearson in 2016. Cells with stronger gradations of red indicate higher percentages of Toronto Pearson travellers. The mapped data shows that while most of our originating passengers come from the GTA, our catchment area extends south to the Niagara Peninsula, west to Lake Huron, north to Georgian Bay and east to Peterborough and the Kawarthas.

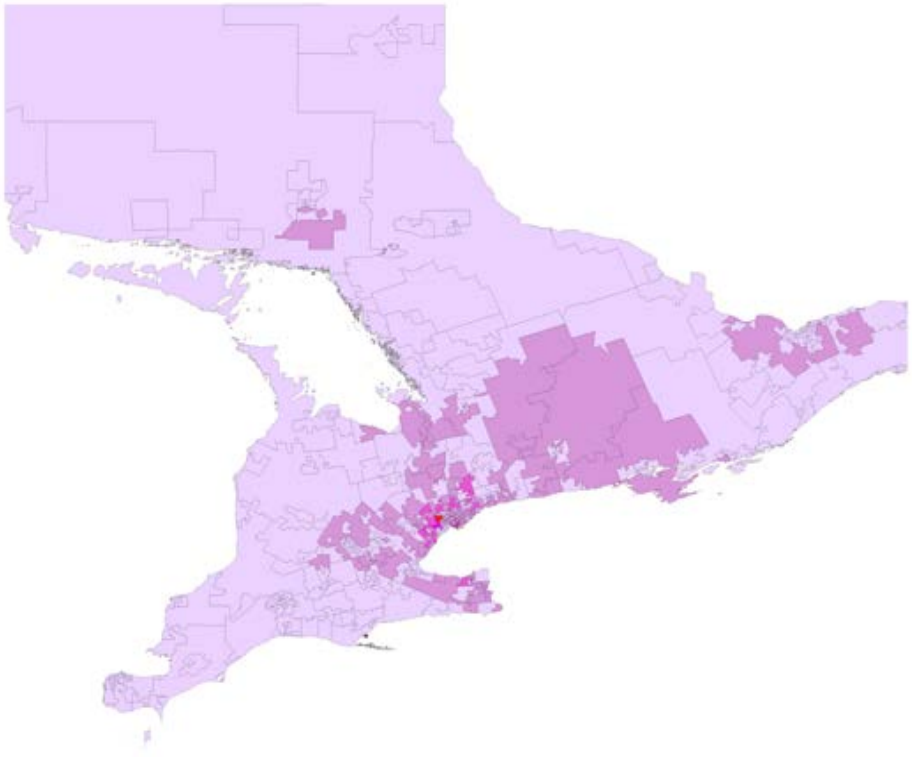


Figure 4-1: Postal Codes for Passengers Beginning Air Journeys at Toronto Pearson (2016)

Demographic Profile

More populous areas typically have higher demand for air travel. But not everyone within a region is equally likely to use aviation services. The propensity for personal air travel tends to increase with age, with higher income and with greater educational attainment. Notably, immigration status or history tend not to drive demand for air travel.

Population. Southern Ontario is the most densely populated and economically productive region in Canada. Currently home to more than 11 million people, it's expected to grow at a rate of 0.8 per cent annually and reach a population of 15 million by 2043. The vast majority of Southern Ontario residents – 88 per cent – live in the metropolitan areas of 10 cities: the Greater Toronto Area (51 per cent, excluding Durham region), Kitchener-Waterloo (7 per cent), London (4 per cent), Hamilton (5 per cent), Windsor (4 per cent), Kingston (1 per cent), Peterborough (2 per cent), the Niagara Falls/St. Catharines region (4 per cent), Oshawa (6 per cent), and the Lake Simcoe region (4 per cent). Further urbanization of Southern Ontario through 2043 will likely add another 2.8 million people to these key metropolitan areas. The Greater Toronto Area (GTA) will add 1.7 million people between 2017 and 2043; about 500,000 of those residents are expected to live in the Western GTA and 160,000 in the Eastern GTA. The Golden Horseshoe is projected to grow by 440,000 people in the same period.

Age. The number of seniors in Southern Ontario is projected to increase both in absolute terms and as a proportion of the region's overall population. By 2041, the number of people aged 65 and older will more than double – from 2.2 million in 2015, or 16 per cent of the population, to over 4.5 million, or 25.3 per cent of the total. Growth in the share and number of seniors will likely accelerate between 2015 and 2031 as the majority of Baby Boomers pass the age of 65. After 2031, however, this growth is projected to slow markedly.

These age trends are significant for airport operators both because seniors have a high propensity for air travel and because older people are more likely to have mobility impairments. We must ensure that our facilities and services remain responsive to the needs of this important group of airport users.

Education. The Toronto region has comparatively high levels of educational attainment. In 2015, 58.8 per cent of the region's residents aged 15 or older had completed some form of postsecondary education – a rate higher than both the provincial (55.6 per cent) and the national (55.4 per cent) average. It's noteworthy that the Toronto region, as a key market for our airport, stands out within a country that already ranks among the most highly educated in the world, according to the Organization for Economic Cooperation and Development (OECD).

Economic Profile

A large, internationally connected population has the potential to drive strong demand for air travel – but an obvious precondition is purchasing power. This section outlines some of the economic characteristics of the region around Toronto Pearson, including the employment landscape, as well as broader conditions such as trends in Gross Domestic Product (GDP) and growth or decline in specific sectors.

GDP. GDP is a key factor in developing aviation forecasts. A strong and growing economy in which people have high disposable incomes typically generates strong demand for air travel both for business and leisure.

Over the 2014–2016 period, Ontario's GDP growth exceeded the national average. The province's GDP represents about 40 per cent of the national total. Industry sectors that contribute the most to economic activity include manufacturing; the combined finance, insurance and real estate industries; health care and social services; wholesale trade; and professional and technical services.

Toronto Pearson's growth closely tracks both national and provincial GDP. However, over the past decade our passenger traffic has grown at a faster rate than the overall economy. Between 2006 and 2016, Toronto Pearson's growth rate was 2.3 times that of Canadian GDP; between 1989 and 2006, by contrast, our growth rate was 1.4 times higher. This relative acceleration has been driven by a number of factors, including changes in the structure of the economy, increased commerce with emerging markets and the declining real cost of air travel. All have combined to increase the amount of air travel Canadians consume per unit of economic output.

Employment. Employment in the Greater Golden Horseshoe and beyond has been growing steadily, with Southern Ontario now accounting for 85 per cent of employment in the province and 33 per cent across the country. The average unemployment rate in Ontario from 2014 to 2016 was the same as the national rate: 6.9 per cent.

The service sector – which includes business and financial services, professional and technical services firms, and arts and culture organizations – now accounts for about 80 per cent of Ontario's economy and is an increasingly important source of employment. Meanwhile, the goods-producing sector has a steadily declining impact on job creation, partly due to automation, and also because many manufacturers have moved to jurisdictions where labour costs are lower. Our 2008 Master Plan reported that 25 per cent of Ontario jobs were related to the production of goods; that proportion has since fallen to 20 per cent.

These trends are important to Toronto Pearson's forecasting, as the service sector spends an estimated 23 per cent more than the goods sector on air transportation per unit of output. We can expect further growth in demand for business-related air travel as Ontario's economy continues to shift into areas where it's most competitive, such as advanced manufacturing, health care, higher education, consulting services, specialized business services, and research and innovation.

Household Spending on Air Travel. Higher household spending on airline tickets is associated with gains in income and educational attainment, as well as age. In the GTA, which has relatively high levels of income and education, household spending on air travel is greater than in the rest of Southern Ontario and is well above the provincial average.

As incomes rise, education levels continue to rise, and as the population ages, we expect the propensity for air travel to increase as well.

CMA	Average Household Per Capita Spending on Airline Tickets in 2013
Barrie	$226
Brantford	$206
Hamilton	$275
Kingston	$253
Kitchener-Waterloo	$249
London	$249
North Bay	$175
Ontario	$271
Oshawa	$239
Sarnia	$241
St. Catharines-Niagara	$205
Toronto	$355
Windsor	$231

Table 4-1: Average Household Per Capita Spending on Airline Tickets, By City

Source: Statistics Canada Survey of Household Spending 2013

Exports. Canada is a trading nation, and Ontario is a particularly export-oriented economy. Key exports include manufactured goods, as well as services such as tourism and international education. In 2015, exports accounted for 35.8 per cent of Ontario's economy – higher than the national average of 31.5 per cent. Air transportation supports export activity both by allowing the rapid shipment of goods and by helping businesspeople connect with national and international markets. In 2015, about 13.5 per cent of Ontario exports, with a value of $34 billion, departed by air from Toronto Pearson.

The relationship between export activity and aviation relies not only on service – the frequency and diversity of direct flights from Toronto Pearson, for instance – but also on equipment. Wide body aircraft, which are being used more and more by carriers (see *Demand Forecasts* on page 29), bring additional capacity to the marketplace by increasing the amount of belly cargo space while reducing the cost of shipping. After conducting an analysis that isolates the effects of wide body aircraft from all other factors driving cargo volumes at Toronto Pearson, we've found that a 10 per cent increase in the number of wide body aircraft stimulates a 1.0 per cent uptick in cargo volume passing through our facility.

Tourism. Tourism plays an important role in Southern Ontario's economy, and Toronto is a particularly strong draw. The leading tourist destination in Canada, Toronto welcomed about 40 million visitors in 2015, more than 35 per cent of them for overnight stays or longer. Visitors to the city spent a total of $7.2 billion in areas such as transportation, accommodation, food and beverage, entertainment and retail. On a national level, 42 per cent of visitors to Canada who travel by air arrive through Toronto Pearson.

American visitors made up the largest share of overnight visitors in 2015: 2.48 million tourists came to Toronto from the United States, spending $1.32 billion. Our city also welcomed 1.75 million visitors from overseas, who accounted for an additional $1.49 billion in direct spending.

Emerging business models in accommodations, notably Airbnb, have the potential to further boost tourist traffic, as they provide a greater selection of places to stay and offer a wider price range to travellers.

International Education. According to the provincial Ministry of Education, "Ontario is recognized around the world as a leader in providing a high-quality education in a system that is safe, welcoming and accessible. It is a destination of choice for students and families from around the world." Ontario has more than 600 post-secondary institutions that attract faculty, staff and students from across Canada and overseas. International students generate air trips – on average about five per person – as they arrive from abroad; visit friends and family on holidays; travel as tourists to the rest of Canada or elsewhere; and ultimately return home or move to the next phase in their education or career. According to the Council of Ontario Universities, of the 515,000 students enrolled at its member schools across the province in 2016, almost 60,000 were international students representing over 190 countries.

Foreign Direct Investment. Ontario is an increasingly important market for foreign direct investment (FDI), which contributes to regional economic growth while strengthening ties between the province and the world – driving demand for air travel. According to the provincial government, 8 per cent of all FDI targeting North America in 2016 flowed to Ontario – up from 6 per cent in 2015. The province's share of Canadian FDI also grew: from 217 projects in 2015, or 47 per cent of the national total, to 242 projects or 53 per cent the following year. During the same period, the number of FDI projects in Ontario grew by 17 per cent, while the value of capital investment increased from $4.1 billion to $4.5 billion.

5. Demand Forecasts

The pressure on Toronto Pearson to provide convenient, efficient global connectivity continues to grow. What has changed is how this steadily rising demand will manifest itself in our airport. Passenger traffic is projected to grow at 3.1 per cent per year[2], higher than forecast in our last Master Plan. But we now foresee lower growth in total aircraft movements, at 1.5 per cent annually. This shift mirrors a broader trend in aviation: as we serve more and more people travelling to and from an expanding array of destinations, they'll typically be flying on larger planes with more passengers aboard – as well as cargo.

Introduction

In preparing this Master Plan, we've developed a new set of 20-year forecasts for passenger traffic, cargo volumes and aircraft movements that consider a broader range of factors driving demand for air transportation. Economic, social, demographic and technological trends all influence demand for aviation services. We've gathered as much trend data and other relevant information as possible and used a comprehensive, probability-based forecasting model to generate the most realistic scenarios for the future.

As we did in our last Master Plan, we've once again examined economic drivers such as passengers' disposable income and patterns of regional growth – looking in particular at employment and GDP. Another key consideration is the cost of air travel, which is influenced by competition among carriers; travellers' preferences for other modes of travel; fuel costs (driven by market pricing, as well as aircraft fuel efficiency); airport and air navigation fees; labour costs; and the changing structure of the airline industry. Other factors that influence airfares include taxes, regulations and related government policies. For example, the introduction of a carbon tax, the status of Canada's free trade agreements, and the federal government's visa and international air policies could all affect the price of airline tickets.

We incorporate these and other factors into our model to project as accurately as possible the number and size of aircraft, the number of passengers and the quantity of cargo we must be prepared to accommodate in the years ahead. Our enhanced forecasting model also allows us to test for potential shocks to the system resulting from sudden inflections in the growth rate within an overall upward curve.

Aviation Forecasts

Aircraft Movement Forecast

Most Likely Scenario. Aircraft movements (takeoffs and landings) will increase to 632,000 in 2037 from today's level of 478,000. This increase reflects an annual growth rate of 1.5 per cent.

Low and High Estimates. Between 540,000 and 676,000 aircraft movements in 2037.

2 *All growth rates compounded annually (CAGR).*

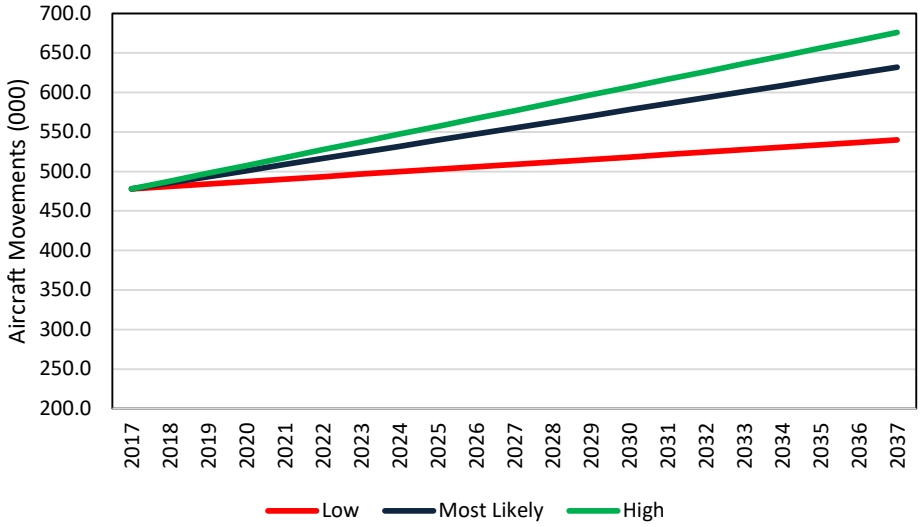


Figure 5-1: Forecast Aircraft Movements

There is growing demand for air travel worldwide, but major airports have finite runway capacity. As a result, planes are getting fuller. However, passenger and cargo loads are constrained by aircraft size. And with load factors (the percentage of seats occupied) already standing at 82 per cent on an annual average basis, unused capacity is limited. So in addition to fuller cabins, there is also a global trend toward larger aircraft.

Because of the shift to larger, more fully occupied planes, we project faster growth in passenger and cargo volumes than in aircraft movements. In the years ahead, proportionally fewer flights will move more people and goods. By 2037, the average number of passengers on a plane passing through Toronto Pearson will be 140, up from 108 today. This represents a 30 per cent increase in the productivity of our runway system.

We also anticipate that many short-haul flights currently serving Toronto Pearson will cease. Some may be replaced by ground transportation, especially as inter-city rail improves in Southern Ontario. Other regional flights that currently connect through Toronto Pearson will likely be able to bypass Toronto as growth in regional markets makes more non-stop routes between smaller centres viable.

Our 2008 Master Plan did not fully appreciate the speed and impact of the trends driving increased runway productivity. As a result, we overestimated aircraft movements. Figure 5-2 shows that in recent years, actual aircraft movements have been on or below the low-forecast line of our last Master Plan. In 2008, we projected that Toronto Pearson would need to accommodate 700,000 aircraft movements by 2030 – a volume that would have exceeded our current runway system capacity. In light of more recent evidence, we now forecast 578,000 movements in 2030 – 17 per cent fewer than our 2008 projection. As a consequence, we envision comparatively less pressure on our runways over the next decade.

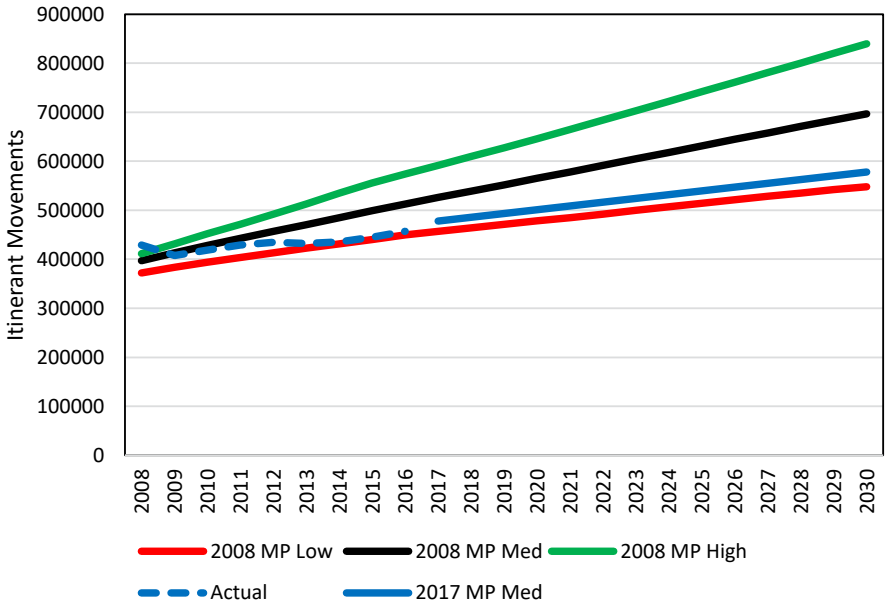


Figure 5-2: Aircraft Movements: 2008 and 2017 Master Plan Forecasts

Passenger Forecasts

Most Likely Scenario. The total number of passengers flying to, from or through Toronto Pearson will increase to 85 million in 2037 from 47 million today. This forecast reflects an annual growth rate of 3.1 per cent.

High and Low Estimates. Between 60 million and 100 million passengers in 2037.

As Toronto Pearson evolves into a top-tier international airport, from 2017 through 2037 we anticipate robust growth – 2.6 per cent compounded annually – in the number of passengers beginning or ending air journeys at our airport. We expect even stronger growth over the same period in the number of passengers making connecting flights: 4.0 per cent compounded annually.

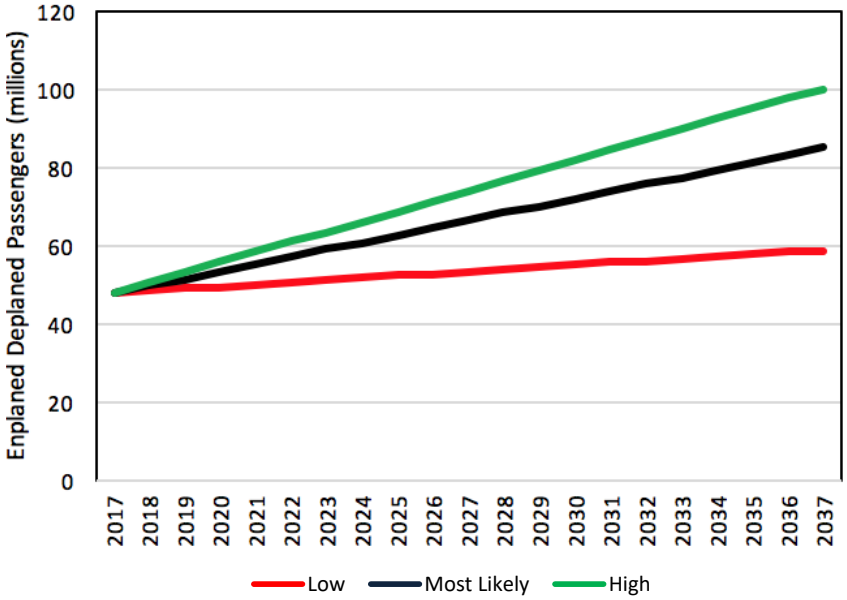


Figure 5-3: Forecast Enplaned/Deplaned Passengers

Our new forecast is higher than what we reported in our last Master Plan. We now project 71 million passengers in 2030, as compared to our 2008 projection of 63 million. Actual passenger traffic at Toronto Pearson has accelerated significantly since 2013 and is now roughly in line with our high forecast from 2008. Our current Master Plan takes account of this shift and what it indicates regarding future traffic growth.

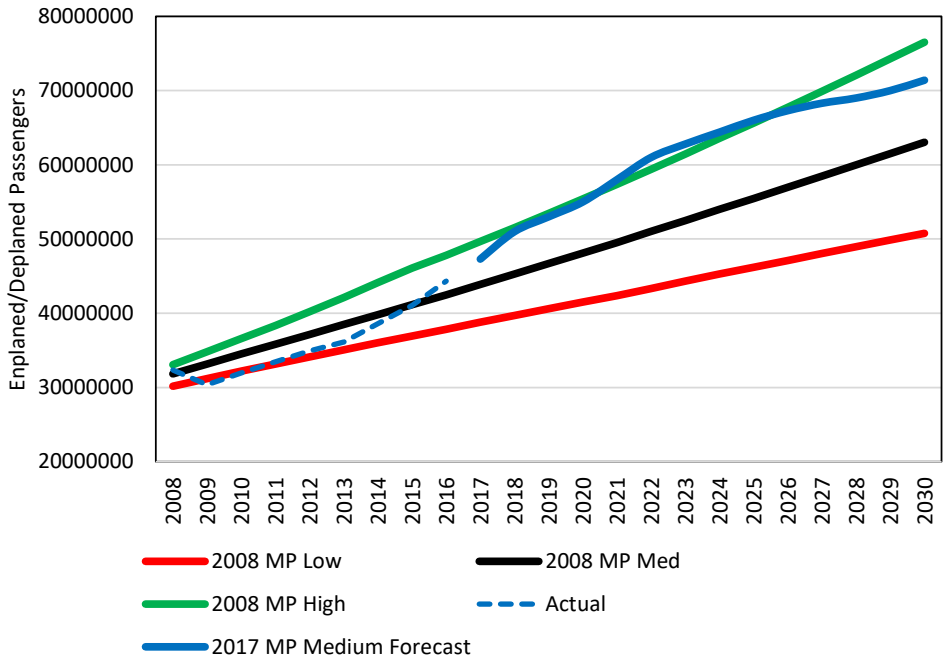


Figure 5-4: Enplaned/Deplaned Passengers: 2008 and 2017 Master Plan Forecasts, Actual

Three main factors are driving the higher passenger traffic forecasts in this Master Plan:

- Ontario's economy has fundamentally shifted away from goods and toward services. The service sector is more dependent on air transportation per unit of output.
- It's become cheaper to fly. Over the past 20 years, the amount of time an average Ontario worker must work to earn enough money for a domestic airline ticket from Toronto Pearson has fallen from 13 hours to 8 hours.
- Air connections through Toronto Pearson are steadily expanding – especially to emerging markets, where demand for air travel has surged. People making connecting flights now account for 31 per cent of Toronto Pearson's passenger traffic, and that proportion is expected to grow. As a global hub airport, Toronto Pearson is connected to 67 per cent of the world's economy through daily, non-stop scheduled service, including to large, growing markets like China, India and Brazil.

Cargo Forecasts

Most Likely Scenario. The volume of cargo enplaned or deplaned at Toronto Pearson will increase to 958,000 tonnes in 2037 from 450,000 tonnes today. This scenario reflects an annual growth rate of 4.1 per cent.

Low and High Estimates. Between 635,000 tonnes and 1,250,000 tonnes in 2037.

Toronto Pearson handles about 50 per cent of the international air cargo in Canada, making our airport a critical link in the supply chain of Canadian businesses. Toronto Pearson serves not only as a gateway for shipments originating in or destined for the Greater Toronto Area, but also as a major connection point for cargo travelling between other locations in Canada and worldwide. In addition to truck-to-air transfers, Toronto Pearson is an active hub for truck-to-truck cargo processing.

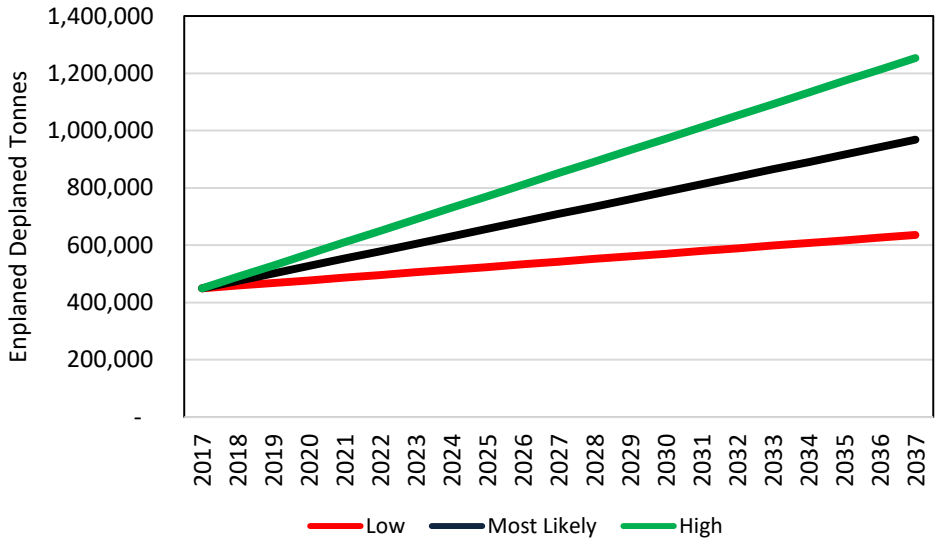


Figure 5-5: Forecast Enplaned/Deplaned Air Cargo

Our 2008 Master Plan forecast 1,274,000 tonnes of cargo in 2030; at 774,000 tonnes, our revised projection for 2030 is considerably lower. The shifting trends that have caused us to adjust our forecasts appear to be driven by three key factors:

- The last Master Plan forecast an increase in the number of dedicated freighter aircraft serving Toronto Pearson; this increase has not materialized. Freighter demand has decreased by 28 per cent over the last eight years, from 8,875 movements in 2008 to 6,364 in 2016. Most air cargo still arrives and departs in the bellies of passenger aircraft, particularly wide body international flights.
- Hamilton International Airport has attracted increasing cargo volumes in recent years. This growth has likely accommodated demand that would otherwise have come to Toronto Pearson.

- The migration of domestic and U.S. air cargo from passenger air carriers to integrated companies like FedEx, UPS and Purolator has been stronger and more rapid than we envisioned in our last Master Plan.

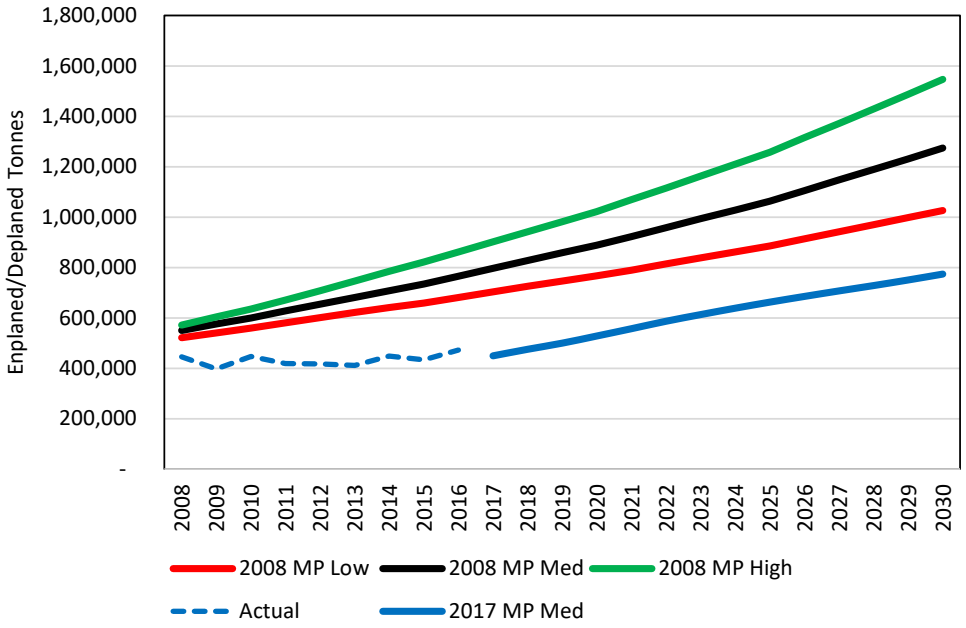


Figure 5-6: Enplaned/Deplaned Air Cargo: 2008 and 2017 Master Plan Forecasts, Actual

Passengers and Cargo Per Movement

The increase in the number of passengers per aircraft movement (see *Aircraft Movement Forecast*, page 29) will have important implications for Toronto Pearson in the years ahead, as it means fewer aircraft movements will be required to meet rising demand for air travel.

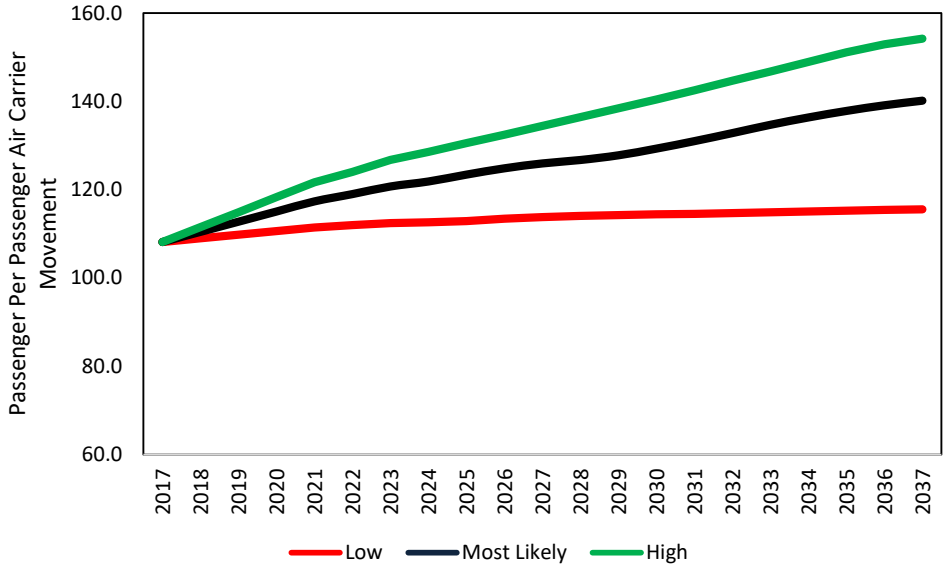


Figure 5-7: Forecast Passengers Per Passenger Air Carrier Movement

Other major North American airports are seeing the same trend toward more passengers per flight. Table 5-1 shows actual and projected passenger volumes at John F. Kennedy International Airport (JFK) in New York and Los Angeles International Airport (LAX). As passenger volumes at both airports grow toward 80 million – a milestone Toronto Pearson expects to reach around 2035 – the average number of passengers per movement is projected to increase by 22 per cent at JFK and 46 per cent at LAX. The 30 per cent increase in productivity we forecast for Toronto Pearson (see page 30) is in line with these two major U.S. airports.

	JFK		LAX	
	Passengers (millions)/year	**Passengers per movement**	**Passengers (millions)/year**	**Passengers per movement**
	50.0	**114**	**50.0**	**80**
	60.0	**131**	**60.0**	**81**
	70.0	**137**	**70.0**	**114**
	80.0	**139**	**80.0**	**117**
Total % increase	**60%**	**22%**	**60%**	**46%**

Table 5-1: Passengers Per Passenger Air Carrier Movement Trends at JFK and LAX

Source: Federal Aviation Administration

Today, the average number of passengers per movement at leading global hub airports is between 33 per cent and 50 per cent higher than at Toronto Pearson. The largest hubs – those already serving between 70 and 80 million passengers annually – do so with an average number of passengers per movement 46 per cent higher than at our airport.

Just as we expect to see more passengers per flight, we also envision proportionally more cargo being shipped with fewer aircraft movements by 2037. Specifically, we forecast:

- a 61 per cent gain in the volume of belly cargo per passenger aircraft movement – made possible by an increase in the number of wide body aircraft, which have additional cargo capacity
- a 100 per cent increase in cargo per freighter aircraft movement
- zero growth in freighter movements. Arrival and departure times for the major integrators (e.g., FedEx) are determined by schedules at their U.S. sorting hubs and are fixed. Additional demand will have to be accommodated with larger aircraft, not with more flights

Forecasts for Facility Planning

To better understand the demands our facilities will face in the coming years and plan accordingly, we break our aggregate passenger traffic forecasts down into projections of hourly and daily passenger and aircraft volumes. Terminal and groundside facilities must be able to accommodate passenger flows during the busiest travel periods. Gates in particular are critical to handling peak-hour traffic effectively.

The charts and tables that follow show our forecasts of peak-hour traffic flows, as well as the rates at which those peaks – and the shoulder periods before and after – will grow. As we plan facility enhancements to meet the needs of tomorrow's passengers and a growing economy, we rely on these hourly demand projections, as well as breakdowns of this data by sector and terminal. Furthermore, they can reflect demand management of traffic so that facilities such as runways and terminals are able to provide good levels of service to our passengers and airline partners on a consistent and sustainable basis.

Peak-Hour Forecasts and Growth Projections

Peak-Hour Passenger Movement Forecasts

	Enplaned/Deplaned		Origin/Destination		Connecting Passengers	
	Arr	Dep	Arr	Dep	Arr	Dep
2017	7,500	6,800	4,800	4,500	2,800	3,300
2022	9,400	8,600	6,400	5,700	3,500	3,700
2027	9,900	9,400	6,600	5,900	3,700	4,200
2037	11,600	11,700	7,700	6,400	4,200	5,600

Table 5-2: Peak-Hour Passenger Movement Forecasts

Based on existing and projected flight schedules

After analyzing trends in the three types of passenger traffic through Toronto Pearson – domestic, international and Canada-U.S. transborder – we forecast especially robust growth in the volume of international and connecting passengers. Both are key indicators of the increased connectivity that helps to drive economic growth.

Peak-Hour Passenger Movement Forecasts

		Enplaned/Deplaned		Origin/Destination		Connecting Passengers	
		Arr	Dep	Arr	Dep	Arr	Dep
2017–2022	Domestic	5.0%	2.5%	4.5%	7.6%	5.0%	2.1%
	International	2.9%	6.7%	2.1%	6.6%	9.9%	6.2%
	Transborder	2.6%	3.2%	1.4%	3.7%	5.2%	1.7%
	Combined	4.6%	4.8%	6.2%	5.1%	4.3%	2.2%
2017–2027	Domestic	2.8%	1.5%	2.0%	3.6%	2.8%	2.1%
	International	2.4%	3.6%	1.4%	3.1%	5.4%	4.7%
	Transborder	2.4%	3.3%	1.8%	2.7%	3.9%	3.5%
	Combined	2.8%	3.2%	3.3%	2.8%	2.8%	2.6%
2017–2022	Domestic	1.8%	1.1%	1.3%	1.7%	1.9%	2.0%
	International	1.5%	3.8%	1.6%	3.0%	3.2%	5.5%
	Transborder	2.9%	3.0%	1.6%	1.9%	4.0%	3.5%
	Combined	2.2%	2.7%	2.4%	1.8%	2.0%	2.7%

Table 5-3: Peak-Hour Growth Rate Forecasts

Note stronger growth in international and connecting passengers

Peak-Day Profiles

As a complement to our peak-hour forecasts, we also model typical busy days. Peak-day profiles enable us to track growth in passenger traffic during the shoulder periods around peak hours and generally help to contextualize peaks within the normal fluctuations of airport traffic. Limits noted in Figure 5-8 are indicative of demand management associated with aircraft movement activity.

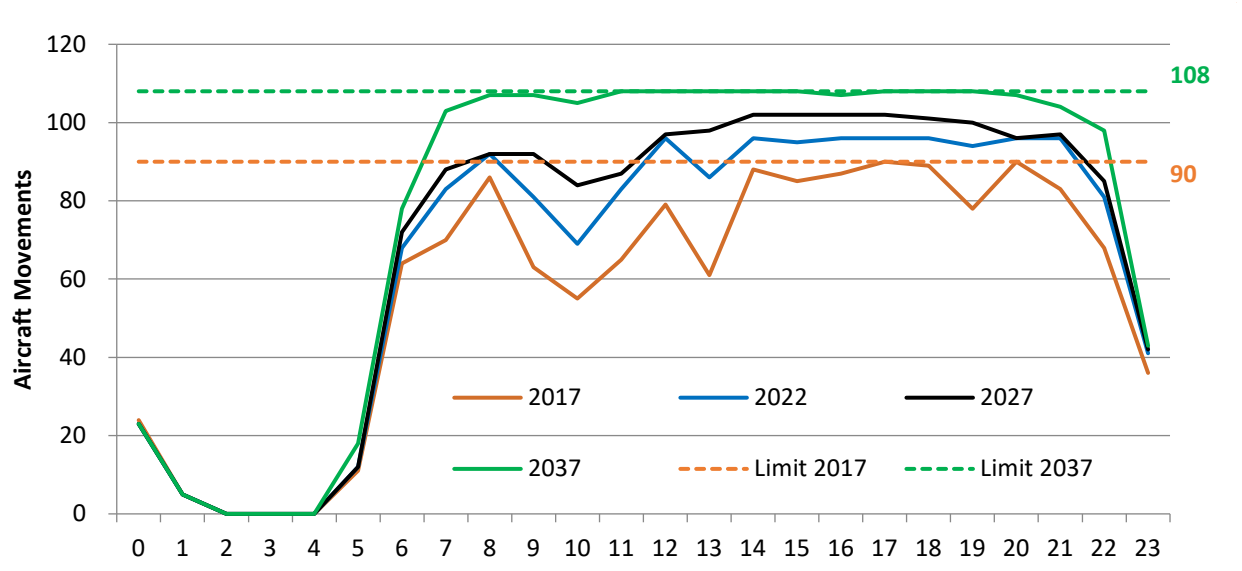


Figure 5-8: Hourly Aircraft Movement Forecasts

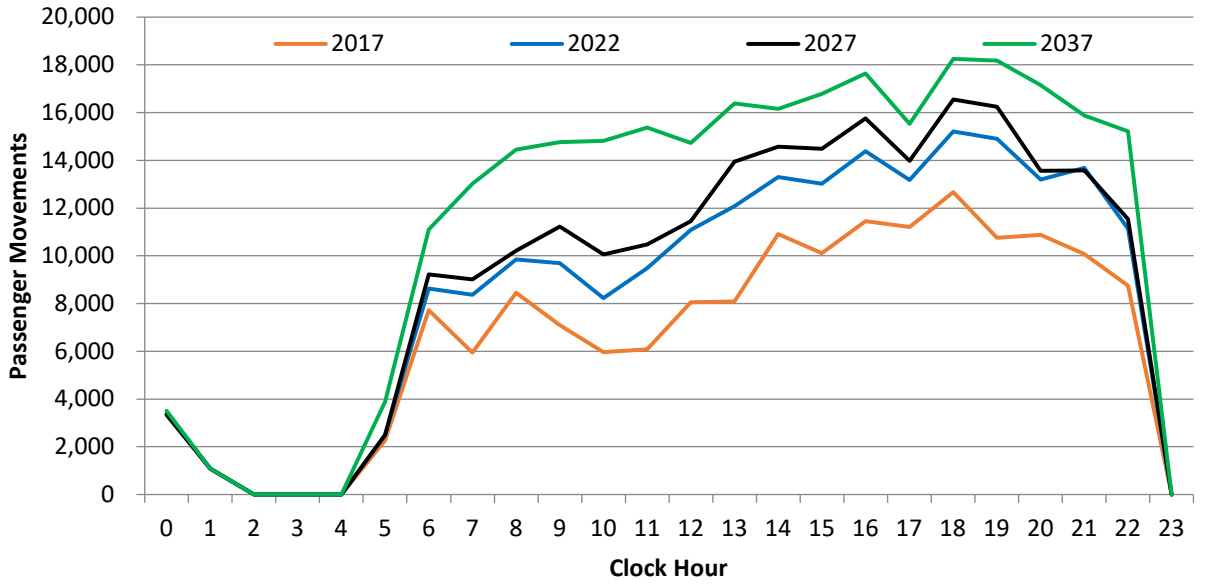


Figure 5-9: Hourly Passenger Movement Forecasts

Peak Stand Demand

Apron and aircraft parking areas are designed based on peak occupancy, also known as peak stand demand. The following table outlines the occupancy levels we foresee, by type of aircraft, during the period covered by the Master Plan.

Peak Stand Demand			
	Wide Body Gates	Narrow Body Gates	Total Gates
2017	31	61	92
2022	40	65	105
2027	51	64	115
2037	79	72	151

Table 5-4: Peak Stand Demand by Aircraft Type

In our facilities planning work, we focus on getting the maximum value from Toronto Pearson's existing footprint and infrastructure. We use tools that enable us to operate more flexibly, such as swing-gates between terminal sectors and Multiple Apron Ramp System (MARS) stands, which allow a single gate to serve either one wide body aircraft or two narrow body planes in rapid succession. We're also continually adapting and enhancing ground operations to better meet peak-hour demand throughout our facilities.

6. Airside System

An airport's ability to grow is largely determined by the capacity of its airside system – in the simplest terms, all of the infrastructure that aircraft use before and after their flights, from fuel and deicing facilities to parking areas and cargo loading equipment. The relative maturity of Toronto Pearson's airside system is therefore a critical factor in our long-term planning. Any proposed development of other major airport sub-systems – including terminals, cargo facilities, and groundside access and support functions – must be aligned with our airside system to ensure balanced growth across all operations.

Introduction

Runways form the heart of any airside system. An airport can only accommodate so many – typically fewer than its physical footprint might suggest. Moreover, runways require space beyond the areas actually used by planes to land and take off; they also need taxiways, operational zones such as aprons, and room for navigational aids. Various regulations and standards designed to ensure the safe operation of aircraft also affect runway configuration, along with the overall capacity of airside infrastructure.

In the early 1990s, Transport Canada conducted an environmental assessment exploring the prospect of adding three new runways at Toronto Pearson. Two have since been constructed and commissioned, bringing the total number of runways to five. A sixth was approved as part of the assessment but has not been built. We'll continue to monitor demand in order to make sound projections – in consultation with our stakeholders – about whether this additional runway might be required to support increased passenger traffic, operational resiliency, a growing region and expansion of the broader Canadian economy.

The analysis presented in this chapter suggests that our current five-runway airside system will accommodate projected traffic increases within the timeframe of this Master Plan; a sixth runway is not needed to meet growth through 2037. However, we will continue to protect the necessary land and zoning, as detailed in our Land Use Plan. Demand is indeed growing, and we expect that additional airside capacity will be required at some point. When, exactly, will depend on how factors such as increased aircraft movements, the renewal of carrier fleets and the need for operational continuity evolve relative to our projections.

Another factor that will influence future infrastructure discussions is the prospect of trade-offs in service quality. As Toronto Pearson approaches the limits of its current capacity, the likelihood of congestion and delays will increase. And as demand continues to grow, the GTAA and its stakeholders will face decisions about how much congestion to accept, and when the negative social and economic repercussions become too great.

This chapter describes and quantifies our airport's current airside capacity and offers some ideas on how that capacity might be moderately increased with the existing five-runway system. Through ongoing monitoring of airside operations, we'll be better equipped to determine which specific infrastructure improvements to undertake and when. And our forecasting and analysis will enable us to consider, design, construct and commission any new facilities in a timely way.

Existing Airside System

The key components of Toronto Pearson's existing airside system are runways, taxiways, aprons, airside roads and deicing facilities, as well as Air Traffic Control (ATC) and Communication, Navigation and Surveillance (CNS) facilities. Since the publication of our last Master Plan, we've made the following changes to the airside system:

- connected Foxtrot and Mike taxiways
- expanded Pad 1 of the Central Deicing Facility
- constructed Taxiway Yankee
- constructed Runway Exit Taxiway Whiskey

Other notable changes since our 2008 plan include the federal government's update of its design standards and best practices for airports[3], and our adoption of internationally recognized standards for the runway end safety area (RESA). Even as we've made changes to conform to international RESA standards, we've maintained provisions in our Land Use Plan to accommodate foreseeable distance requirements (as discussed in the introduction to this chapter).

Figure 6-1 provides a visual overview of our airside system, and the text that follows describes the operations of each element.

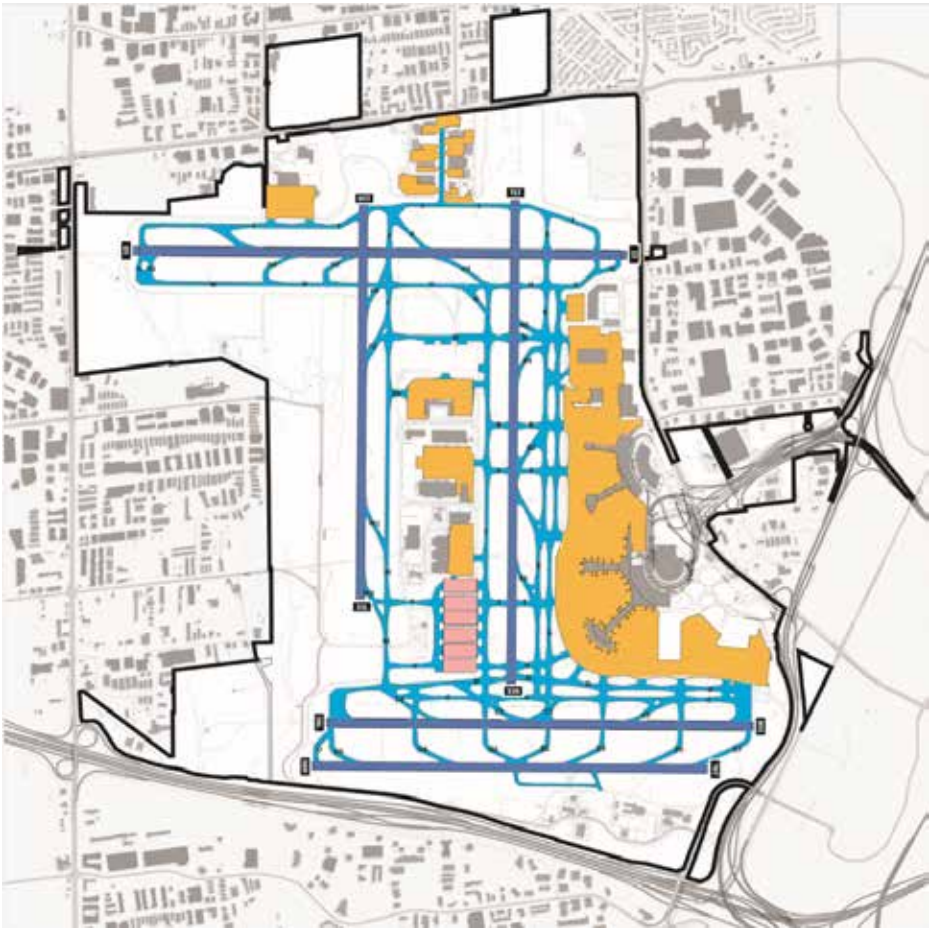


Figure 6-1: Existing Airside System

3 *Aerodrome Standards and Recommended Practices (TP 312) 5th Edition.*

Runways

Toronto Pearson has five runways:

Three East/West. Runways 06L-24R and 06R-24L are closely spaced parallel runways located at the south end of the Airport. A third, Runway 05-23, runs parallel to the other two at the north end.

Two North/South. Runway 15L-33R is closer to the east side of the Airport and the terminal buildings. Runway 15R-33L runs parallel, to the west of its neighbour.

Table 6-1 shows the lengths of all five runways. For some, available takeoff and landing distance is less than the full runway length, because space has been allocated for a runway end safety area (RESA). All runways at Toronto Pearson have a width of 61 metres (200 feet).

Toronto Pearson Runway Lengths

Runway Orientation	Runway Name	Runway Length		Takeoff Distance Available		Landing Distance Available	
		metres	feet	metres	feet	metres	feet
East/West	05-23	3,389	11,120	3,284	10,775	3,243	10,640
				3,284	10,775	3,136	10,290
	06L-24R	2,956	9,697	2,956	9,697	2,956	9,697
				2,923	9,589	2,863	9,392
	06R-24L	2,743	9,000	2,743	9,000	2,743	9,000
				2,712	8,898	2,712	8,898
North/South	15L-33R	3,368	11,050	3,318	10,886	3,318	10,886
				3,368	11,050	3,368	11,050
	15R-33L	2,770	9,088	2,770	9,088	2,591	8,500
				2,767	9,078	2,588	8,490

Table 6-1: Toronto Pearson Runway Lengths

Taxiways

The airport's five runways are supported by an extensive system of taxiways with a total length of 42 kilometres. The taxiway system includes:

- several high-speed exit taxiways on each runway to allow landing aircraft to leave the area quickly
- taxiways running parallel to all runways, allowing aircraft to move between runways and the various passenger, cargo and hangar aprons
- dual taxiways around busy passenger terminal areas (Taxiways A, B, C and D) that allow bi-directional traffic flows and independent taxiway routings for arriving and departing aircraft

Aprons

Toronto Pearson's airside facilities include aprons at:

- passenger terminals for unloading, loading and servicing passenger aircraft
- cargo facilities for unloading, loading and servicing all-cargo aircraft
- airline hangars for aircraft maintenance
- business aviation hangars for unloading, loading and servicing corporate jets

The GTAA directs aircraft movement on the majority of aprons from a control tower on Terminal 1. When an aircraft leaves the taxiway system and enters an apron area, its control is handed over from the NAV CANADA control tower to the GTAA apron control tower. Conversely, the control of departing aircraft is handed over from the GTAA apron tower to the NAV CANADA tower as aircraft enter the taxiway system.

Airside Roads

An extensive system of airside roads (shown in Figure 6-2) lets vehicles move between Toronto Pearson facilities to perform routine operations and maintenance duties. Airside roads also allow fire and rescue service vehicles to quickly access any part of the airport grounds.

In addition to surface roads, the airside road system includes a four-lane tunnel that passes under Runway 15L-33R and Taxiways A, B and E. The tunnel lets vehicles move safely and efficiently between infield facilities and the passenger terminal buildings on the east side of the airport without having to cross active runways or taxiways. Regular tunnel users include trucks and tugs moving catering supplies and cargo between infield facilities and aircraft on the terminal aprons.

Deicing/Anti-icing Facilities

Deicing and anti-icing are essential to the safe operation of aircraft. Deicing removes frost, snow and/or ice from critical surfaces such as wings and sensors. Frost deicing requires the application of relatively low volumes of deicing fluid. Anti-icing protects the aircraft from further accumulation. Operations during snow or freezing rain conditions require both deicing and anti-icing fluids.

Most deicing operations at Toronto Pearson are carried out at the infield Central Deicing Facility (CDF), which is managed and operated by the GTAA. The CDF contains six pads; each pad can accommodate two narrow body aircraft or a single wide body aircraft. Two of the six pads can accommodate large, Code F-sized aircraft such as the Airbus A380. In all, the CDF can deice up to 12 narrow body aircraft or six wide body aircraft simultaneously. A staging area adjacent to each pad provides space for aircraft to get in line for deicing, expediting throughput.

Adjoining the CDF's pads and staging facilities to the west is a support area that contains glycol storage tanks, an "ice house" from which CDF operations are controlled, staff training facilities and a deicing vehicle maintenance facility. (Trucks support all Toronto Pearson deicing operations.) The CDF was designed and constructed with an extensive recovery system for glycol, the main chemical used for deicing, to minimize environmental impacts from runoff. The facility includes underground storage tanks for spent glycol, as well as recycling technology.

An additional single-pad facility, the Hangar Deicing Facility, is located next to Air Canada maintenance Bay 11. Used on a contingency basis, it can accommodate a single, medium-sized (Code C) aircraft.

Air Traffic Control and Communication, Navigation and Surveillance Facilities

Because Toronto Pearson sometimes has to operate in weather conditions that reduce visibility, the airside system includes electronic navigational and visual approach aids that enable instrument-guided approaches to all runways. The GTAA makes land available for on site communication, navigation and surveillance (CNS) equipment that is owned, operated and maintained by NAV CANADA. Figure 6-2 shows Toronto Pearson's current CNS equipment configuration.

The Toronto Area Control Centre (ACC) and the Toronto Pearson control tower, both located on airport grounds, are operated by NAV CANADA. The ACC is responsible for the control of aircraft across a significant portion of Ontario; any plane that's in the air and not in the process of landing at or departing from a particular airport is under the control of this facility. Control of aircraft arriving at our airport is transferred from the ACC to the Toronto Pearson control tower as planes make their final approach to their assigned runways. Conversely, control of departing flights is transferred from the Toronto Pearson tower to the ACC shortly after aircraft become airborne.

Figure 6-2: Existing ATC and CNS Facilities

Toronto Pearson

Capacity of the Existing Airside System

The GTAA works systematically to maintain appropriate capacity across Toronto Pearson's airside system. However, capacity is determined to a large extent by factors outside our control – for instance, Transport Canada regulations and evolving NAV CANADA technology and practices. We will continue working closely with these key stakeholders to ensure our airside system adapts appropriately to regulatory, technological and procedural changes in the years ahead – recognizing that such changes may require adjustments to the system-capacity projections laid out in this Master Plan.

Airport operators regularly review and quantify the overall capacity of their airside systems. Figure 6-3 is a capacity coverage chart showing the existing five-runway system at Toronto Pearson. Each coloured block represents a single operating configuration that we may adopt in response to a specific set of wind and weather conditions. The vertical axis shows the number of hourly aircraft movements possible under the operating configuration shown; the horizontal axis shows the proportion of time that configuration is available for use. For instance, the largest block indicates that the airport can operate east/west runways 93 per cent of the time, and when those runways are in use we can accommodate 110 aircraft movements per hour.

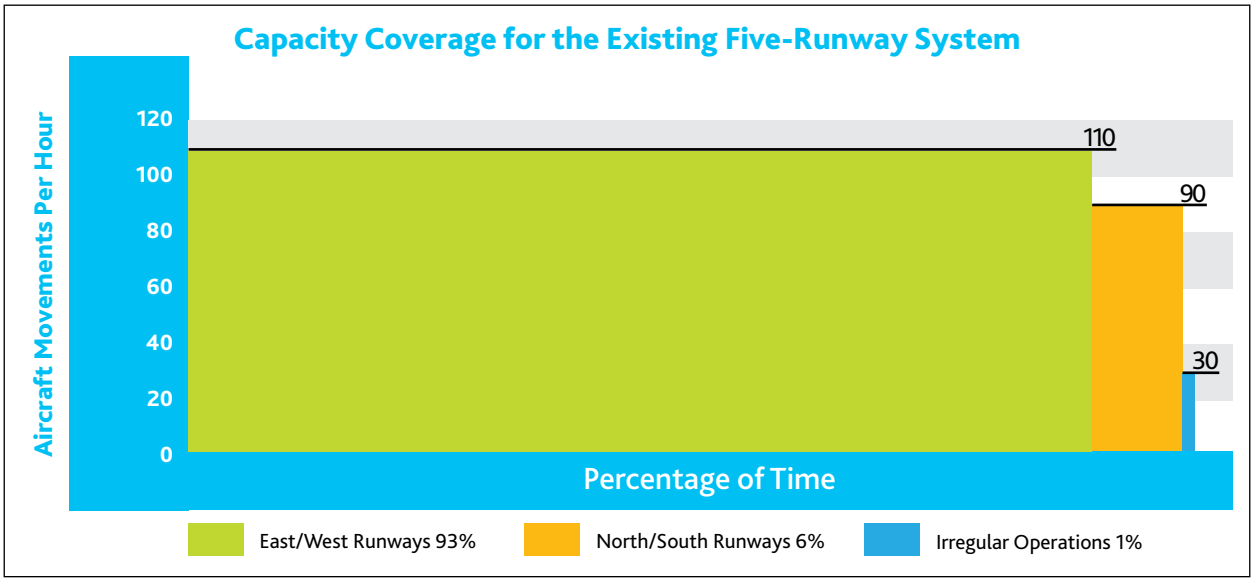


Figure 6-3: Capacity Coverage Chart for the Existing Five-Runway System

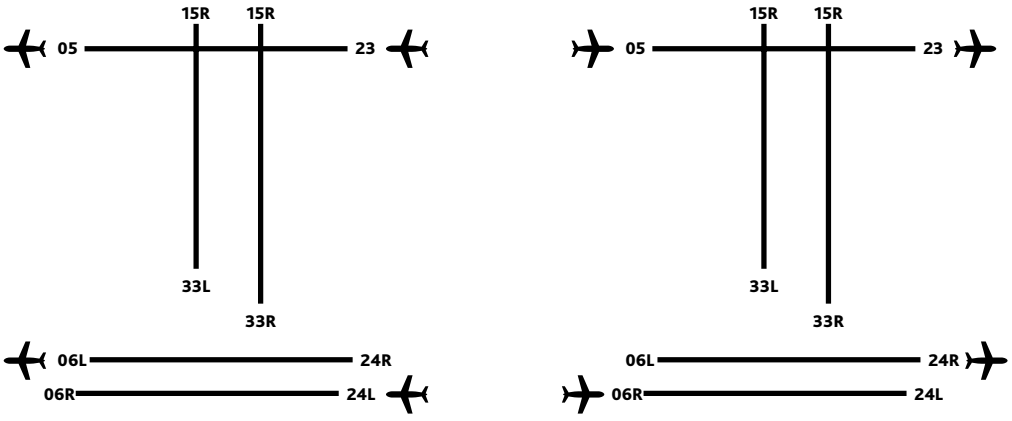
Available Configurations for Runway Operations

The capacity coverage chart for Toronto Pearson addresses three main types of runway operations, each of which allows a different number of aircraft movements per hour.

East/West Runway Operations. When Toronto Pearson's three east/west runways are in use simultaneously, the separation between runways 06R-24L and 06L-24R is not great enough to permit each to accommodate arrivals and departures on independent schedules. Each departure on one runway has to be coordinated with approaches and arrivals on the adjacent runway. For noise mitigation and operational reasons, we use the outer runway (06R-24L) primarily for arrivals, and the inner one (06L-24R) primarily for departures.

Runway 05-23 is sufficiently separated from the southern runway complex to be operated independently, serving a mixture of arrivals and departures. This type of runway operation is shown in Figure 6-4.

It's preferable for aircraft to fly into the wind when landing and taking off, and all airports adjust their operations accordingly. The diagram on the left in Figure 6-4 depicts a westerly wind flow at Toronto Pearson: aircraft depart into the wind on Runways 23 and 24R, and land into the wind on Runways 23 and 24L. The operation is reversed under easterly wind flow conditions, as depicted in the right-hand diagram.



Westerly Operation **Easterly Operation**

Figure 6-4: East/West Runway Operations

Our computer simulations – based on the anticipated aircraft mix at Toronto Pearson and a balanced demand of arrivals and departures – indicate that the operational arrangement depicted in Figure 6-4 has a capacity of approximately 110 aircraft movements per hour: 48 on Runway 05-23 and 60 on the closely spaced parallel runways, Runways 06L-24R and 06R-24L.

These capacity values reflect operations under instrument meteorological conditions (IMC). Visual meteorological conditions (VMC) increase capacity somewhat, as controllers and pilots are able to see runways and aircraft clearly and thus can moderately reduce spacing between aircraft without compromising safety. Under VMC, the operation depicted in Figure 6-4 can yield capacities of up to 126 movements per hour.

Even under IMC, capacity will likely grow moderately in the coming years. Advances in air traffic control techniques and navigation technology – such as visual departure separation, time-based arrival separation, performance-based navigation and new ways of categorizing aircraft wake turbulence – can enhance operations under both VMC and IMC. As technology continues to develop, it's reasonable to expect that under IMC the capacity of Toronto Pearson's east/west runways could grow to 110 movements per hour or even slightly higher.

Our goal is to establish capacity estimates that are sufficiently conservative and realistic such that Toronto Pearson can deliver against them reliably. When we take both IMC *and* VMC into account, we still foresee the east/west runways facilitating an average of 110 aircraft movements per hour. Weather data suggests that we should be able to count on this capacity approximately 93 per cent of the time.

It should be noted that during periods of reduced demand, air traffic control sometimes uses only two of the three east/west runways – an operating scenario not depicted in the capacity coverage chart. We anticipate that this scenario will occur less frequently in the years ahead as demand for air travel continues to grow. The maximum capacity indicated in the chart will reflect actual operations more and more often.

North/South Runway Operations. The capacity coverage chart shows a second, less common operational configuration at Toronto Pearson: the use of our two north/south runways. Typically, we only shift to this scenario when conditions make the east/west runways difficult or impossible to use: for instance, during thunderstorms or strong north/south winds, or when snow and ice removal operations are underway on the east/west runways. The north/south alternative allows us to maintain much of our capacity until the east/west runways are again available.

Arrivals are handled primarily by one north/south runway, and departures by the other. Arrivals need less runway length, so they're typically assigned to the shorter runway, 15R-33L, while 15L-33R accommodates departures. However, air traffic control does sometimes assign arrivals to 15L-33R either to accommodate a heavier aircraft that needs a longer landing distance, or simply to supplement our arrival capacity when there's a gap in the flow of departures.

Figure 6-5 illustrates north/south runway operations. The diagram on the left shows operations under north-wind conditions: 33L is the main arrivals runway and 33R is the main departures runway, accommodating arrivals as appropriate. The diagram on the right shows operations under south-wind conditions, when arrivals may be assigned to either 15L or 15R depending on operational priorities (with departures using the opposite).

Our analysis of recent data indicates that the capacity of the north/south runways is nearly 90 aircraft movements per hour under visual meteorological conditions (VMC), which are typical when the north/south runways are in use.

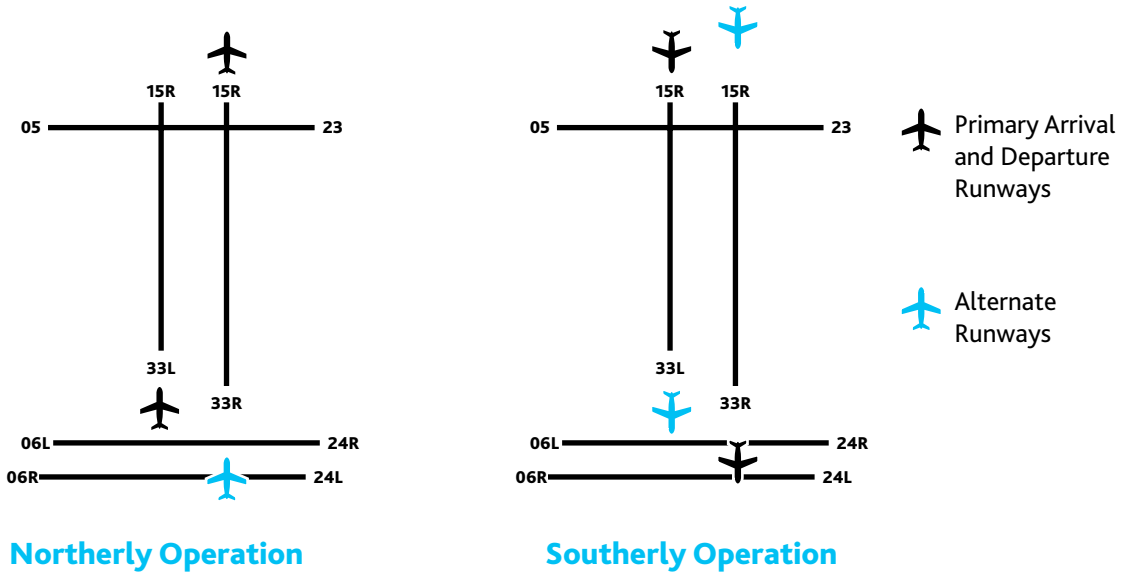


Figure 6-5: North/South Runway Operations

Irregular Runway Operations. Under irregular operations, Toronto Pearson uses no predetermined configuration but instead assigns flights to whichever runways are safe and available. Capacity is much lower under irregular operations – about 30 movements per hour. We resort to this scenario only about 1 per cent of the time, usually for one of the following reasons:

- A winter storm requires the periodic closure of runways and taxiways for snow removal.
- Aircraft need deicing/anti-icing prior to departure.
- Thunderstorms create an inability to load, unload or service aircraft on the apron due to unsafe working conditions.

- We are conducting construction or restoration work on runways.
- Poor visibility conditions limit runway selection; only aircraft with appropriate navigational equipment can use specific runways.
- Other circumstances, such as an emergency, require temporary closure of our airside infrastructure.

Quantifying Current Capacity

Based on the possible operating configurations supported by Toronto Pearson's current airside infrastructure – and the proportion of operating time each configuration is generally in use – we can estimate hourly, daily and annual average capacity for the airport overall.

Average Hourly Capacity. According to the data shown in Figure 6-3, the capacity coverage chart, Toronto Pearson's weighted average airside capacity is 108 aircraft movements per hour.

Planning Day Capacity: Current Estimate. Demand for air travel fluctuates by time of day, so multiplying hourly capacity by 24 is not a viable way to calculate daily capacity. To arrive at a more realistic picture, planners take a typical busy summer weekday and divide it into three segments: peak hours, off-peak hours, and night hours.

We assume that during peak hours, Toronto Pearson operates at the maximum capacity conditions allow: 108 aircraft movements per hour (as demonstrated above). This number of hourly movements is indicative of demand management in order to provide acceptable overall levels of service at the Airport at all times. For off-peak hours, we assume reduced demand and reduced throughput: about 95 per cent of total capacity. Night-hours capacity is set in accordance with the annual nighttime operations budget agreed between the GTAA and Transport Canada.

When we combine the hourly capacity of peak, off-peak, and night hours, we arrive at a total 24-hour capacity for Toronto Pearson of around 2,000 aircraft movements.

Annual Capacity: Maximum Versus Practical Capacity. Demand fluctuates not only during the day but also throughout the year. Summer is busier than winter, and weekdays are busier than weekends. Here again, simply multiplying our planning-day capacity by 365 days would yield an unrealistically high annual capacity figure. Taking into account day-to-day and seasonal variability, we've concluded that 325 is a more realistic multiplier, yielding a *maximum annual airside capacity* of 650,000 aircraft movements.

In theory, this is an attainable level of throughput with our current airside infrastructure. But in practice, achieving that traffic volume would almost certainly result in significant levels of congestion and delay, causing Toronto Pearson to fall short of the level of service we strive to deliver. We therefore calculate our *practical annual airside capacity* at approximately 95 per cent of the maximum. For our existing five-runway airside system, our practical capacity is approximately 615,000 movements annually.

To plan for future demand on our airside system, we rely on a range, with practical capacity as the floor and maximum capacity as the ceiling. In our analysis, the most likely annual number of aircraft movements projected for 2037 is just below the middle of our system capacity range.

Future Airside Development

Figure 6-6 shows a range of airside developments that are possible within the horizon of this Master Plan.

Figure 6-6: Potential Future Airside Development

Expansion of Deicing Facilities

Toronto Pearson's Central Deicing Facility (CDF) is state-of-the-art: safe, efficient and environmentally responsible. But we project that it will need to expand in the current planning period for several reasons:

- Our airport must be able to accommodate more aircraft movements overall. As demand grows, we want to maintain as much capacity as possible in all weather conditions.
- We're accommodating more wide body aircraft. This means that our existing CDF pads are not able to serve as many planes. It also takes more time to deice a larger aircraft, so each pad is occupied for a longer period.

Adding deicing infrastructure to the infield area would be an efficient solution, allowing us to create a large facility with multiple pads. A possible infield site, the North Deicing Facility – already indicated in the previous Master Plan – is shown in Figure 6-6. Expanding our existing CDF is another option.

Perimeter Taxiways

In recent years, a number of major international airports have introduced perimeter taxiways to facilitate uninterrupted taxiing of aircraft, independent of runway movements. Perimeter taxiways allow aircraft to reach airside destinations – terminal buildings, cargo handling areas, maintenance hangars and other facilities – without encroaching on active runways, and thus without requiring coordination by air traffic control. This contributes to the overall safety and capacity of runway operations.

Because perimeter taxiway users don't have to stop and start in yielding to runway users, they may also burn less fuel. Figure 6-6 shows several possible locations for perimeter taxiways:

- beyond the end of Runway 33R, in the northern portion of the Airport
- beyond the end of Runway 15L, in the southern portion of the Airport
- as an ancillary fillet on Taxiway Foxtrot at the south end of the Airport

Runway Rapid-Exit Taxiways

Analysis indicates that the hourly capacity of some runways could be increased with the addition of more rapid-exit taxiways. These would help to reduce runway occupancy times for landing aircraft, and would allow for more direct taxi routes to some destinations. Figure 6-6 shows possible sites for additional rapid-exit taxiways on Runways 33L, 15R, 05, 33R and 15L.

Future Runway 05R–23L

In 1991–1992, an environmental assessment was conducted for the addition of three new runways, as well as supporting taxiways and navigational aids, to meet forecasted demand at Toronto Pearson. Two of these runways have since been built: 15R-33L was commissioned in 1997, and 06R-24L in 2002.

The third runway – an east/west runway designated as 05R-23L – remains unbuilt. The original planners envisioned it running parallel to existing Runway 05-23, which would be renamed 05L-23R to denote its relationship with its new neighbour.

The construction of 05R-23L is not part of the current Master Plan. However, we will continue to protect land that would make this runway alignment possible, both as we make land use decisions on the grounds of Toronto Pearson and as we consider registered zoning beyond the airport boundary.

Other Possible Airside Development

The GTAA constantly evaluates modest airside enhancements designed to improve the efficiency of airport operations, to reduce fuel burn and air emissions, and to meet future regulatory requirements. We anticipate that some of the following enhancements may be implemented during the period of this Master Plan, pending further assessment:

- Taxiway Echo could be extended northward toward Taxiway Juliet to facilitate the movement of aircraft from the Central Deicing Facility to Runway 15L (see Figure 6-6).
- The airside road system around the circumference of the airfield could be completed by connecting the road at the west end of Runways 06L-24R and 06R-24L to the road adjacent to the remote receiver. Such a connection would allow Toronto Pearson employees to travel between the north and south airside areas on the west side of the Airport without exiting and re-entering the secure area.
- Land Uses discusses, among other topics, development options that could be applicable to the Boeing Lands, located at the southwest corner of Airport and Derry Roads and now owned by the GTAA. Depending on the evolution of our development plan, taxiway access to this land may be necessary. The perimeter taxiway at the end of Runway 15L (see Figure 6-6) could help to fulfill that need.
- A number of fillets at key taxiway intersections could be widened, and some runways could be given added shoulders, to further accommodate Airbus A380 operations.
- It may be necessary to extend runway end safety areas (RESAs) to account for possible future regulatory revisions from Transport Canada. Should such a requirement be mandated, we believe the necessary changes could be made within the existing boundaries of Toronto Pearson.

Opportunities to Maximize Airside Capacity

The airside capacity quantified in this chapter depends on a number of assumptions and variables. Given that Toronto Pearson is expected to approach its maximum capacity during the course of this Master Plan, we should consider other potential means of increasing it.

Daily Traffic-Peak Spreading

Our calculations assume that as demand rises, Toronto Pearson will operate at full capacity for a total of 16 hours on a typical busy day, and at 95 per cent of full capacity during two off-peak hours with lower demand. This calculation already implies a significant degree of peak spreading – i.e., shifting schedules to avoid the busiest travel times – during peak hours.

Toronto Pearson could set limits on the number of available runway slots per hour. This would induce some flights to use non-peak slots, as they would be unable to operate during peak periods. Even in the absence of a deliberately engineered traffic-demand management system, the outcome might well be the same: should traffic grow to the point of exceeding peak-hour capacity, delays would essentially force carriers and travellers into non-peak periods anyway. In either case, more passengers would travel at less-preferred times of the day – an outcome that carries some potential social and economic costs.

Larger Aircraft

Our airside capacity calculations assume that passenger aircraft at Toronto Pearson will, within the horizon of this Master Plan, come to carry an average of 140 passengers – a sizeable increase over the current 108. This rise in the average number of passengers per aircraft will mean higher airside passenger capacity. However, given that the typical aircraft has a relatively long life cycle, it will take time for increased demand to fully materialize. The average aircraft size at Toronto Pearson in 2037 will be determined in part by fleet replacement decisions made by air carriers many years earlier. Moreover, airlines plan fleet renewal and growth within the context of their overall route networks. The anticipated operating environment at any given airport will have an impact on an airline's overall fleet proportionate to the importance of that airport in the carrier's route network.

Weekly and Seasonal Traffic Patterns

As discussed above ("Quantifying Current Capacity"), we multiply our peak-capacity planning-day by 325 (as opposed to the 365 days of the year) to reflect traffic fluctuations throughout the week and across the seasons. We do not see strong prospects for boosting airside capacity by trying to spread demand to less busy parts of the week or less busy times of the year. Weekly and seasonal demand patterns are shaped by business schedules, school vacations and other factors. Even serious airport congestion is unlikely to induce travellers to change their travel times from, for instance, summer to spring.

7. Passenger Terminal System

It's in Toronto Pearson's terminals that millions of travellers' journeys begin. And for millions more arriving from elsewhere, our airport is the doorstep to Toronto, the region and the entire country. We work closely with our airline and government agency partners to streamline processes and create a passenger experience that's smooth, efficient and enjoyable. Moving forward, we're adopting innovative technologies and design solutions to gain the most value from our existing facilities. And to keep pace with growing demand, we're developing plans to enhance and expand our terminals – including the integration of passenger processing into our proposed Regional Transit Centre.

Introduction

The current structure of Toronto Pearson's terminal system was established in January 2007 with the opening of the international pier of Terminal 1 – a key addition that completed the new facility we'd begun operating three years earlier. Since that time, our focus has been on optimizing our use of Terminal 1 while carrying out a major enhancement and renovation program in Terminal 3. We expect that the final phase of improvements to Terminal 3 will be completed during 2021 (see *Capacity Analysis* on page 58).

Over the past decade, we've taken an incremental approach to terminal development, expanding passenger capacity on a "just in time" basis. Our goal is to ensure that existing facilities are used to the maximum before we expand or enhance them. We've succeeded in adding capacity as needed by closely monitoring facility utilization and service levels, and by setting targets that balance efficiency with our commitment to delivering a great passenger experience.

Over the same period, we've worked to ensure that all development is financially sustainable. To that end, we've pursued new opportunities for generating non-aeronautical revenue, including from retail shopping, restaurants and services such as banking and personal care. By diversifying our revenue sources, we've been able to stabilize or reduce aeronautical rates and charges. This benefits both carriers and their passengers (whose fares cover a portion of the fees) while keeping our airport competitive. In 2016, the average cost per enplaned passenger at Toronto Pearson was approximately 38 per cent lower than the cost in 2007.

These approaches to managing both capacity and affordability have been effective. But with the growth in aviation activity we've seen in recent years, our facilities are now reaching their limit. We have few remaining options for incremental capacity expansion in our terminals. And demand continues to grow: our current forecasts (see *Demand Forecasts* on page 29) indicate that Toronto Pearson may be serving as many as 85 million passengers annually by 2037.

Current Facilities

Figure 7-1 shows Terminal 1 and Terminal 3, the two passenger facilities currently in operation at Toronto Pearson. Together, they offer a combined total of 86 gates with passenger bridges, and 31 positions for commuter aircraft (from which passengers disembark via steps). This translates into an overall capacity of about 47 million passengers annually.

Figure 7-1: Existing Terminal Facilities

East of Terminal 1 there is an apron area, the East Hold, which has 11 remote aircraft stands. These are usually inactive, serving as aircraft parking spaces. But in recent years, operators have sometimes used the stands on an ad hoc basis during the peak summer travel season. When the East Hold is called into service for passenger operations – typically to alleviate congestion after a schedule disruption – travellers are bussed to and from its remote stands.

Terminal 1

Terminal 1 is the newer of the two main facilities at Toronto Pearson. It accommodates domestic, Canada-U.S. transborder and international traffic. Opened in phases beginning in April 2004, Terminal 1 primarily serves Air Canada and its Star Alliance carrier partners, along with one unaligned international airline.

Figure 7-2 shows a plan view of Terminal 1 and its piers. Piers D and E opened in 2004. Pier F, which opened in 2005, includes a hammerhead capable of accommodating large aircraft. Hammerhead F opened in 2007. In 2010, the Gate 193 Extension was built east of Pier F to replace a satellite commuter aircraft facility that has since been demolished. Currently, the Gate 193 Extension is being expanded as indicated in Figure 7-2.

Figure 7-2: Terminal 1

Four gates on the Pier F hammerhead are configured to accommodate large aircraft such as the Airbus A380. Each gate can connect two bridges to an A380-class aircraft – one to the main-deck door, and one to a second door on either the main or upper deck.

In all, Terminal 1 has 50 bridged gates and 22 commuter aircraft stands, and approximately 346,000 m^2 of gross floor area. This translates into a total capacity of about 30 million passengers annually. In 2016, Terminal 1 handled 28.7 million passengers, of which about 40 per cent were domestic, 29 per cent Canada-U.S. transborder and 31 per cent international.

Terminal 3

When Terminal 3 opened in 1991, it was the first major airport facility in the country to be financed and managed by a private-sector operator under a lease agreement with Transport Canada. The GTAA took over the facility in May 1997.

Terminal 3 accommodates domestic, Canada-U.S. transborder and international flights. Among the carriers it supports are WestJet Airlines and members of the oneworld and SkyTeam alliances, as well as Air Transat, Sunwing and other international scheduled and charter airlines.

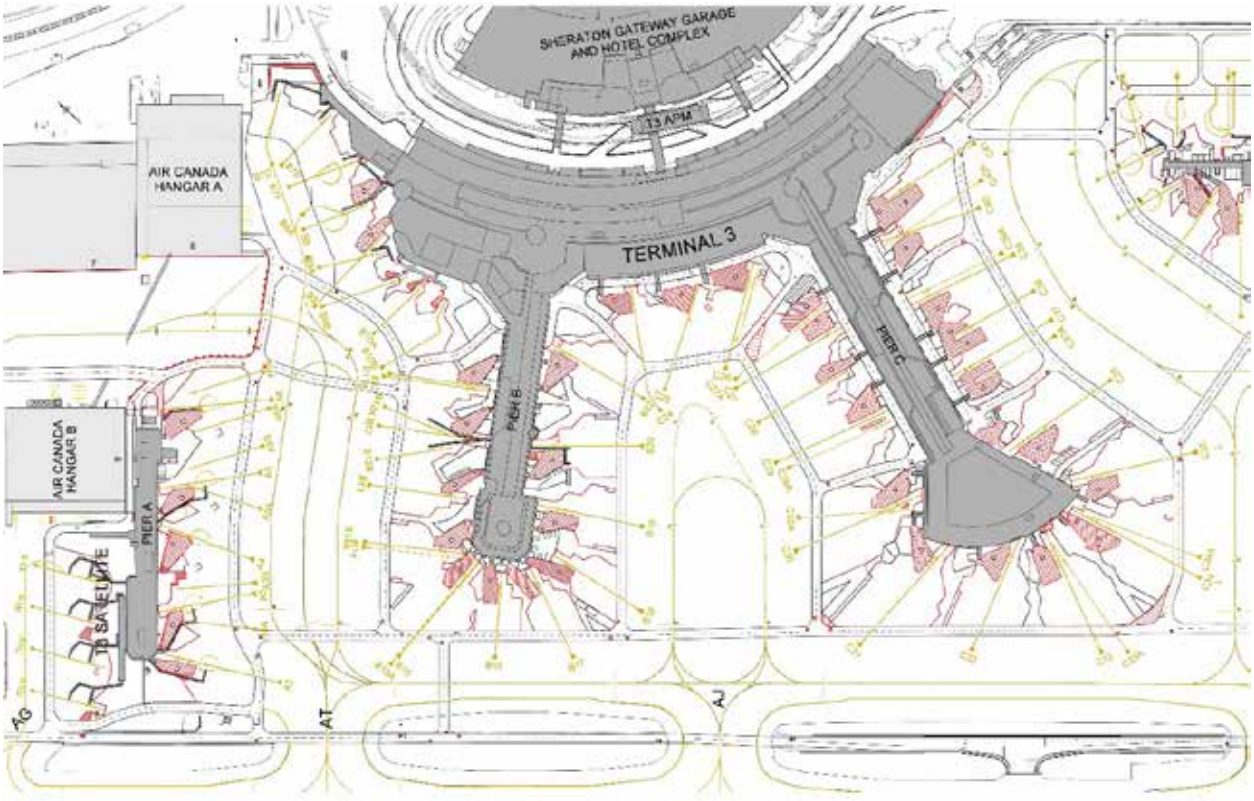


Figure 7-3: Terminal 3

The terminal has undergone a number of significant upgrades over the years, including the addition of a hammerhead extension to Pier C, which now has two gates capable of accommodating the Airbus A380 and similar large aircraft. More recently, the main passenger processing area in Terminal 3 has been extended to allow more check-in, security screening, inspection and baggage-handling capacity.

Terminal 3 currently has a gross floor area of approximately 178,000 m^2. This total includes Terminal 3 Pier A (formerly called the Terminal 3 Satellite), which was renovated and reactivated in June 2015. Terminal 3 has a total of 36 bridged gates and nine commuter aircraft stands with the capacity to process about 17 million passengers annually. In 2016, Terminal 3 handled 15.7 million passengers, of which 33 per cent were domestic, 25 per cent Canada-U.S. transborder and 42 per cent international.

Capacity Analysis

Translating Forecasts into Facility Requirements

The creation of this Master Plan has been guided by a set of rigorous demand forecasts (some of which are presented in *Demand Forecasts* on page 29). To plan the development of our passenger terminal facilities, we translate these forecasts into specific facility requirements, taking into consideration baggage-handling capacity, security screening throughput, number of available gates and many other factors.

This section describes Toronto Pearson's current terminal facilities and how we expect them to function and evolve in the coming years. (Please see *Terminal Development* on page 63 for an overview of prospective plans within a longer time horizon.)

Current Facilities				
Aircraft Gate Facilities	**Total Airport**	**T1**	**T3**	**IFT**
Bridged Gates	97	50	36	11
Commuter Positions	31	22	9	0
Transborder Passenger Departure Facilities	**Total Airport**	**T1**	**T3**	**IFT**
Check-in Counters (All functions)	50	24	26	0
Kiosks	93	45	48	0
Self-serve Bag Drops	20	10	10	0
Canadian Air Transport Security Agency Regular Lanes and Plus* Lanes	15	7*	8	0
U.S. Customs and Border Protection Counters	58	38	20	0
U.S. Customs and Border Protection Kiosks	58	34	24	0
Trusted Traveller Kiosks	37	25	12	0
Domestic/International Passenger Departure Facilities	**Total Airport**	**T1**	**T3**	**IFT**
Check-in Counters (All functions)	240	112	128	0
Kiosks	193	111	82	0
Self-serve Bag Drops	20	4	16	0
Canadian Air Transport Security Agency Regular Lanes	38	25	13	0
Transborder/International Passenger Arrival Facilities	**Total Airport**	**T1**	**T3**	**IFT**
Canada Border Services Agency Counters	53	34	19	0
Canada Border Services Agency Kiosks	95	30	65	0
Trusted Traveller Kiosks	41	21	20	0

Notes:
Check-in counters (all functions) – includes traditional counters, manned bag drop and rework counters
Canadian Air Transport Security Regular Lanes to Plus Lanes replacement program has commenced in 2017
U.S. Customs and Border Protection Counters – includes counters and Document Verification Officer positions but excludes 8 counters and 8 DVO for transfers
Trusted Traveller Kiosks – includes Nexus and Global Entry kiosks
Canada Border Services Agency Kiosks – includes both ABC and PIK kiosks

Table 7-1: Toronto Pearson Current Facilities

Current Transfer Facilities			
Transfers to Transborder Facilities	**Total Airport**	**T1**	**T3**
Canadian Air Transport Security Agency Lanes	6	6	0
Check-in Counters (All functions)	13	13	0
U.S. Customs and Border Protection Counters	8	8	0
U.S. Customs and Border Protection Kiosks	24	24	0
Trusted Traveller Kiosks	10	10	0
Transborder/International Passenger Arrival Facilities	**Total Airport**	**T1**	**T3**
Check-in Counters (All functions)	4	4	0
Canadian Border Services Agency Counters	4	4	0
Canadian Border Services Agency Kiosks	0	0	0
Trusted Traveller Kiosks	0	0	0
Canadian Air Transport Security Agency Lanes	1	1	0

Notes:
Check-in counters (all functions) - includes traditional counters, manned bag drop and rework counters
U.S. Customs and Border Protection Counters - includes counters and Document Verification Officer positions
Trusted Traveller Kiosks - includes Nexus and Global Entry kiosks

Table 7-2: Toronto Pearson Passenger Terminal Facilities as of Q2 2017

Terminal 1 and Terminal 3 both support a mix of domestic, transborder and international services. To balance demand between the two terminals, we assign airlines to each with the goal of optimizing overall use.

In gauging our terminals' capacity to meet growing demand, we centre our analysis on a few key areas:

- aircraft gates
- check-in areas
- inspection by both Canadian and U.S. border services
- pre-board security screening
- baggage systems – inbound, transfer and outbound

Terminal 1 Capacity

Planning for Terminal 1 reflects our in-depth understanding of how the needs of the facility's primary users – Air Canada and its Star Alliance partners – will change as these carriers add new destinations, increase frequency on existing routes, evolve their fleets to include more large aircraft and make other business decisions. We expect that the planned changes described in this chapter – including additional gate capacity, the use of remote stands at peak times, and technology and process improvements designed to increase productivity – will be sufficient to accommodate traffic growth.

Aircraft Gates. To meet the growing demand, Terminal 1 is currently being expanded: we're building a new apron for additional five contact stands and one remote narrow body stand on the east side of the Gate 193 Extension, along with the associated gate hold-rooms, arrival corridor and improved vertical circulation.

We plan a more substantial gate expansion program in the next few years (see *Terminal Development* on page 63).

Check-In and Security Screening. As passenger-processing technology continues to advance, and as more travellers make use of options like self-service check-in and bag drops, Terminal 1 will be able to serve more people in less space. We anticipate a significant increase in passenger flows when we introduce new check-in capacity in two locations: the east end of the existing check-in hall (which is being repurposed) and the new Terminal 1 east expansion (described in the *Terminal Development* section). Until the latter becomes operational around 2022, we expect that internal building modifications, technology advances and process improvements will provide the capacity increases required to keep pace with growing demand.

Over the past decade, increasingly stringent pre-board screening procedures have slowed passenger flows through our security inspection areas, effectively reducing their capacity. Each screening lane currently processes between 100 and 120 passengers per hour, operating as a "regular" Canadian Air Transport Security Authority (CATSA) screening lane. Despite continuing efforts to increase efficiency, this average range has been difficult to improve. However, recent advances are promising. CATSA has begun to roll out an enhanced screening approach, CATSA Plus, which combines new equipment and processes to achieve throughput of up to 260 passengers per hour per lane – more than double the "regular" lane rate. CATSA Plus is being introduced in all terminal security screening locations and should be fully implemented in a few years' time.

In addition to increasing our check-in capacity, the Terminal 1 east expansion will provide extra space to support pre-board security screening for transborder and international flights.

Meanwhile, the processing requirements of both the Canada Border Services Agency (CBSA) and U.S. Customs and Border Protection (CBP) have become increasingly complex and time-consuming. However, the introduction of new technologies – including the NEXUS trusted traveller program, Global Entry biometric identification kiosks, Primary Inspection kiosks and Automated Border Control kiosks – has the potential not only to offset increased processing times but possibly to expand the overall capacity of existing inspection facilities.

Even as we work to improve the basic mechanics of passing through Terminal 1, we're also constantly enhancing our retail offerings, dining options and other services to make the passenger experience both efficient and enjoyable.

Baggage Handling. CATSA is about halfway through a 10-year process to revamp all Hold-Baggage Screening (HBS) equipment for checked baggage at major airports nationwide. Under the direction of Transport Canada, the agency is retiring its existing X-ray-based systems in favour of more advanced, CT-equivalent technology. Making this change will ensure compatibility with HBS systems outside Canada; airports in the European Union, for instance, are phasing out old technology and plan to have only CT-based HBS systems by 2022.

Our plans for Toronto Pearson include implementing further system improvements for outbound, transfer and inbound baggage. And the planned Terminal 1 east expansion will increase our airport's overall baggage handling capacity.

Terminal 3 Capacity

Terminal 3 is capable of accommodating the growth in demand we foresee through 2037, provided we implement the following changes (as well as those described in the *Terminal Development* section on page 63).

Aircraft Gates. Increasing the capacity and accessibility of Pier A, a satellite facility of Terminal 3 (see Figure 7-4), is an important part of Toronto Pearson's efforts to meet growing demand. As a first step, we plan to demolish the Hangar 8 maintenance facility. We expect demolition to be completed in 2018, and the area should be converted to apron space by 2019. We then plan to develop a link between the north end of Pier A and the west end of Terminal 3, with five gates along its span serving narrow body aircraft by 2021.

The other end of Terminal 3 is also slated for expansion. We foresee adding two more gates for narrow body aircraft between 2020 and 2022. Beyond these initiatives, we'll accommodate any further traffic growth at Terminal 3 using remote stands supported by bus service to and from the terminal building.

Check-In, Security Screening, Government Inspection. The process changes discussed above with regard to Terminal 1 – such as the increased use of self-service technology – apply equally to Terminal 3. We've replaced many conventional check-in counters with self-service kiosks and bag-drop units, significantly increasing our processing capacity. The remaining conventional check-in counters primarily serve very specific needs:

- premium check-in service
- support when a self-service process requires intervention by a human agent
- checking in passengers of airlines that have not yet adopted our self-service processes

Despite the efficiency gains from self-service kiosks and other modifications, a moderate expansion of the check-in hall is still needed to serve new gates at the east and west ends of Terminal 3. We have preliminary plans for these adaptations and can implement them quickly as new gates become operational.

Other key changes we foresee for Terminal 3 (as in Terminal 1):

- CATSA Plus security screening lanes will roll out in the next few years.
- New technologies are changing and accelerating government-agency inspections.
- We continue to improve passenger amenities with a diverse array of retail shops, restaurants and services.

Baggage Handling. We are implementing a new HBS system in Terminal 3 serving all travel sectors – domestic, Canada-U.S. transborder and international – and expect it to be completed soon. Our plans include a range of measures to improve baggage storage, handling and movement, helping to boost overall system capacity.

Impact of New Technologies

The global aviation industry is constantly seeking new ways to make passengers' entire travel experience – from purchasing tickets to navigating security to boarding aircraft – quick, simple and seamless, with more opportunities to relax and enjoy the journey. The common thread weaving together much of this work is technology. Over the next decade, we expect to see a range of new services adopted widely, including:

One Order. Developed collaboratively by several aviation and technology firms, this passenger documentation concept will eliminate the need to juggle various reference numbers and forms in the course of a journey, replacing them with a single, flexible air travel document.

One Identity. Still in an early phase of development, this innovation will eliminate the current system of multiple ID checks – at security, border control and the gate – and instead identify passengers only once using biometrics such as facial recognition, iris scans and/or fingerprints.

Improved Passenger Screening. Sophisticated sensors and thermal cameras will monitor passengers as they move through the airport facility from curb to gate. No dedicated screening area will be required, and the system will be activated only as necessary.

Enhanced Self-Service Capabilities. New technologies will enable passengers not only to check in remotely – a practice that's already mainstream – but to have their bags travel separately to their final destinations with unique identifiers.

Alongside improvements in areas such as ticketing and security screening, we expect that the entire airport experience will change dramatically in the coming years. As mobile technology evolves – and as more devices are brought online (in what some call the Internet of Things) – airports and their partners will find new ways to keep passengers informed throughout their journey. This communications channel will also create opportunities for airport shops, restaurants and entertainment providers to send travellers offers tailored to their personal interests and tastes.

New software and services will allow passengers to map out airport experiences in advance – booking their preferred dining choices, for instance, or arranging to purchase travel-related items or gifts to take abroad. Travellers will soon be able to browse and shop at an airport retail location and then have their purchases delivered elsewhere. This "click-and-collect" model eliminates the burden of carrying purchases onboard an aircraft; it also means retailers can operate with minimal inventory on site.

In parallel with these changes, we expect that advances in artificial intelligence (AI) will dramatically transform airport staffing. Customer service robots and AI kiosks are already in use at several global airports. As in all sectors and industries, future advances are likely to change how people work in various airport areas, perhaps eliminating some types of jobs while allowing others to be performed remotely.

Collectively, these technological advances and process changes have major implications for terminal design. In a future environment where passengers can check in remotely, send their bags in advance, use self-driving cars to get to and from the airport, and need fewer airline and security staff to make their way onto the aircraft, terminals will undoubtedly look very different. The need for large parking facilities, check-in counters, bulky kiosks, security screening infrastructure – and indeed many of the walls and physical barriers in place today – may no longer exist.

Terminal Development

Short-to-Medium-Term Development Plans

Building on many of the initiatives outlined in earlier sections, in the short and medium term we plan to increase Toronto Pearson's capacity by physically expanding our terminals and making technological and process changes to improve throughput of passengers and baggage. Figure 7-4 illustrates our plans to develop the following aspects of physical infrastructure:

- In the area east of Terminal 1, we plan to expand the Gate 193 Extension, expand the terminal processor and construct a new Concourse H, as well as extending the apron areas to the east and northeast.
- We plan to add gate capacity between Pier A and Terminal 3, and subsequently develop the areas west of Pier A.
- One option under consideration, to be discussed with business partners and stakeholders, is to link Terminal 1 and Terminal 3 by expanding their existing structures to the west and the east, respectively.

Construction of the proposed Regional Transit Centre to the north of the existing terminals (see *Ground Access System* on page 65) would allow us to start incremental development of additional passenger-processing capacity.

Figure 7-4: Short-to-Medium-Term Development

Medium-to-Long-Term Development Options

To continue meeting demand as Toronto Pearson evolves into a top-tier international airport, we are evaluating multiple options to expand passenger terminal capacity in the medium to long term. Areas under consideration are northwest of Terminal 3, south of the future Regional Transit Centre, northeast of Terminal 1 and in the midfield.

8. Ground Access System

In February 2017, the GTAA announced plans for a Regional Transit Centre integrating Toronto Pearson with existing and proposed rail and bus networks that will ultimately link much of Southern Ontario. Working with ground transportation agencies and all levels of government, we've proposed a multi-modal hub to provide easier airport access and offer greener, more economical and less stressful travel options – for passengers, and for the hundreds of thousands of airport-area workers who currently travel our region's traffic-clogged roads. The new hub will support UP Express, the rail link to downtown Toronto launched in 2015, along with current transit services and several that are in development. At the same time, we're studying the shift in vehicle traffic as taxi and limo operators compete with ride-sharing services such as Uber. While our focus is on aviation, our primary goal is enhancing the flow and connectivity of people and goods across our region and around the globe.

Introduction

Apart from connecting air passengers, everyone who travels to and from Toronto Pearson uses our ground access system; this includes travellers, shippers, suppliers and service providers, employees and employers. The system was composed entirely of roads until 2015, when the Union-Pearson Express (UP Express) connected Toronto Pearson to downtown Toronto by rail – a mode of access we expect will expand dramatically in the years ahead.

Meeting the level of demand for air travel we forecast in this Master Plan (see *Demand Forecasts* on page 29) will require a dramatic improvement in ground access to our airport. For Toronto Pearson to fulfill its potential as a catalyst for job creation and growth across our region, we must make it easier for more people and goods to quickly and efficiently reach us by road and rail. Improving access will require sustained effort over several years. It will also challenge us to remain flexible and adaptable as regional transportation options evolve and new technologies emerge.

This chapter describes a wide array of changes to our ground access system. Some are definite and imminent; others are long-term possibilities that may come to pass, perhaps with adaptations, depending on factors both within and beyond our control. Taken together, the changes proposed in this chapter are aimed at the following outcomes:

- Maximize Toronto Pearson's catchment area.
- Shift short-haul air passenger traffic to rapid rail services, preserving runway capacity for long-haul flights.
- Move passenger and employee ground access toward high-capacity, low-emission public and private vehicles.
- Ensure that Toronto Pearson functions as an efficient link in the supply chains of exporters and importers – by using more efficient ground transport services to free up road capacity, resulting in faster, more reliable cargo movement.

The centrepiece of our ground access strategy through 2037 is the creation of a multi-modal transit and mobility hub at Toronto Pearson: the Regional Transit Centre. We envision this centre being developed in conjunction with a new facility, known as Terminal-New (T-New), which would relieve pressure on our existing terminals by accommodating functions such as check-in and security screening. We believe this proposed Regional Transit Centre has the potential not only to substantially improve access to our airport, but also to support greater

productivity throughout the region by connecting Toronto, Mississauga and Brampton. It will also facilitate faster, more convenient movement across the high-traffic Northern Arc of the Greater Toronto and Hamilton Area (GTHA) (see *The Benefits of a Regional Transit Centre* on page 75).

Road Access and Car Parking

Key Improvements since the 2008 Master Plan

Several improvements have been made to the physical infrastructure in and around Toronto Pearson since we published our last Airport Master Plan. As well, passengers accessing our airport by road enjoy more choice in how to reach us – whether by expanded bus service or ride-sharing options such as Uber – than they did a decade ago.

Highway Access. Toronto Pearson continues to benefit from excellent connectivity to the provincial highway system and to the regional road network that serves the GTHA. Since 2008, roadway improvements near our airport have included:

- widening of Hwy 401 west of Hwy 427
- partial widening of Hwy 427 north of Hwy 409
- improvements to the Hwy 401/403/410 interchange
- operational and capacity enhancements to intersections on surrounding arterial roadways

The Ontario Ministry of Transportation is currently constructing or planning additional expansion projects on Hwys 401, 410 and 427 near Toronto Pearson. Improvements on Hwys 410 and 427 include high occupancy vehicle (HOV) lanes.

Public and Employee Parking. Toronto Pearson's Value Park Garage opened in 2009. Located in Area 6B on Viscount Road, this six-storey facility provides about 3,500 reduced-rate public spaces and 5,400 spaces for airport employees. Value Park users can reach Terminals 1 or 3 using the Airport's automated people mover (APM) system, the LINK Train. In 2014, we expanded LINK Trains from six cars to seven, which boosted their hourly capacity from 2,150 to 2,500 passengers in each direction.

Since 2008, we've enhanced public parking services at Toronto Pearson in several other ways. We now offer valet parking at both terminals, online reservations for parking in all lots, and an additional cell phone lot (see description in *Existing Facilities* on page 67) in Area 6B, accessed from Network Road. To serve growth in electric vehicle use, charging stations have also been installed in each of the terminal garages, as well as cell lot 2 on Network Road.

More Vehicle and Service Options. Passenger traffic to our airport has increased since 2008. In parallel with this overall growth, we've seen more passengers arriving and departing via busses, taxi-vans and shuttles offering on-demand transportation services well beyond the GTHA. Toronto Pearson has also been accommodating more pre-arranged taxi, limo, bus and premium ride-sharing services. Many passengers now leave our airport with rides they've booked in advance of their flight arrival.

Existing Facilities

Road Access. Private vehicles remain the most common mode of transport for both passengers and employees accessing Toronto Pearson. Taxi and limo services are the second most popular choice among travellers. All of these users, as well as cargo movers, benefit from our airport's excellent connectivity with the provincial highway system, including direct access to Hwys 409 and 427. As for surface streets, our two passenger terminals are accessible from the east via Airport Road and Silver Dart Drive. On the west side, Convair Drive, Britannia Road and Courtneypark Drive approach Cargo West (formerly known as the Infield Cargo area).

Public Parking. A number of public parking options are available at Toronto Pearson.

The Terminal 1 Parking Garage is an eight-level structure containing approximately 8,400 public spaces (including 700 rental car spaces).

The Terminal 3 Parking Garage is a five-level structure with about 3,800 public spaces (including 600 rental car spaces).

The Value Park Garage (see description in *Key Improvements Since the 2008 Master Plan* on page 66) provides approximately 3,500 reduced-rate public spaces, while the Value Park Lot, just across Airport Road from the Value Park Garage, offers an additional 1,200 surface spaces, also at a reduced rate.

The Viscount Station Reserved Lot has 100 spaces.

At all of these facilities, passengers or people picking up or dropping off travellers can reserve parking through the Toronto Pearson/GTAA website before arriving at the airport. There are also several private parking facilities nearby that provide shuttle services to our passenger terminals.

Employee Parking. Approximately 9,000 parking spaces are available for employees throughout Toronto Pearson.

East – Most employees working in the terminals park either in Area 6B in the Value Park Garage, in an adjacent outdoor lot, or in the south lot of Viscount Station. These facilities have about 6,500 spaces in all.

West – The GTAA provides about 1,000 spaces on the west side of the airport, accessible from Britannia Road and serving Cargo West, the GTAA Three-Bay Hangar, the Central Deicing Facility and other infield operations.

South – On the south side of the airport, about 1,500 spaces are distributed among multiple lots along Convair Drive. These are used by GTAA and Air Canada staff, as well as Peel Regional Police and Transport Canada.

Cell Phone Lots. Two cell phone lots, offering about 250 spaces in total, are located in Area 6B and are accessible from Network Road. Drivers can park and wait there until their parties are available for pick-up at the arrivals-area curbs.

Vehicle Rentals. The ground levels of the parking garages serving Terminals 1 and 3 include quick-return areas for several major car rental companies. The companies wash and refuel their cars off-site. Rental vehicles occupy about 1,300 parking spaces in the terminal garages (included in the public space numbers stated above). Additional car rental firms operate outside the airport property and shuttle customers to and from Viscount Station, which has LINK Train access to our passenger terminals.

Future Road-Access Development

As the GTHA continues to grow, road congestion is making it harder to access Toronto Pearson during peak periods. Roadway infrastructure is under the control of various provincial, regional and municipal authorities. It's important to the health and prosperity of our region that all key players work together to improve ground access to Toronto Pearson as part of a broader, integrated GTHA transportation network.

We forecast that in the short term, with infrastructure remaining largely as it is today, increased traffic around our airport will be roughly proportional to the growth in air passenger volumes. Over the longer term, as rail and bus service improves, we expect that road traffic will grow less rapidly; more people will be using higher-occupancy modes of transport.

In addition to more mass transit, in the years ahead we expect that ride-sharing, car-sharing and flexible rental arrangements will also account for a larger proportion of road trips to Toronto Pearson. As for the impact of autonomous vehicles, while this may be significant once the technology becomes mainstream, potential outcomes are difficult to discern at this point.

Development to 2027

Roadways. No major road improvements on airport lands will be required to accommodate growth in passenger demand before 2027. However, we do foresee some modest changes that will improve traffic flow and ease congestion.

The Ontario Ministry of Transportation is undertaking incremental expansion of the provincial highway network near the airport during the master planning period. As part of its expansion projects on Hwys 410 and 427, the Ministry is also introducing high occupancy vehicle lanes (HOV) and provisions for high occupancy toll (HOT) lanes in certain sections. These changes should help alleviate delays for air passengers and Toronto Pearson employees who use transportation modes that rely on road access. Since vehicles like taxis and limos are high-occupancy, air passengers who use those modes should experience more reliable highway travel.

As highway improvements help to accommodate increased traffic in the near term, we will continue working with our partners to develop a Regional Transit Centre that will ultimately relieve pressure on all major arteries by providing enhanced access to the airport (see *The Benefits of a Regional Transit Centre* on page 75).

At the airport itself, we may undertake localized road improvements near the Regional Transit Centre, including on Viscount Road and in Area 6A, to accommodate increased bus movements and associated passenger loading and unloading.

Figure 8-1: Areas 6A and 6B

The City of Mississauga has initiated discussions with the GTAA and other affected property owners about a proposed new off-ramp from westbound Hwy 401. The ramp would extend across the southwest portion of the airport lands, connecting to the south with an extended Creekbank Road and to the north with Enterprise Road and Atlantic Drive. Although we have not identified this improvement as urgent for meeting current demand, we recognize the potential for the planned roadways to alleviate congestion at the Dixie/Hwy 401 interchange and on the surrounding road network. The City of Mississauga is currently working to secure land for the ramp and road-extension construction. We have reserved the GTAA lands required and are engaged in property-exchange discussions.

Terminal Roads and Curbs. We expect to make improvements to terminal frontage roads and curbs to accommodate growth in curbside passenger demand at Toronto Pearson, especially during peak periods. Terminal 3 in particular already experiences significant congestion at busy times. Infrastructure enhancements will likely be part of the eventual solution; but in the short term, easing congestion at the terminal frontage roads and curbs will primarily involve operational measures.

These will include a combination of:

- increased parking enforcement
- reallocation of curbside loading/unloading areas for specific modes to improve traffic flow
- new and/or expanded cell phone lots (with improved directional signage on approach roadways) to encourage drivers who are picking up passengers to wait at a nearby location before proceeding to the terminal curb
- permitted double parking zones

Other demand management measures that we plan to evaluate further include curb pricing and short-term parking incentives. A detailed assessment of the effectiveness of these and various other options is pending.

Post-2027 Development

We foresee two major changes that may oblige us to make roadway improvements beyond 2027. One of these is growth in demand for road access by air passengers and cargo movers. The other is the expansion of our passenger terminals, which would be driven by rising demand for air travel. Listed below are some specific roadway improvements that may become necessary in the latter half of this Master Planning period.

Existing Terminal Areas. We've identified three main areas for improvement in the immediate vicinity of Toronto Pearson's passenger terminals:

- realignment of Terminal 1 east roadway access – including roadways exiting Terminal 1, as well as Silver Dart Drive access to/from Terminals 1 and 3, and roadways connecting the two terminals to Hwy 427 and Airport Road
- realignment of the Terminal 3 outbound road to Hwy 427 – in conjunction with realignment of the roadways east of Terminal 1
- a new directional ramp from Hwy 427 northbound to Hwy 409 westbound – to replace the current Hwy 427 northbound access ramp into the airport

Many of our pre-2027 plans are aimed at diverting passengers away from small vehicles (whether personal or commercial) and onto higher-occupancy modes of transport. Depending on how effective these efforts are – and on how much air passenger demand rises overall – by 2027 we may need to provide more curbside capacity at Terminal 3 than we do today. It's possible that all curbside passenger loading and unloading will eventually move away from Terminal 3 and into T-New. In the meantime, we may need to adjust capacity at Terminal 3 to avoid major congestion.

Identifying the most effective way to add any necessary curbside capacity requires further analysis. One option would be to remove the Terminal 3 Parking Garage to allow for greater activity at the terminal, and to replace that lost parking capacity with a new facility in Area 6B.

Airport – West Side and Infield. We've identified two possible changes to the west side of the Airport that would likely facilitate increased movement of cargo traffic. We only plan to implement these changes if and when it's necessary in order to meet demand:

- Improvements at the intersection of Convair Drive, Britannia Road and Courtneypark Drive, including geometric improvements and traffic signals, could reduce delays and queuing during peak periods.
- Courtneypark Drive could be widened and extended from the Airside Service Road over Spring Creek and under Runway 15R-33L and Taxiway Foxtrot, eventually connecting into the extension of Britannia Road at the north end.

The GTAA has identified several ways in which passenger terminals and aprons might be adapted to accommodate growth in demand beyond 2027. These changes would have implications for ground facilities at the proposed Regional Transit Centre and at T-New, including a need for access roads and parking.

Both the transit centre and T-New are expected to be constructed in phases (see *Development of the Regional Transit Centre* on page 83). The expansion we envision for T-New after Phase 1 (likely to be completed by 2027) would require road-access modifications to increase traffic capacity from Hwy 409 and Airport Road through to the T-New frontage roads and curbs, as well as to the expanded Regional Transit Centre. We envision multiple levels for the new terminal-frontage roadways to separate departure and arrival passenger flows. The inbound ramps from Hwy 409 would also likely require grade separation over Airport Road.

Future Car Parking Development

In the years ahead, more people across our region will be able to conveniently access Toronto Pearson by rail and bus – including both public transit and high-capacity commercial options. With a smaller proportion of travellers accessing our airport in personal vehicles, we expect that demand for both employee and public parking will grow more slowly than forecast growth in air travel and facilities employment. Passenger surveys suggest that the introduction of the UP Express service has already dampened demand for parking, although not as significantly as anticipated.

Not only are transit choices expanding, but vehicle ownership rates are declining. At the same time, the overall cost of operating a vehicle in the GTHA, including parking, is increasing. For these reasons, we expect to see a fundamental shift in personal vehicle usage – and therefore in demand for parking at Toronto Pearson.

Nevertheless, there may still be a need for additional on site parking in the medium-to-long term as passenger growth continues – even if a smaller proportion of those passengers drive. If new rapid transit connections to our airport are not implemented (see *Future Transit Initiatives* on page 80), additional parking capacity will almost certainly be necessary. In that event, we would likely meet the additional demand for parking with incremental construction of parking facilities in Area 6B, coordinated with the phased construction of T-New and the Regional Transit Centre. We'll also continue to protect land for possible expansion of the existing Terminal 1 Parking Garage; we have a provisional plan that would add 3,000 parking spaces to that facility.

It's possible that increased ground vehicle traffic at Toronto Pearson will be manifest mainly in congestion at the terminal curbs – that is, from people dropping off or picking up travellers. This scenario would also have implications for how we plan our parking facilities; it might, for instance, require us to make operational changes, such as offering more short-term parking at the terminal garages.

Table 8-1 shows forecasts of overall demand – from employees, passengers and people dropping off or picking up travellers – for parking in the main terminal area, including Area 6. The second column shows forecasts of passengers originating from or destined to Toronto Pearson (see *Demand Forecasts* on page 29 for a more detailed discussion). The columns to the right show how parking demand would vary depending on the proportion of air passengers who access Toronto Pearson by transit rather than personal vehicles.

More detailed work is required to validate these estimates, but the implication of the analysis presented below is that our current parking infrastructure will be sufficient to meet 2037 demand, provided that 30 per cent to 35 per cent of air passengers are reaching Toronto Pearson by mass transit at that point.

Terminal-Area Parking Space Demand (rounded) – Public and Employee Total

Year	Passengers (millions)	Transit Mode Share (%)						
		10	15	20	25	30	35	40
2016[1]	29.5	19,900	-	-	-	-	-	-
2027	44.4	28,400	26,900	25,400	23,900	22,400	20,900	19,400
2037	52.4	33,200	31,500	29,700	27,900	26,200	24,400	22,600

1 Assumes a current passenger parking supply of 17,050 spaces and an employee parking supply of 7,000. This analysis assumes that current demand is 80 per cent of capacity for air passengers and 90 per cent of current capacity for employees.

Table 8-1: Demand for Terminal-Area Parking Under Various Transit Usage Scenarios

Over the long term, transit uptake may improve dramatically and parking demand may level off; but even then, in the medium term – while travellers await the introduction of convenient alternatives to personal vehicles – more parking capacity may well be required.

With regard to rental cars at Toronto Pearson, the GTAA is committed to working with providers on an integrated package of facilities – including ready stalls, quick-turnaround facilities and service centres that maximize customer service while minimizing vehicle shuttling and resulting greenhouse gas emissions.

LINK Train Development

We expect that the existing LINK Train system will be sufficient over the medium term although ridership levels during peak periods can approach capacity today. As a result, some capacity expansion to the system in the short term is currently being planned. Our projections indicate that periods when ridership approaches capacity will become more frequent, but that capacity will accommodate growing demand for travel between Terminal 1 and Viscount Station for a number of years. During that period, the GTAA will continue to assess whether further incremental expansion to the system is warranted.

Some of our planning scenarios involve the conversion of Terminal 1 and/or Terminal 3 into passenger concourses with no groundside infrastructure (see *Development of the Regional Transit Centre* on page 83). Should those scenarios come to pass, a replacement for the LINK Train system would be necessary.

Rental Cars

About 5 per cent of Toronto Pearson's air passengers rent cars at our airport. Concession fees from rental agencies represent a substantial source of non-aeronautical revenue for the GTAA. Car rental facilities include counters and ready-return stalls in the parking garages adjacent to the terminal buildings, as well as service centres (located elsewhere) where cars are cleaned, fuelled, detailed and repaired. Car rental companies also manage their fleets – adding or removing vehicles – at the service centres. The existing model maximizes customer convenience, but it forces rental operators to shuttle cars between customer service areas and vehicle service centres – an inefficient use of both fuel and staff time.

We may wish to engage our rental agency business partners in discussing whether the introduction of quick-turnaround areas (QTAs) would help to improve the efficiency of their operations at Toronto Pearson. Used at some other airports, QTAs let rental agencies consolidate customer service functions, fuelling, and routine vehicle cleaning in their operating areas near the terminal buildings. Under the QTA model, vehicle service centres located elsewhere on airport lands are used exclusively for major repairs and fleet management. The QTA model is more efficient in terms of both labour and emissions, and is neutral in terms of its space requirements. Any extra space a rental agency needs at its QTAs in order to perform fuelling and cleaning functions can be subtracted from the footprint of its vehicle service centre.

Another topic on which we'll continue to engage our car rental partners is the rapid transit infrastructure we expect to see over the medium and long term, and what it may mean for their operating areas. Currently, two major rental companies are located in areas that would likely be affected by a rapid transit route running between the proposed Regional Transit Centre and Renforth Station (on Eglinton Avenue). Over the course of this Master Plan we'll work collaboratively with car rental providers to identify appropriate areas for their facilities as the wider ground transportation system evolves.

Last-Mile Transportation Services

Over the past several years, new transportation models have been emerging to fill the gap between mass transit and personal vehicles. These offerings, enabled by technology in general and by mobile phones in particular, are already changing the way some passengers and airport employees access Toronto Pearson. Their influence is likely to grow in the years ahead.

While some new transportation options are similar to traditional taxi services, novel variations on carpools, ride-sharing and shuttles continue to emerge.

It's not only technology that's changing: organizations and expectations are changing, too. Employers in and around Toronto Pearson are becoming more aware of their employees' transportation needs, and some are exploring shared transportation options to help alleviate the hassle of travelling across municipal jurisdictions by transit.

We're monitoring these trends closely in order to ensure that our operations are well adapted to the ground transportation preferences of employees and air passengers, and that we're effectively anticipating emerging trends. We're paying particular attention to ride-sharing services that have been granted licences to operate in municipalities surrounding our airport.

To ensure Toronto Pearson is well positioned to meet the needs of all users, we'll continue to work with transportation network companies such as Uber and Lyft to understand how their operations intersect with our own. For instance, we're considering additional holding areas where ride-sharing vehicles can await pick-ups.

The GTAA is also exploring opportunities to directly improve ground access to our airport by modes other than personal vehicles: for instance, the introduction of a shuttle service between Toronto Pearson and other employment centres and mobility nodes in the area.

Active Transportation

The GTAA is committed to exploring ways that will make it easier for passengers and employees to access Toronto Pearson on foot and by bicycle (modes often described as "active transportation"). Making active transportation to and from our airport safer and more appealing is consistent with our broader goal of easing congestion on local roadways. It also responds to the imperative to reduce greenhouse gas emissions related to our operations, and is in line with the emerging policies and plans of surrounding municipalities.

To make active transportation a realistic option for air passengers and employees, we'll have to make terminal buildings and groundside facilities (including the new Regional Transit Centre) more accessible to pedestrians and cyclists. One key will be creating better links between Toronto Pearson and the cycling and pedestrian networks that surround it. Consulting and collaborating with relevant municipal agencies and with Metrolinx will be vital to our success.

Public Transit and Regional Transit Centre

Key Improvements since the 2008 Master Plan

Several new mass transit options have become available to Toronto Pearson users since our last Master Plan:

UP Express is a rail service between Toronto Union Station and Terminal 1. Introduced by Metrolinx in 2015, the service is scheduled to operate in both directions every 15 minutes between 5:30 a.m. and 1:30 a.m. The travel time between Union Station and Terminal 1 is approximately 25 minutes.

Local bus services have also improved. The Toronto Transit Commission (TTC) and Mississauga transit (MiWay) run more frequent regular service, and MiWay now has an express route between Toronto Pearson and Humber College. There are new GO Express routes between our airport and both Hamilton and Richmond Hill. And Brampton Transit also offers limited-stop service to Toronto Pearson.

Greyhound Canada has resumed operations to/from Toronto Pearson, providing direct service to several destinations in Southern Ontario, as well as connections to the United States.

Demand Trends

Mode Share. Figure 8-2 shows the transportation modes air passengers use to reach Toronto Pearson today.

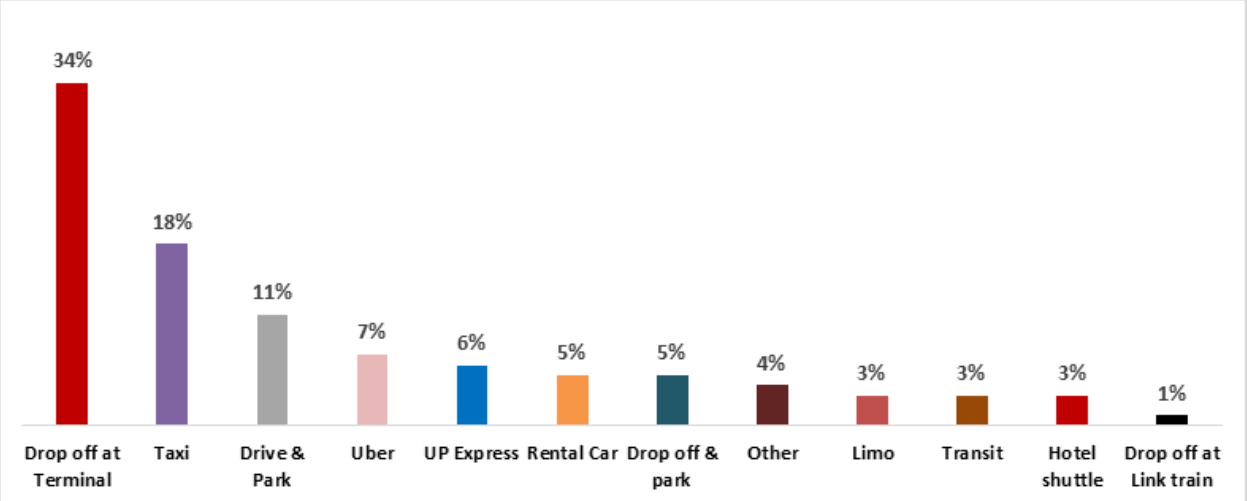


Figure 8-2: Ground Access Mode Share (Air Passengers)

Source: 2016 GTAA Ground Transportation Survey

Although usage patterns did not change dramatically between 2000 and 2016, we've observed a moderate shift since 2008 toward the use of public transit, as well as an increase in the number of drop-offs and pick-ups at terminal curbs. We believe that the introduction of UP Express and ride-sharing services such as Uber have driven these changes.

Public Transit. Detailed analysis of our 2016 Ground Transportation Survey affirms that a greater proportion of air passengers are now using public transit to reach Toronto Pearson. Travellers are responding to the fact that transit options have become more reliable and less time-consuming as a result of various agencies' investments in the overall network.

At the same time, ride-sharing services such as Uber appear to be taking market share not only from traditional taxi and limo services, but from public transit as well. This has meant that some passengers are moving out of their own cars and into Uber vehicles – a change that relieves less pressure from roadway infrastructure than a shift to transit would. Still, to the extent that ride-sharing apps serve air passengers arriving from locations without efficient transit options, they can be seen as complementary to transit and not a countervailing force.

Like air passengers, Toronto Pearson employees are now slightly more likely to use public transit to reach their workplaces – although they're adopting this alternative at a slower rate than the general population. Single-occupancy vehicles remain by far the most common way for employees to reach our airport. Between 85 per cent and 90 per cent of employees travel in private vehicles, whether they're dropped off or drive themselves. About 10 per cent use transit.

Income and travel time are key factors determining employees' transit use: those with higher incomes or who face longer commutes are less likely to use transit. However, the introduction of UP Express and additional express bus service to Toronto Pearson may cause the correlation between income and transit use to weaken in the future. Another major influencer on overall transit ridership is the level of service available in employees' neighbourhoods – especially at appropriate times of the day for the many Toronto Pearson employees who do not work traditional day shifts.

We expect that a larger share of both air passengers and employees will access Toronto Pearson via public transit and other high-occupancy transportation modes over the course of this Master Plan. These options will become more attractive as they begin to demonstrate improved convenience and economy. We believe that the planned Regional Transit Centre, in conjunction with proposed rapid transit and expanded express bus services, will accelerate the trends we've already begun to observe.

The Benefits of a Regional Transit Centre

Ground Access at Global Hub Airports. To fulfill our potential as a top-tier international airport – and a driver of economic growth for the region, province and country – Toronto Pearson must become significantly more accessible. Air passengers, employees and cargo will need to be able to move to and from Pearson – and the surrounding Airport Employment Zone (AEZ) – more easily and via a broader range of transport modes. In the absence of fundamental changes to the current ground access system, the time it takes for people and goods to move to and from Toronto Pearson and the AEZ will become longer and less predictable over time. This will have adverse consequences for our airport and the enormous amount of economic activity that depends on the connections we provide.

Today, about 10 per cent of passengers and employees use public transit to access Toronto Pearson – a proportion that will need to double or triple if we are to meet forecast demand for air travel. Achieving that target will require a coordinated strategy. The GTAA is working closely with Metrolinx and municipal agencies to increase the availability of public transit options to our airport and the AEZ. We also need to find more effective ways to encourage both passengers and employees to use transit.

Today, about 300,000 people are employed in the AEZ, and that number is expected to grow. Improving and expanding transit service will not only help us fulfill Toronto Pearson's mandate to drive economic growth by enhancing the region's global connectivity; it will also allow more people to benefit from the economic opportunities we help to create. Employers in the AEZ will gain access to a larger talent pool, and residents of nearby areas – particularly those in lower-income neighbourhoods – will have more job opportunities.

Many leading international airports have aggressive goals for the proportion of users who reach their facilities by public transit. London Heathrow has set a target of more than 50 per cent, driven in large part by its desire to offset emissions from aviation growth. Similarly, the Swedish government required Stockholm-Arlanda airport to achieve a public transit share of more than 50 per cent as a condition for the approval of a new runway.

Table 8-2 compares several major international airports in terms of the percentages of air passengers taking advantage of transit, as well as the ground transport infrastructure that's currently in place. As the table shows, Toronto Pearson lags behind its peers in terms of both available transit infrastructure and the proportion of passengers who currently make use of it.

Many top-tier airports around the world have successfully achieved public transit mode shares of 30 per cent and higher by creating ground transportation centres – multi-modal hubs that accommodate a range of trains and busses and are fully integrated with terminal facilities. For instance, at both Amsterdam Schiphol (Figure 8-3) and Frankfurt Main Airport (Figure 8-4), rail stations have been built below the terminal complexes, with integrated office and retail development.

By 2037, our ground transportation goal is to have 30 per cent of all passengers travel to and from Toronto Pearson via transit.

Airport	Passengers 2014 (millions)	Distance to City Centre (km)	% Passengers Using Public Transit	Airport Express Train	Metro/Rapid Transit	Regional/ National Trains
Amsterdam Schiphol AMS	55.0	9	39%	No	No	Yes
Chicago MDW	21.2	15	5%	No	Yes	No
Frankfurt FRA	59.6	10	33%	No	Yes	Yes
Hong Kong HKG	63.1	34	63%	Yes	No	No
London Heathrow LHR	73.4	24	36%	Yes	Yes	No
New York JFK	53.2	19	8%	No	Yes	No
Vancouver YVR	19.4	15	20%	No	Yes	No
Toronto Pearson	38,569,088	22.5	10%	Yes	No	No

Table 8-2: Comparison of Multi-Modal Hubs, Transit Mode Share, Ground Access Options

Figure 8-3: Multi-Modal Global Hubs – Amsterdam Schiphol Airport

Figure 8-4: Multi-Modal Global Hubs – Frankfurt Main Airport

Improved Regional Connectivity. Transportation is a significant challenge not only around Toronto Pearson, but across the GTHA. The average daily commute time in Toronto is 66 minutes – the highest in Canada and in the top quartile of North American cities. Our region's performance in this regard is deteriorating: delays due to congestion have been growing at 9 per cent annually on major highways, and by as much as 36 per cent on major roads. Many economic experts have concluded that deficiencies in transportation service and infrastructure are constraining growth and diminishing quality of life in our region. Improving and expanding our transit networks and enhancing our roads are vital objectives not only for the effective functioning of Toronto Pearson, but for the continued social and economic well-being of our whole region.

Union Station is the only major ground mobility hub in the GTHA. Creating a second hub would improve transportation across the region by increasing the capacity, reach and frequency of service of the current transit network. Making rail and bus services more convenient and less time-consuming would help to attract a larger share of travellers from outside downtown Toronto. Currently, transit options in the AEZ are slow and offer too little coverage to compete effectively with private vehicles.

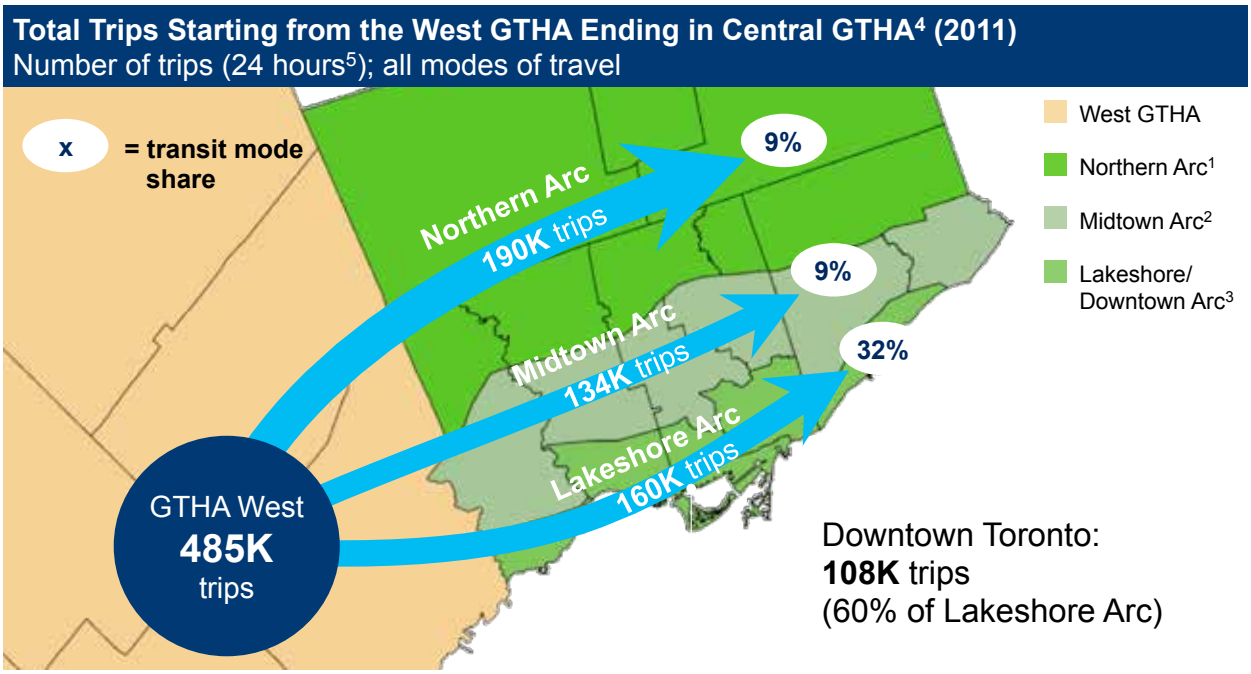
Ground mobility hubs increase transit service by aggregating demand for popular legs of journeys. All travellers have distinct origins and destinations, but hubs help to bring them together with others for shared segments of their trips. This allows operators to deliver higher-frequency service. It can also help to justify new lines, as well as higher-capacity modes of transit, such as light rail. As these changes boost the overall speed and convenience of transit, a greater share of the population moves away from cars and into shared modes – reducing congestion and benefiting the environment.

Substantial Travel Demand in the Western GTHA. The western suburbs of the GTHA, including Peel, Halton and Hamilton, generate more than 4.5 million trips per day on all modes of travel, including private vehicles and public transit. This represents 35 per cent of all trips; the central GTHA generates 56 per cent and the eastern GTHA generates 9 per cent. Of the western GTHA's 4.5 million trips, only 7 per cent currently use public transit. By contrast, in the central GTHA, which offers much more transit infrastructure and service, the proportion is three times higher at 21 per cent.

The transportation needs of the western GTHA will increase significantly as the region's population continues to grow. The area will account for 34 per cent of the Greater Golden Horseshoe's population growth over the next two decades – as compared to 43 per cent for the central GTHA, 8 per cent for the east, and 15 per cent for the Outer Golden Horseshoe. If the additional transportation demand in the west is not addressed through a substantially improved transit system, current congestion trends will only worsen.

The western GTHA is particularly underserved by transit when it comes to journeys that are not bound for downtown Toronto. As Figure 8-5 shows, there are fewer daily trips from the west along the lakeshore into downtown than there are along the Northern Arc of the GTA, which includes North Toronto, Vaughan, Richmond Hill and Markham.

Despite the large number of trips that move along the Northern Arc, public transit ridership is low – accounting for less than 9 per cent of all travel and as little as 3 per cent in some regions (Markham, for instance). On the other hand, of the 108,000 trips from the western GTHA to downtown Toronto, 57 per cent are by public transit. The reason for this discrepancy is that limited transit options along the Northern Arc make travel times uncompetitive with driving. Commuters from the western GTHA have shown a willingness to use public transit when viable options exist. Addressing the current lack of rapid transit options along the Northern Arc has the potential to significantly improve ridership.



1 Vaughan, Richmond Hill, Markham, Etobicoke North, York-Downsview, Willowdale, Don Valley-Hillcrest, Scarborough North; 2 Etobicoke Central, York-Crosstown, Midtown Toronto, Don Mills, Scarborough Centre, Scarborough East; 3 Etobicoke South, West End Toronto, Downtown Toronto, East End Toronto, Scarborough Southwest; 4 Includes only trips that have a final destination in Central GTHA; i.e., does not include trips passing through Central GTHA; 5 Approximately 70% of trips occur during AM/PM peaks, across all three arcs.

Source: University of Toronto - Transportation Tomorrow Survey (2011 trip data, by planning district)

Figure 8-5:

Distribution of Trips from GTHA West to Central GTHA

An Ideal Location for a Second Major Mobility Hub. Given high demand and the proven efficiency benefits, we believe there is a clear need for a second mobility hub serving the western GTHA. Moreover, our proposed Regional Transit Centre could help improve ground transportation across the Northern Arc by linking disparate suburban transit options, connecting them to each other as well as to Toronto's denser urban system. The evidence indicates that the following key factors contribute to effective ground mobility hubs:

Good geography. Centrally located relative to high-demand trip origins and destinations.

Connecting capacity. Aggregating sufficient regional demand to justify high-frequency transit service.

Strong catchment. Effectively serving as a trip generator, with an established base of frequent riders that ensures stable utilization of the hub and a productive return on capital investment.

Strategic transit carrier. Well positioned and equipped to act as a connector of multiple transportation networks.

Accessibility. Easy for commuters to reach and use, reducing potential barriers to ridership.

Social licence. Offering benefits that are substantial and widely shared, connecting underserved communities and increasing overall liveability and affordability.

The area around Toronto Pearson performs well on each of these dimensions, making it a promising location for a mobility hub.

Situated at the boundary of Peel Region and the City of Toronto, our airport is a natural commuter waypoint for those travelling across the region. A hub at Toronto Pearson could act as an entry point not only to the Northern Arc, but also to central and downtown Toronto – for instance, via the Eglinton West/Crosstown Light Rail Transit (LRT) service, or by UP Express. Aggregating trips from the western GTHA would also facilitate more frequent service, higher-capacity transit modes and more extensive route coverage – both within the western GTHA and along the Northern Arc.

Our airport benefits from its location at the boundary of three major municipalities – Toronto, Mississauga and Brampton – and is an ideal connection point between their respective transit systems. Connecting these distinct regional services is currently a challenge; the systems are only linked by a small number of lines and stops. A mobility hub at Toronto Pearson would provide an opportunity to better consolidate those connections and create inter-municipal bus or other transit routes.

Toronto Pearson is adjacent to four major highways and served by UP Express and select municipal bus lines. Other transit options that are currently nearby – or will be in the near future – include the Mississauga Bus Rapid Transit (BRT), Eglinton Crosstown/West LRT and Finch West LRT. This proximity to existing and planned rapid transit services enhances the feasibility of creating a Regional Transit Centre at our airport, as linking to this hub would simply require the extension of existing lines, as opposed to the creation of new ones.

Toronto Pearson isn't just advantageously situated between other desirable destinations. The high concentration of jobs in the Airport Employment Zone (AEZ) – generating more than a million trips daily – combines with air passenger traffic to create significant demand for ground transportation. A hub offering improved service and coverage would have the potential to convert a much larger proportion of AEZ workers to transit. And as utilization by these commuters – along with airport users, Northern Arc travellers and other segments – continued to grow, the increased traffic would support more frequent transit service and extend the value of any capital investment through economies of scale.

Future Transit Initiatives

Since 2008, Metrolinx and municipal transportation agencies in the GTHA have been actively developing plans for expanded public transit, focusing particularly on infrastructure and services in the Toronto Pearson area. A number of these proposed projects would serve the AEZ, but to date no funding has been committed to new services that would connect to the airport proper.

This Master Plan assumes that existing, planned and proposed transit lines could be linked to the proposed Regional Transit Centre at Toronto Pearson within our planning timeframe. Figure 8-6 illustrates all current and potential transit lines in the area.

Figure 8-6: Transit Initiatives in the Airport Area

Mississauga Transitway. The Mississauga Transitway, an exclusive transit right-of-way for MiWay and GO Transit busses, was slated for completion by December 2017. During 2018, MiWay plans to launch a new core express service (Route 100) between Winston Churchill Boulevard and Toronto Pearson. Initially, the service will operate in mixed traffic lanes to and from Terminal 1 Ground Level, but an improved connection to our airport may be provided as the service matures. This would include a new transit-only (bus and LRT) bridge across Hwy 401, as well as transit-priority lanes and signals at intersections along the route.

Eglinton West LRT Extension. The proposed Eglinton Crosstown LRT line includes a possible extension to Toronto Pearson. The portion of the route currently under construction, running from Kennedy to Mount Dennis (near Weston Road), is scheduled for completion in 2021. The extension from Mount Dennis west to Renforth Station and potentially on to Toronto Pearson has not yet been funded. Metrolinx and the City of Toronto are leading the feasibility studies and planning for the section between Mount Dennis and Renforth Station, as this would constitute part of the City's SmartTrack initiative. Metrolinx, in cooperation with the GTAA, the City of Mississauga, the City of Toronto and the TTC, has undertaken a feasibility study to identify an optimal LRT route between Renforth Station and the planned regional hub at Toronto Pearson.

Finch West LRT Extension. The Finch West LRT is a planned 11-kilometre line that will run along the surface of Finch Avenue from Humber College to the new Finch West Subway Station (at Keele Street on the Toronto-York Spadina

Subway Extension). The project has secured funding and is expected to be completed in 2023. Metrolinx has noted in its regional transportation plan the potential to extend the Finch LRT westward to Toronto Pearson. This system component is not currently funded, but we anticipate that Metrolinx will undertake additional planning studies required in the near future – particularly if Woodbine Entertainment Group proceeds with a plan announced in April 2017 for a large-scale mixed-use development on its racetrack lands.

Regional Express Rail. The Province's Regional Express Rail (RER) program, which we expect will be realized over the next 10 years by Metrolinx, proposes to transform the GO Rail network through several key enhancements, including:

- the eventual electrification of GO Transit train service on lines owned by the province
- two-way service on all routes throughout the day, including on evenings and weekends
- both all-stop and limited-stop (or express) service
- additional station stops

By creating the RER system, GO Transit expects to increase traffic across its network from 1,500 train trips weekly in 2015 to about 2,200 by 2020. That total is projected to reach about 6,000 trips per week by 2024.

Along the Kitchener corridor, service between Union Station the Bramalea GO Station will be scheduled every 15 minutes. For routes that extend farther west on the same line, service will be available at 30-minute or 60-minute intervals depending on time of day.

A new rail line that diverges from the existing Kitchener track corridor could offer direct service to and from Toronto Pearson via GO RER – and also potentially via high-speed rail. We believe these prospects warrant serious consideration.

Figure 8-7: Kitchener GO RER Corridor, Potential "Bend" Alignment

The GTAA has undertaken a pre-feasibility review of options for linking the Kitchener GO RER corridor to Toronto Pearson. This process has yielded several possible configurations of rail links, including the "bend" alignment depicted in Figure 8-7, as well as a new branch or spur line running through the proposed Regional Transit Centre.

In addition to supporting our goal to increase transit mode share by air passengers to Toronto Pearson by 2037, direct RER service has the potential to advance other goals, including:

- catalyzing development throughout the Toronto-Kitchener/Waterloo innovation corridor
- expanding Toronto Pearson's catchment area
- freeing up airside capacity as passengers who would otherwise have taken short-haul flights may choose to travel by rail

High-Speed Rail. Since 2014, the Province of Ontario has been studying the possibility of high-speed rail (HSR) service between Toronto and Windsor, with stops proposed at Union Station, Toronto Pearson, Waterloo, London and Windsor. Any proposed HSR service in this corridor would use the Kitchener GO line.

In 2015, the government appointed the Hon. David Collenette as Special Advisor on HSR, asking that he specifically examine long-term prospects for the Windsor, London, Kitchener-Waterloo and Toronto corridor. In a report released in the spring of 2017, officials announced that they would proceed with an environmental assessment, including an agency and public consultation plan, to further assess the project's benefits and costs.

The GTAA's own analysis suggests that HSR could potentially divert up to two million trips annually from road or air to rail between Toronto Pearson and London/Kitchener-Waterloo.

Highway 407 Transitway. The Highway 407 Transitway is a planned transit service that will run parallel to Hwy 407 from Burlington to Oshawa. A key component of the Province of Ontario's plan for improved inter-regional transportation in the Greater Golden Horseshoe, the 407 Transitway will be a separate right-of-way for GO and municipal bus rapid transit services. Its route will include stations, platforms, parking and passenger pick-up and drop-off facilities. The 407 Transitway has the potential to meet a substantial proportion of the transit demand along the Northern Arc.

The 407 Transitway could significantly improve inter-regional connectivity to the proposed transit centre at Toronto Pearson, linking several GO and municipal bus services to our airport. For instance, the current GO Route 40 could use the Transitway as it travels between Toronto Pearson and Richmond Hill. As we continue to engage Metrolinx, municipal transit operators and stakeholders across the region in discussions about the connectivity benefits of a Regional Transit Centre at Toronto Pearson, the 407 Transitway will definitely be part of the conversation.

Development of the Regional Transit Centre

The planned Regional Transit Centre at Toronto Pearson – along with our new, centralized passenger processing facility, T-New – would be developed in phases. Various regional transit connections could be incorporated over time, including those discussed in the foregoing section: the Eglinton West LRT Extension, Bus Rapid Transit by MiWay, the Finch West LRT Extension, Regional Express Rail from the Kitchener line and the provincial HSR service.

Our proposal locates the regional mobility hub across Airport Road from Terminals 1 and 3, with access from Hwys 409 and 427, as well as from Airport Road. Situated at the heart of a new mixed-use commercial area, it will include office, retail, hotel and other commercial space. The vision for the surrounding area calls for improved streetscapes with sidewalks, landscaping and attractive lighting. Figure 8-8 shows an initial rendering.

Figure 8-8: Regional Transit Centre/Terminal-New Concept Rendering

Development to 2027

The Regional Transit Centre is a multi-year project that will be driven by demand for additional processing capacity, business partner needs and planned extension of better ground transit options in the Greater Toronto and Greater Golden Horseshoe Areas.

We've forecasted that phase one of the Regional Transit Centre would commence operations in conjunction with the earliest potential light rail connection to Toronto Pearson: the extension of the Eglinton Crosstown/West LRT. Discussions with Metrolinx indicate that the LRT extension will take from seven to 10 years to design and build following a funding decision.

We're currently protecting lands for a new transit-only bridge over Hwy 401 to serve the proposed Eglinton LRT extension. The bridge would cross the highway parallel to Renforth Drive, running from the new Renforth Station on Eglinton Avenue, up Commerce Boulevard to the area adjacent to the GTAA Administration Building (on Convair Drive).

In the near future, even before the Eglinton LRT line connects to Toronto Pearson, we plan to begin facilitating new bus connections to the new LRT line. While construction of the initial phase of the Regional Transit Centre is underway, we'll provide either an off-street bus terminal or enhanced bus stop facilities on Viscount Road (or possibly in Area 6A) for passengers travelling to the westernmost Eglinton LRT station. This will provide near-term connectivity to the TTC while helping to seed demand for the transit options to come.

In our plan, the initial phase of the Regional Transit Centre will be built in conjunction with the first phase of the proposed T-New facility. Air passengers who reach the regional hub by transit will have the option of completing check-in at T-New before proceeding to their departure gates in Terminal 1 or 3.

In addition to offering light rail connectivity, the transit centre's first phase will be designed to accommodate a heavy-rail station for RER and HSR services along the Kitchener GO corridor. As discussed above, this RER/HSR connectivity will require realignment of existing tracks or a new branch of the main line; we project that this work can be completed as early as 2027.

During the initial phase of construction, we don't anticipate major changes to nearby roads. We may modify traffic signals at some intersections to facilitate increased bus movements and growth in traffic volume. We'll also consider localized road improvements on Viscount Road and in Area 6A, proceeding with modest adaptations if our analysis indicates that this will help to accommodate increased bus movements and associated on-street passenger loading and unloading.

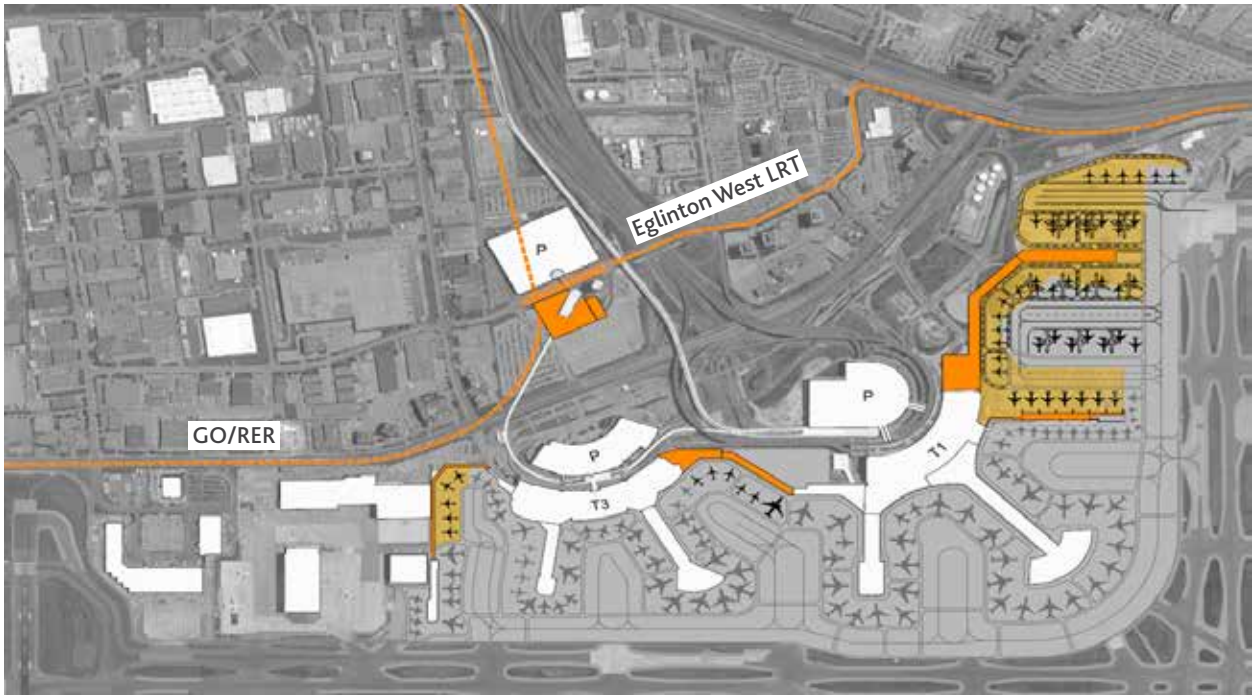


Figure 8-9: Phase 1 Regional Transit Centre/T-New Development (2027)

Post-2027 Development

Our long-term infrastructure plan identifies several options for future terminal and apron expansion. All of these are intended to help Toronto Pearson meet growing demand for air travel beyond 2027. As we consider possible expansion of the Regional Transit Centre after 2027, we must take into account how each approach would intersect with expansion plans across our facility.

The potential timing and extent of transit hub development beyond 2027 will depend on several factors:

The T-New facility. If, as we project, T-New will be processing a growing number of passengers by 2027 and therefore physically expanding in phases, demand for ground transportation will also be on the rise. This will require additional transit service to the Regional Transit Centre.

Rail and bus transit services. As the Finch West LRT connection to the Regional Transit Centre is implemented, or as additional or more frequent express bus services are introduced, we'll likely have to make incremental expansions to our bus terminal facilities, as well as improvements to the LRT station, to maintain efficient, high-quality service.

Curb demand at Terminals 1 and 3. The volume of commercial vehicles loading and unloading curbside at Terminals 1 and 3 may eventually become so great that we will decide to relocate all public transit – and potentially other commercial ground services – to the Regional Transit Centre.

How Toronto Pearson's terminals develop, both physically and in their operations, will have significant implications for the Regional Transit Centre. As discussed above, one possibility under consideration would convert Terminal 3 to a passenger concourse and relocate passenger-processing functions, such as check-in and security screening, to T-New. In this scenario, Terminal 3's groundside facilities would be eliminated to make way for additional aircraft gates. The new access roads, parking spaces and frontage curbs at T-New would likely be developed in conjunction with expanded bus terminal facilities at the Regional Transit Centre. This would require road access modifications to allow more traffic flow – of private and commercial vehicles, as well as transit busses – from Hwy 409 and Airport Road.

Similarly, our planning for Terminal 1 includes a range of possible configurations for bus access, some of which divide service between Terminal 1 and the Regional Transit Centre – for example, directing express routes to the terminal and other routes to the hub. In other scenarios, all bus traffic would be routed to the transit centre. We've also considered the possibility of converting Terminal 1 to a passenger concourse (as described above for Terminal 3) and relocating groundside capacity to T-New, with road-access improvements as needed.

9. Cargo and Logistics

Toronto Pearson is more than a global hub for passenger travel. Our airport is also an important centre of international cargo traffic – a primary node in a multi-modal supply chain that supports Canadian exporters, distributes imported goods and helps to drive economic growth. As passenger carriers continue their shift to wide body aircraft, we expect that belly cargo will account for most of the volume we handle. We're evolving our cargo facilities to maximize productivity while also looking for ways to operate more sustainably, balancing cost-efficiency with workplace safety and opportunities to reduce vehicle emissions.

Introduction

As trade has become more global, businesses have grown increasingly reliant on air cargo transport as a vital link in their supply chains. The rise of e-commerce has intensified this trend and brought more individual consumers into the picture. Air cargo is already central to the workings of the global economy. By volume, only about 3 per cent of goods traded globally travel by air. By value, however, the proportion is 35 per cent. Excluding trade with the United States, 23.2 per cent of Canada's imports and exports are shipped by air. Demand for efficient, reliable air cargo transportation has never been stronger – and it's expected to keep growing.

Air cargo connectivity has major implications for Canada's economy. Exports help to drive productivity, and boosting export activity is a key part of the federal government's economic agenda. Analysis by the GTAA shows that the connections Toronto Pearson offers to international markets drive higher productivity in many sectors. To choose just one example, Toronto Pearson's frequent scheduled service to emerging markets helps to connect Canada's agri-food sector with demand for high-quality Canadian food products abroad.

Toronto Pearson leads the nation in air cargo activity; in 2016, just under half of all international air cargo leaving or entering Canada was processed at our airport. Moreover, Toronto Pearson's catchment area for cargo is large, including Southern Ontario and Quebec, as well as the U.S. Northeast and Midwest. Canadian and American exporters make use of airports on both sides of the border, adjusting their routes depending on pricing, schedules and capacity. Some air cargo is trucked from the United States to Toronto Pearson, while some Canadian air cargo is trucked to U.S. airports for dispatch overseas. Both national economies benefit from integrated trade corridor planning that includes airports, highways and key transborder bridges.

About two-thirds of the air cargo that moves through Toronto Pearson is carried in the bellies of passenger aircraft. We forecast that the proportion will increase over the period of this Master Plan as our airport accommodates more wide body passenger aircraft with additional belly cargo capacity. (The number of dedicated freighter aircraft is expected to remain constant or decline.) Our analysis shows that the additional belly cargo capacity available in wide body aircraft not only accommodates but actually stimulates exports by reducing the cost of air freight. For example, Canadian exports to China – particularly perishables and other consumer goods – increase when non-stop, wide body air service is scheduled more frequently. Indeed, the amount of belly cargo capacity accounts for about a quarter of the 19 per cent increase in the value of Canadian exports shipped from Toronto Pearson to China over the past six years.

This chapter offers an overview of air cargo movement and handling at Toronto Pearson. It also proposes measures for the future aimed at increasing our airport's throughput of cargo and making Toronto Pearson a more convenient and desirable hub for firms shipping goods by air.

Key Markets and Commodities

Air transportation is more expensive than other modes of transport, but it's still the best option for many importers and exporters. Whether air cargo is cost-effective depends on key characteristics of the goods being shipped, including fragility, security requirements and weight. Products with high value-to-weight ratios are often shipped by air. So are perishables and other time-sensitive products. Key Canadian import and export commodity categories include live animals, vegetable products, prepared foods and mineral products.

Broader economic trends are reflected in the list of top goods exported and imported by air via Toronto Pearson, which includes lobsters, ginseng roots, semen of bovine dairy animals, perishables, pharmaceuticals, gold, cellular phones, car parts, moulds and aircraft parts.

Top Toronto Pearson Air Import and Export Markets by Value (2016)

Rank	Import		Export	
1	United States	$8.0B	United Kingdom	$12.1B
2	China	$3.9B	United States	$11.0B
3	Germany	$2.9B	China	$1.0B
4	Switzerland	$2.7B	Japan	$0.9B
5	Peru	$1.4B	Germany	$0.8B
6	Vietnam	$1.2B	Hong Kong	$0.8B
7	Argentina	$1.2B	France	$0.8B
8	Japan	$1.2B	Italy	$0.6B
9	Italy	$1.1B	Switzerland	$0.6B
10	Mexico	$1.0B	Brazil	$0.6B

Table 9-1: Top Toronto Pearson Import and Export Markets by Value

Table 9-1 shows the top 10 import and export markets served by Toronto Pearson. While the United States remains an important trading partner, the volume of cargo imported from China is expected to continue growing in the years ahead. Overall traffic from Asia to North America is projected to increase at an annual rate of 4.6 per cent, and growth in air cargo will likely accompany that trend. Nurturing Canada's large and expanding trade relationship with China will require efficient, reliable air cargo capacity.

Key Stakeholders in Toronto Pearson's Air Cargo Operations

Figure 9-1: Air Cargo Industry Structure

Figure 9-1 shows the key players in the air cargo business. Those with an integrated business model – for example, FedEx or UPS – manage all aspects of an air cargo shipment, from pickup through delivery to the consignee. Shipments supported by a non-integrated business model involve a number of service providers along the cargo chain. The non-integrated model has more participants, including airlines, truckers and freight forwarders (for example, firms such as DB Schenker or Kuehne + Nagel). Typically, air carriers sell a large proportion of their belly cargo capacity to forwarders who then fill it. The role of forwarders has increased in recent years, primarily because significant consolidation in that industry has increased the major players' buying power with airlines.

Cargo generally travels in several stages and by multiple modes of transport from the point of origin to a final destination. Goods are typically trucked to and from airports at either end of an air journey; and like passengers, some shipments require connecting flights.

Air carriers facilitate the airport-to-airport segments of the journey, most often transporting cargo in the bellies of passenger aircraft. But the enterprises that control and oversee the entire shipping process are typically freight forwarders and logistics providers. They manage route planning, arranging for cargo to be trucked to and from airports, and dealing with the customs brokers who facilitate the movement of goods across international borders. At transfer points along the shipping journey – for instance, from plane to truck – cargo handlers are usually responsible for activities like unpacking, separating, repackaging and/or temporarily storing goods. Even air carriers that deal exclusively with cargo depend on freight forwarders, cargo handlers and other intermediaries to manage the complex mechanics of the shipping process.

Integrators such as FedEx, UPS and Purolator provide a complete service from door to door by using their own trucks for pickup and delivery to or from an airport. These companies also operate their own aircraft networks, managing dedicated staff and systems every step of the way – though they make use of other carriers' belly cargo capacity when necessary.

Our airport facilitates the work of all these stakeholders by providing operating space, access to specific facilities and equipment (e.g., refuelling stations and air-to-truck cargo transfer supports), timely information about cargo movements, and convenient ways to move onto and around airport lands. Cargo handling agents, for instance, require warehouse space at Toronto Pearson (including temperature-controlled environments) to accommodate storage, unpacking and repackaging, as well as pallet-making and other cargo-related activities.

Truck-to-air and air-to-truck cargo movers also need to be able to travel efficiently between our airport and the Ontario highway system. Ease of access to related businesses nearby, such as customs brokers, is also useful – which is why most customs brokers in the GTA are distributed around the perimeter of Toronto Pearson.

Figure 9-2: Airport Cargo Areas

Existing Facilities

Figure 9-2 shows Toronto Pearson's West, East and North cargo transfer and processing operations:

Cargo West occupies about 30.4 hectares and includes three cargo buildings, an apron, vehicle parking, truck loading docks and manoeuvering areas. Each of its buildings has equipment to facilitate the direct and efficient transfer of goods from aircraft to truck. At full capacity, the large common-use apron at Cargo West can simultaneously handle nine B747 and one B767 aircraft. It's equipped with two in-ground fuelling stations and two nose-tethering devices for B747 freighters; the latter prevent aircraft from tipping back on their tails in the event they become severely unbalanced during loading or unloading.

Cargo East, also known as Vista Cargo Terminal, is a privately owned and operated complex that occupies about 11.5 hectares. At capacity, its apron can accommodate four narrow body freighters or two wide body aircraft. Cargo East is owned and operated by a private entity. The facility is set up to facilitate non-integrated companies, including airlines, freight forwarders, ground handling services, warehousing and expeditors.

Most ground-to-ground transfers at Cargo West and Cargo East are destined for onward shipment through a U.S. airport and subsequent transport to the end destination.

Cargo North, with an area of 21.1 hectares, is occupied entirely by FedEx, which operates out of a two-building complex with dedicated ramp space. The facility has been set up for a single integrated operator and cannot be shared by competing firms. In addition to facilitating air-to-ground transfers, Cargo North processes a significant quantity of ground-to-ground freight.

Demand and Capacity

The forecasts presented in Chapter 5 of this Master Plan project that annual air cargo demand at Toronto Pearson will grow from 450,000 tonnes this year to about 968,000 tonnes in 2037, based on a compound annual growth rate of 4.1 per cent.

Our cargo-processing capacity depends partly on the availability of land and how efficiently that land is used. Figure 9-3 shows that compared to peer airports, Toronto Pearson's cargo operations process relatively small quantities of cargo per square metre. If our airport were to operate as efficiently as the peer group average, we would be able to process the quantity of cargo we expect in 2037 – 968,000 tonnes – without expanding the footprint of our current facilities.

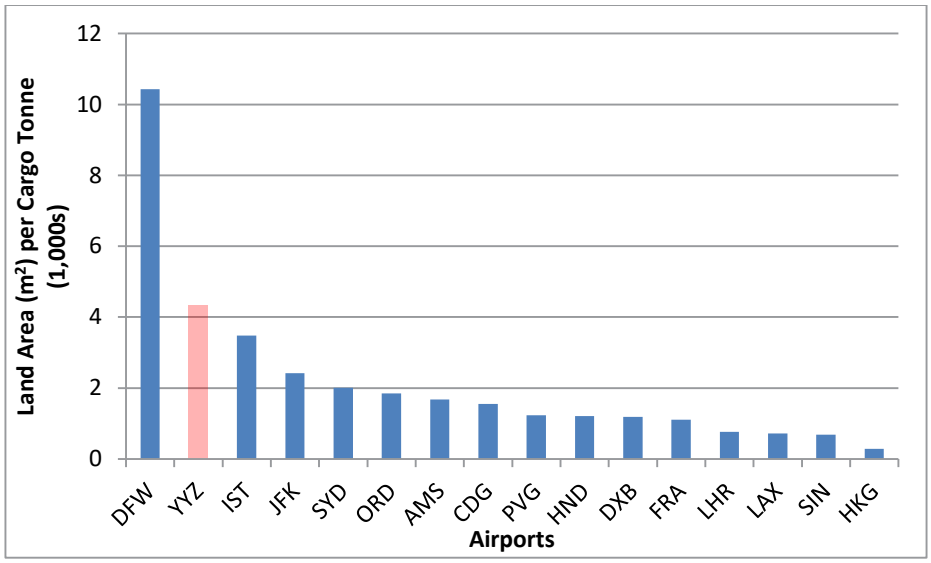


Figure 9-3: Cargo Processing Efficiency at Peer Airports

However, because Toronto Pearson's cargo operations involve multiple owners and tenants, efficiency varies across our three processing sites. We can influence but cannot directly control these operations. Moreover, regardless of our cargo facilities' comparative performance today, we know that overall throughput must increase if our goal is to accommodate future demand within our existing footprint. Achieving this outcome may require us to revisit the business and development models for our air cargo facilities.

Another variable we must consider is the volume of cargo processing at Toronto Pearson that involves moving goods from truck to truck. Further data and analysis are required to quantify and forecast demand in this area. More generally, factors on which we need to gain additional information include types of cargo; travel time from warehouse to aircraft (or the reverse), processing times, the requirements of just-in-time delivery, cross-dock transfers between buildings, custom controls and clearance processing times, cargo security measures, effective management of high-value goods, and the availability of appropriate facilities for the full spectrum of future cargo needs.

Future Facility Requirements

Short- to Medium-Term Requirements

With regard to the quantity of cargo Toronto Pearson will need to process in the short to medium term, we expect our existing facilities will be sufficient provided we can modestly increase our rate of throughput, as discussed above.

As for the quality of service we're able to offer importers and exporters, we plan to consult with current and future users about how we can all better support the handling of high-value and high-demand cargo shipments.

Specific topics we plan to explore include:

- temperature-controlled facilities
- enhanced security measures
- improved processing and movement of trucks onto and out of airport lands
- cross-dock opportunities (allowing quick transfers with no storage time)
- closer working relationship with various government agencies

Long-Term Facility Requirements

Other top-tier international airports, by participating in joint working groups, have developed close relationships with a range of stakeholders in the air cargo industry, including shippers, integrators, freight forwarders, government agencies, trucking companies and other key players. These collaborative relationships have made it possible to increase the speed and efficiency with which cargo moves into, through and out of their airports.

We plan to take a similar approach to facilitate world-leading cargo operations at Toronto Pearson. Improvements in our capabilities will have widely shared benefits. In particular, we intend to focus on improving the productivity of our cargo facilities, and on enhancing the flow of timely and relevant information to the various actors involved in the shipping process.

Locational Considerations

As we've said, most cargo at Toronto Pearson is carried in the bellies of passenger aircraft, and mainly on international flights. It would therefore be ideal to locate cargo facilities as close as possible to international gates. This would minimize labour costs, cut emissions and reduce the need for cargo vehicles to cross active taxiways and runways. Unfortunately, our current cargo facilities are not adjacent to the loading and unloading areas for passenger aircraft – and adopting that configuration is not feasible, given our airport's overall layout.

Although the configuration of our existing facilities is less than optimal in this respect, the GTAA plans to work closely with air carriers and other stakeholders to develop processes that will expedite the movement of cargo between aircraft and handling facilities. One option that has not been studied but could be considered is locating cargo facilities on the east side of Airport Road.

Even integrators such as UPS and FedEx – which have self-contained facilities to support their own aircraft and trucks – stand to benefit from improved cargo-movement processes across Toronto Pearson, as they too rely on belly-cargo alternatives when circumstances require.

Airside Considerations

In order to ensure safe takeoffs, airlines are sometimes required to reduce the weight on a particular aircraft. It's difficult for carriers to foresee when such a "payload penalty" may be imposed. The decision depends on a range of variables, including weather conditions, the amount of fuel required for the flight segment and the specific characteristics of the departure runway. Because passengers naturally expect to depart as planned, accompanied by their bags, cargo tends to be at greater risk of being removed when operators need to reduce an aircraft's weight. This can create a significant vulnerability for some firms whose supply chains rely on goods shipped by air.

A recent GTAA study found that at Toronto Pearson, the flights most at risk of payload penalties are those undertaken by large twin-engine aircraft departing for long-haul destinations – typically in the Pacific Rim, and most often in the summer months, when higher ambient temperatures reduce takeoff performance. One reason for this pattern is that on certain Toronto Pearson runways, safety standards require aircraft to gain altitude quickly to ensure they're well clear of specific (off-airport) obstacles situated near the ends of the runways. Assigning aircraft to alternate runways from which they could climb at a less rapid rate – allowing them to carry more weight – is not permitted during the quiet hours of 12:30 a.m. to 6:30 a.m., when overall runway use is restricted to mitigate noise.

Given the growing importance of air cargo traffic to Asia, it's concerning that our analysis finds a specific vulnerability in summertime flights to the Pacific Rim. In 2014, the value of Ontario exports on aircraft bound for China and Hong Kong in the summer amounted to $598 million[4]. Exports from other provinces routing through Toronto Pearson added another $38 million, for a total of $636 million in Canadian goods. The payload limits imposed by a combination of runway-adjacent obstacles and nighttime restrictions may have significant costs for Canadian exporters – not only delaying specific shipments but adversely affecting companies' competitiveness over time by making their supply chains less reliable. As Toronto Pearson plans for future demand, it's vital that we are attentive to such patterns so we can work with all stakeholders to ensure our airport remains an effective partner to exporters across Canada.

Ground Access Considerations

The GTAA has proposed to develop a Regional Transit Centre at Toronto Pearson integrating rail, light rail and bus connections to communities across the Greater Golden Horseshoe. We're now working with key stakeholders – including transit authorities and federal, provincial and municipal governments – to determine how the project can be implemented to maximize regional productivity, competitiveness and economic growth (see *Corporate Responsibility: Economic Growth* on page 123).

One impetus for this planned multi-modal hub is to free up road capacity for the movement of goods. Toronto Pearson is an essential node in many regional firms' supply chains, linking the national ground transportation network with global sources and markets. For example, the highest-value link in the Ontario highway system is Hwy 401 between Toronto Pearson and Hwy 427, which carries about $1.8 billion in goods per day (out of a total of $3.4 billion on all Ontario highways).

Toronto Pearson's existing ground access system is capable of handling short-term growth in vehicle demand associated with increased air cargo activity. We're therefore proposing no major improvements in the near term. (Please see *Ground Access System* on page 65 for further discussion.) The City of Mississauga, however, is exploring a road improvement that could facilitate access to our air cargo operations – specifically the Cargo West facility –

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4 This is an estimate since we only have data on the final destination of the export. Some exports to China and Hong Kong will be shipped via other routes while some exports to other Asian countries will be shipped via China and Hong Kong.

as vehicle traffic continues to grow. The proposed change is an off-ramp from westbound Hwy 401 that would extend across the southwest portion of the airport lands. South of the 401, the ramp would connect to an extended Creekbank Road. North of the highway, it would link to Enterprise Road and Atlantic Drive. Although this project is being spearheaded by the City of Mississauga and not by the GTAA, we recognize its potential to increase road capacity around Toronto Pearson in general, and more specifically to relieve pressure at the Dixie Road/Hwy 401 interchange. The off-ramp may have particular benefits for vehicles serving cargo-related businesses (e.g., customs brokers) along the western edge of the airport. The GTAA has reserved lands to support the implementation of this roadway improvement, and we're engaged in land-exchange discussions with Mississauga officials.

10. Aviation Fuel

Toronto Pearson handles more jet fuel than any other facility in Canada, and managing that aspect of our operations safely, efficiently and cost-effectively is a critical part of fulfilling our commitment to stakeholders. Since our last Master Plan, many air carriers have added more fuel-efficient aircraft to their fleets, aiming to reduce costs and shrink their carbon footprint. We've also seen the emergence of biofuels as a sustainable alternative in commercial aviation. At the same time, our airport faces rising peak-day demand from larger aircraft serving long-haul destinations. Balancing all of these factors requires agile day-to-day management of our fuel facility, as well as rigorous planning for the future – including increased capacity and possible relocation of our on site storage tank farm.

Fuel Infrastructure Overview

The jet fuel facility at Toronto Pearson is the largest of its kind in Canada. More than two billion litres of fuel flow through the system annually. Toronto Pearson's fuel infrastructure has expanded rapidly in recent years to keep pace with increasing demand and to support the GTAA's passenger terminal development program.

When aircraft refuel at any major Canadian airport, they use facilities and equipment owned by a fuel consortium or another service provider associated with that airport. These consortia are typically structured as not-for-profit corporations. Airlines pay to become consortium members at airports they use regularly; their membership fees cover the costs of maintaining and operating the fuel infrastructure there.

Airport fuel infrastructure falls into three main categories: receiving, storage and distribution. Receiving infrastructure moves fuel from pipelines, trucks and rail tankers into our airport's on site storage infrastructure: large, stationary jet fuel tank farms. Distribution infrastructure includes the pipelines, hydrants and trucks that move fuel from bulk storage to places where aircraft can access it. Airport fuel consortia and/or airport authorities typically engage third-party firms to operate and manage their fuel infrastructure.

Figure 10-1 provides a schematic view of Toronto Pearson's jet fuel infrastructure.

Storage Infrastructure

The schematic shows two of three bulk jet fuel storage facilities. One is a tank farm with 17 million litres of capacity, currently in use on Silver Dart Drive. This facility is due to be decommissioned when a new tank farm on Newton Road (also shown in the schematic) becomes operational in mid-2018. With 40 million litres of capacity, the Newton Road facility is an important addition to Toronto Pearson's storage infrastructure.

A third facility, not visible in the schematic, is a rail tank farm located northeast of Toronto Pearson on Canadian National Railway (CN) track. (A pipeline linking the rail facility to Toronto Pearson's fuel distribution system is visible at the top of the diagram.) The rail tank farm became operational in 2009 and has a capacity of 40 million litres. When the Newton Road facility comes online in 2018, these two sites will give Toronto Pearson a total fuel storage capacity of 80 million litres, up from the current capacity of 57 million litres.

Receiving Infrastructure

In addition to providing half of our airport's jet fuel storage capacity, the CN rail tank farm is the most significant piece of receiving infrastructure Toronto Pearson has added during the past decade. It allows the airport to

receive fuel by rail from an import terminal in the port of Quebec City and from a transload terminal operated by CN WorldWide North America in Flat Rock, Michigan.

Other key pieces of receiving infrastructure include:

- a pipeline connecting our tank farm on Silver Dart Drive to refineries in Sarnia
- a pipeline connecting to the Trans Northern Pipeline, allowing Toronto Pearson to receive fuel deliveries from Montreal

Any storage tank facility operated by the consortium is also capable of receiving deliveries by truck.

Distribution Infrastructure

Toronto Pearson's distribution infrastructure is extensively interconnected, allowing operators to efficiently move fuel from bulk storage to where it's needed. Multiple connections among facilities also make it possible to quickly route fuel around any one part of the system in the event of a delivery problem. The airport's tank farms are interconnected by pipelines and are also linked directly into the hydrant system that moves fuel to the gates at the passenger terminals. In addition to servicing gates, the hydrant system pumps fuel to fixed base points where operators can load fuel trucks for delivery to aircraft parked away from gates.

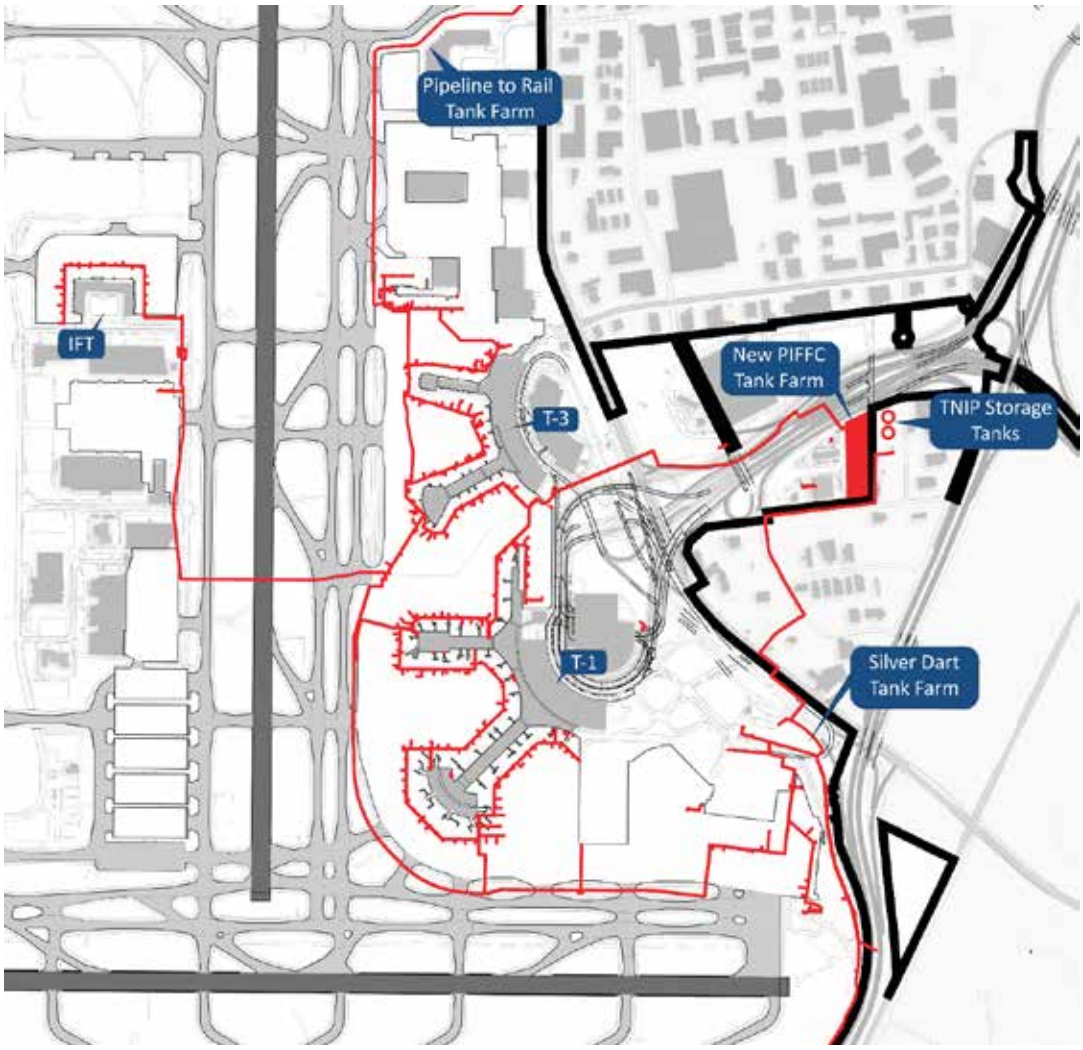

Figure 10-1: Jet Fuel Infrastructure at Toronto Pearson

Current Storage Capacity and Recent Jet Fuel Demand

Major international airports generally store enough jet fuel on site to sustain normal operations for five to seven days in the event of a supply shortfall. Adequate fuel reserves enable airports to handle occasional supply-chain issues without causing major disruptions for travellers. Toronto Pearson currently has enough capacity to meet international fuel storage norms, but as traffic volumes continue to increase, pressure on our fuel infrastructure is growing. The consortium is actively managing and adapting fuel facilities to keep pace with rising demand.

In 2016, Toronto Pearson consumed about 2.74 billion litres of jet fuel, or about 7.5 million litres per day. At this rate of consumption, the airport's current storage capacity of 57 million litres could support about 7.5 days of operation in the event that jet fuel supplies were cut off. When the new tank farm becomes operational in 2018, boosting storage capacity to 80 million litres, the consortium will in theory be able to sustain close to 11 days of normal operations (at 2016 average daily demand) with on site fuel storage capacity.

Because fuel use fluctuates seasonally, however, a daily consumption rate averaged across the year doesn't give an accurate picture of requirements during peak travel periods. In 2016, peak-day fuel use was 9.58 million litres, or 127.6 per cent greater than the daily average for the year. During the seven-day period of highest demand, carriers required 9.20 million litres per day, or 122.4 per cent more than the annualized daily average. Therefore, in the peak summer travel period when passengers rely most heavily on Toronto Pearson, the full capacity of the new storage tanks should be able to support about 8.7 days of operation in the event of a fuel disruption, assuming 2016-level demand peaks.

Jet Fuel Demand Forecast

Toronto Pearson's goal is to be able to operate for up to seven days during peak season, relying solely on stored fuel supplies. We regularly generate jet fuel demand forecasts to understand how well our supply infrastructure aligns with the demand implied by projected growth in passenger and cargo volumes.

The three factors that have the greatest impact on fuel demand at our airport are the efficiency of aircraft, the distance they travel and the passenger and cargo loads they carry. Our forecasts therefore take into account the aircraft technology improvements, changing flight-stage lengths, and forecasts of median passenger and cargo volumes for each of the domestic, Canada-U.S. transborder and international flight segments we expect to service in the years ahead. (Please see *Demand Forecasts* on page 29 for a discussion of global trends in passenger and cargo loads.)

Figure 10-2 shows the results of our analysis. We foresee an increase in daily average fuel demand at Toronto Pearson from 7.52 million litres in 2016 to 15.30 million litres in 2037 – a 2.72 per cent cumulative annual growth rate.

To ensure Toronto Pearson has sufficient fuel supplies to meet peak seven-day demand in 2037 – assuming the ratios between peak and average demand remain constant – the airport will require storage capacity for approximately 113.5 million litres of fuel. The growth we project in peak-day fuel requirements indicates that an 80-million-litre storage capacity, which we expect to have in place by 2018, will be adequate to meet our fuel-reserve standards until 2023.

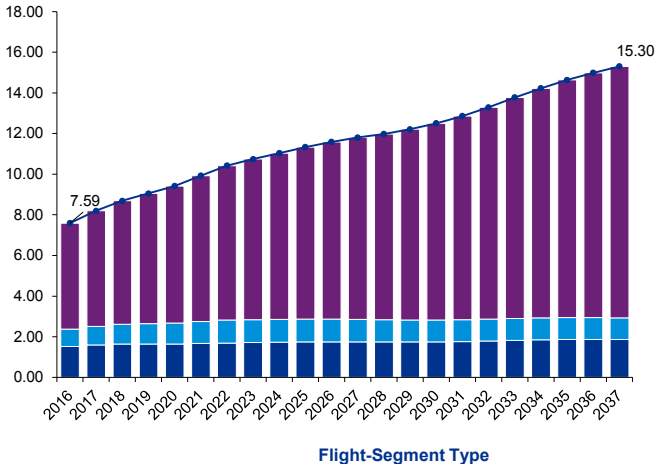

Figure 10-2: Daily Average Fuel Requirement by Flight-Segment Type

Adaptation to Biofuels

Recognizing the imperative to reduce greenhouse gas (GHG) emissions around the world, many industries, including aviation, have begun to explore the potential of biofuels[5] – which proponents argue have the added advantages of reducing costs and improving fuel security. Many industry experts believe that electrification may one day enable radical reductions in GHG emissions from aviation, but the technology required to make that happen is years away. In the nearer term, using biofuels to supplement petroleum-based jet fuel is generally seen as the most feasible way to reduce emissions from air travel.

Biofuel production has advanced considerably in recent years. Early biofuels were criticized for their potential negative impacts on water, land and food supplies. The newest generation of biofuels is produced from algae; they require fewer resource inputs and have higher yields than earlier products.

We expect that in the near future, bio-jet fuels will function effectively as drop-in fuels – that is, they'll be easily combined with petroleum-based fuels, distributed through existing infrastructure and used in existing machinery without substantial modifications. Assuming this prospect becomes a reality, we anticipate the following implications for Toronto Pearson:

- A new pipeline, rail or truck delivery system may be required to transport biofuels from production sites to a blending facility near Toronto Pearson.
- Although the blending facility would ideally be adjacent to the airport, it would be separate from our existing fuel receiving infrastructure. The facility would have to provide separate storage for three products: unblended biofuel, petroleum-based jet fuel and the final, blended biofuel product.
- Blended fuels are stable and can be delivered by pipeline or other means to the system operators responsible for refuelling aircraft. A drop-in biofuel would require no changes to Toronto Pearson's current fuelling infrastructure.
- The existing distribution system will have to be modified with decouplers to let operators allocate the appropriate fuel to each airline. The system will also need to enable operators to track consumption of each type of fuel, since airlines that use biofuels will have to be charged for the delivery and storage of the blended product.

5 The term "biofuel" refers to any liquid or gaseous fuel derived from renewable biological resources. Material used to produce biofuels may include farm crops, agricultural or forestry residue, organic waste or other biomass.

11. Utilities

Utilities are critical to our airport's ability to function efficiently and reliably. They help us ensure a safe and comfortable environment for tens of millions of passengers annually, and for the 49,000 people who work at Toronto Pearson. As demand for aviation services continues to grow, so will our requirements for power, water and other services. Meeting projected needs through 2037 will require additional investment in infrastructure, allocation of land for potential facilities and access corridors, and a further strengthening of long-term relationships – especially with the municipal and regional providers we depend on to keep Canada's largest airport running smoothly and sustainably.

Introduction

This chapter describes how we plan to meet Toronto Pearson's future requirements in several key areas:

- water for domestic use and fire protection
- natural gas for heating
- sanitary and storm sewers
- electrical power
- communications
- heating and cooling systems

Over the course of this Master Plan, we'll continue to develop our infrastructure strategically, focusing on operational flexibility, reliability and sustainability as we pursue our long-term capacity goals.

Collaborative relationships are also vital to our success. The GTAA will continue to consult and work with federal, provincial, regional and municipal authorities to build our utility capacity. We're committed to engaging collaboratively with all partners, whether they provide services directly to our airport, have jurisdiction over aspects of our operations or are affected by our service requirements.

Water

Toronto Pearson's domestic water is primarily supplied by the Region of Peel. It enters our water main infrastructure at four locations. There are two feeds on the east side of the airport lands: one where Airport Road intersects with American Drive, the other where it intersects with Elmbank Road. On the west side, one feed runs from Britannia Road to the infield and terminal buildings, and a second runs from Derry Road to the general aviation area. A fifth feed from Courtneypark Drive has not yet been fully developed.

An internal distribution system serves most facilities at Toronto Pearson, moving water from municipal feeds to where it's needed. However, some buildings – including the Cogeneration Plant, the Central Utilities Plant, Vista Cargo and buildings in the Airport North area – are serviced directly from the Region of Peel distribution network, independent of our water mains.

Demand for domestic water in our terminals is primarily a function of the number of passengers we serve. We estimate our requirements at 70 litres per passenger per day, and calculate annual needs by adjusting for normal

traffic fluctuations throughout the year. Our demand forecasts (see *Demand Forecasts* on page 29) project that Toronto Pearson will accommodate 85 million passengers per year by 2037.

We follow published standards and coordinate with Emergency Response Services to ensure that the water we have available for fire protection is sufficient at all times. We'll continue to work with the Region of Peel to ensure that all relevant infrastructure, including Peel's own distribution system, is capable of meeting our water needs – both for domestic uses and for fire protection – as growth in passenger traffic increases over the course of the Master Plan.

Natural Gas

Toronto Pearson uses natural gas, drawn from the Enbridge Gas distribution system, for the generation of electricity and for building heating.

Our two biggest gas users are:

- the Cogeneration facility, which consumes natural gas to generate electricity and has the ability to provide electricity to the grid, the airport or both
- the Central Utilities Plant (CUP), which provides hot and chilled water to Terminal 1 and provides auxiliary heat to several other buildings, including snow-melting facilities around both terminals

Natural gas reaches smaller-scale commercial users in two stages. First, a system of high-pressure and intermediate-pressure gas mains, which run within the rights-of-way of all major arterial roads bordering Toronto Pearson, brings gas onto our site. The gas then moves at lower pressure within our infrastructure to facilities that need it. Usage is metered, and individual operations are charged accordingly.

Since the publication of our 2008 Master Plan, there has been only one notable change to natural gas infrastructure at Toronto Pearson: infield facilities that normally receive heat from the CUP have been equipped with additional boilers to provide heating redundancy.

We anticipate that future development of Toronto Pearson, at least through the medium term, will have minimal implications for natural gas infrastructure. We'll review our natural gas service requirements with Enbridge as we move forward with terminal expansion and phased development of the Regional Transit Centre, and/or make any associated changes to the Cogeneration and CUP facilities.

Sanitary Sewers

The sanitary sewage discharged from Toronto Pearson flows in two directions.

Sewage originating on the east side of the airport lands – from Terminal 3, Air Canada Cargo, the Cogeneration facility and the CUP – ultimately flows into the City of Toronto's Mimico Creek trunk sewer. A pumping station and a gravity sewer initially move waste north across Areas 6A and 6B into a Region of Peel collection sewer. This connects to the Toronto trunk sewer, which discharges to the Humber Sewage Treatment Plant. The Toronto sewer also receives low-concentrate glycol from our Central Deicing Facility and stormwater management facilities (see *Storm Sewers* below).

On the west side of the airport, a pumping station moves sanitary sewage from Terminal 1 (including its parking garage), the infield area and the South Administration Area into the Region of Peel's Etobicoke Creek trunk sewer, which discharges to the Lakeview Sewage Treatment Plant.

The rate at which the terminals generate sanitary sewage flow is primarily a function of passenger traffic volume. Our analysis indicates that the current sewer outlet capacity will be sufficient to meet our facilities' needs as traffic grows – and as we expand to accommodate that growth – over the course of this Master Plan.

Many sites of planned future development at Toronto Pearson – including the Boeing Lands (Area 15) and Areas 2A, 13A, 13B, 13C and 13E – are directly adjacent to municipal sewer systems. Sanitary effluent from those new facilities can therefore be directly discharged into municipal systems, limiting new infrastructure requirements for our airport.

Storm Sewers

Toronto Pearson works with local and provincial conservation authorities to ensure our stormwater management practices are environmentally responsible. We adhere to strict conservation rules and guidelines requiring that stormwater runoff does not exceed pre-development levels and that it causes no sediment or pollutants to enter streams and rivers.

The airport lands are divided into several drainage zones. A total of 14 stormwater management facilities, designed to control both the quantity and quality of runoff, are distributed across our airside and groundside areas. Figure 11-1 shows their locations. Three facilities – Moore's Creek, Carlingview and Aeroquay – are large underground concrete tanks. The remaining 11 are retention ponds of various sizes and designs.

The GTAA is committed to constantly enhancing stormwater management systems as our facilities and operations evolve. We'll keep working collaboratively with neighbouring municipalities to ensure that our systems are compatible with theirs, and that collectively we are effective in protecting the health of local waterways.

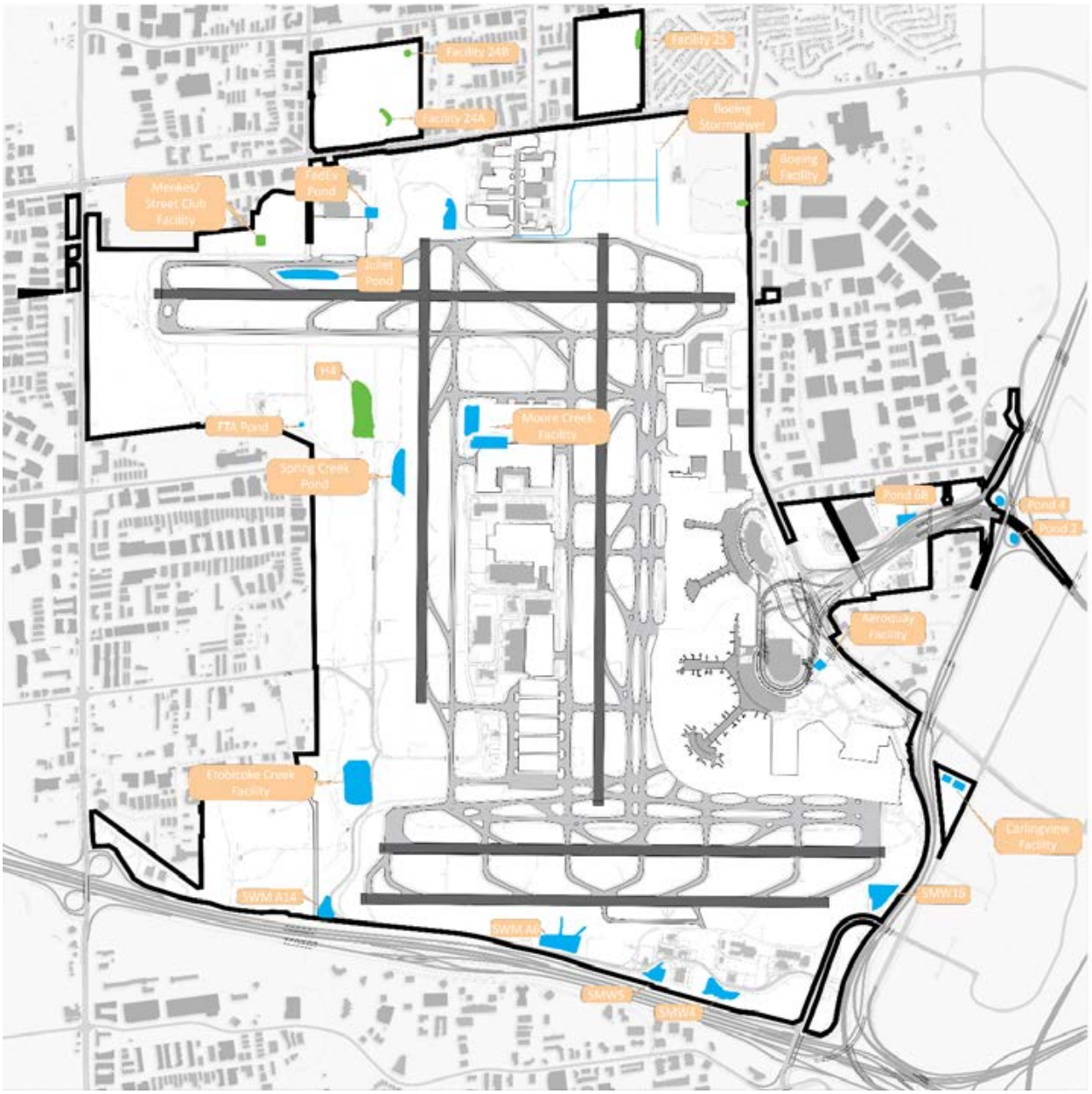

Figure 11-1: Stormwater Management Facilities

Electrical Power

Toronto Pearson receives power via four 27.6 kV feeders: two lines from the Richview Transformer Station, one dedicated line from Bramalea Transformer Station and one shared line from the Cardiff Transformer Station. The geographic distribution of these sources – to the north, the northwest and the east – adds redundancy to help ensure a secure supply of power.

The feeders terminate at four switchyards with air-insulated equipment, including circuit breakers for switching and fault protection. Dual full-capacity loops connect the east and west switchyards along the southern perimeter of the airport lands, while another dual loop extends through the middle of the site. Load modules tap off the dual loops at various points to provide power to nearby facilities, and key buildings have at least two power feeds.

The load modules are mounted on concrete pads, which are contained in sealed enclosures and pressurized with sulphur hexafluoride (SF_6) gas. The units employ state-of-the-art protection and control technology, and are connected by fibre-optic cable to management and data collection systems. Electricity usage at Toronto Pearson is continuously monitored by a local utilities company, which manages, operates and maintains our entire 27.6 kV power distribution system under contract to the GTAA.

Currently, Toronto Pearson's power peak load is 41 MW. The existing feeders and distribution system have sufficient capacity to carry forecast load through the near future. Requirements from major future developments will need to be evaluated.

In 2005, we constructed a 117 MW Cogeneration facility (Co-gen) to provide an alternate source of power for Toronto Pearson facilities. The Co-gen consists of two gas turbines and one steam turbine, each connected to the Ontario grid through a 44 kV feeder. Power from the Co-gen is exported to the grid, but it can be switched to feed the airport as changes in operations require.

In addition, excess steam from the Co-gen can be sent to the Central Utilities Plant to offset natural gas requirements for the boilers during the winter heating season, or to offset electricity use by the chillers in summer. In our projections beyond 2018, the existing Co-gen facility will continue to be a viable alternative source of power, as well as steam.

Communications

Over the last decade, the GTAA completed a major conversion to electronic data management processes at Toronto Pearson, adopting leading practices from the information and telecommunications industries. The enhanced system was designed to be resilient and redundant; key technologies are interconnected, and all equipment is protected against interruptions in power supply.

Users across our airport are linked by a campus-area network (CAN). The backbone is a common cabling system comprising 425 kilometres of fibre-optic cable and 2,350 kilometres of copper cable, all encased in concrete ducts. Connecting all buildings, the CAN uses carrier-class technologies to provide Internet connectivity for systems such as check-in counters, kiosks, gates, baggage systems, security checkpoints and office computers. In some locations, coaxial cable supports specialty services. Our network links to the external infrastructure of service providers such as Bell Canada through robust communications hubs.

We expect that Toronto Pearson's existing communications infrastructure will be sufficient to meet the growing needs of employees, partners and passengers throughout the timeframe of the Master Plan.

Central Utilities Plant

The Central Utilities Plant (CUP) generates hot and chilled water for the heating and cooling of many key Toronto Pearson buildings. An underground network of distribution pipes connects the CUP to Terminal 1 and its parking garage. The infield area is heated – but not cooled – by the CUP, also through underground pipes. Terminal 3 has its own heating and cooling system and is not serviced by the CUP.

The cooling systems in the CUP are equipped with five 1,250-ton electric centrifugal chillers and a pair of 2,000-ton steam turbine-driven chillers.

The plant's heating systems consist of four 65,000-pound steam boilers. This output can be increased as demand grows.

Overall, the Toronto Pearson CUP is capable of delivering approximately 100 per cent more heating capacity. For cooling, however, we're already at capacity. To meet the cooling needs of new or expanded facilities, we plan to add electrical-drive chillers. The CUP was designed to support staged construction of airport facilities. Built out to its limit, the CUP has space to handle an additional two boilers and four chillers.

Figure 11-2 shows an overview of the CUP's hot and chilled water lines.

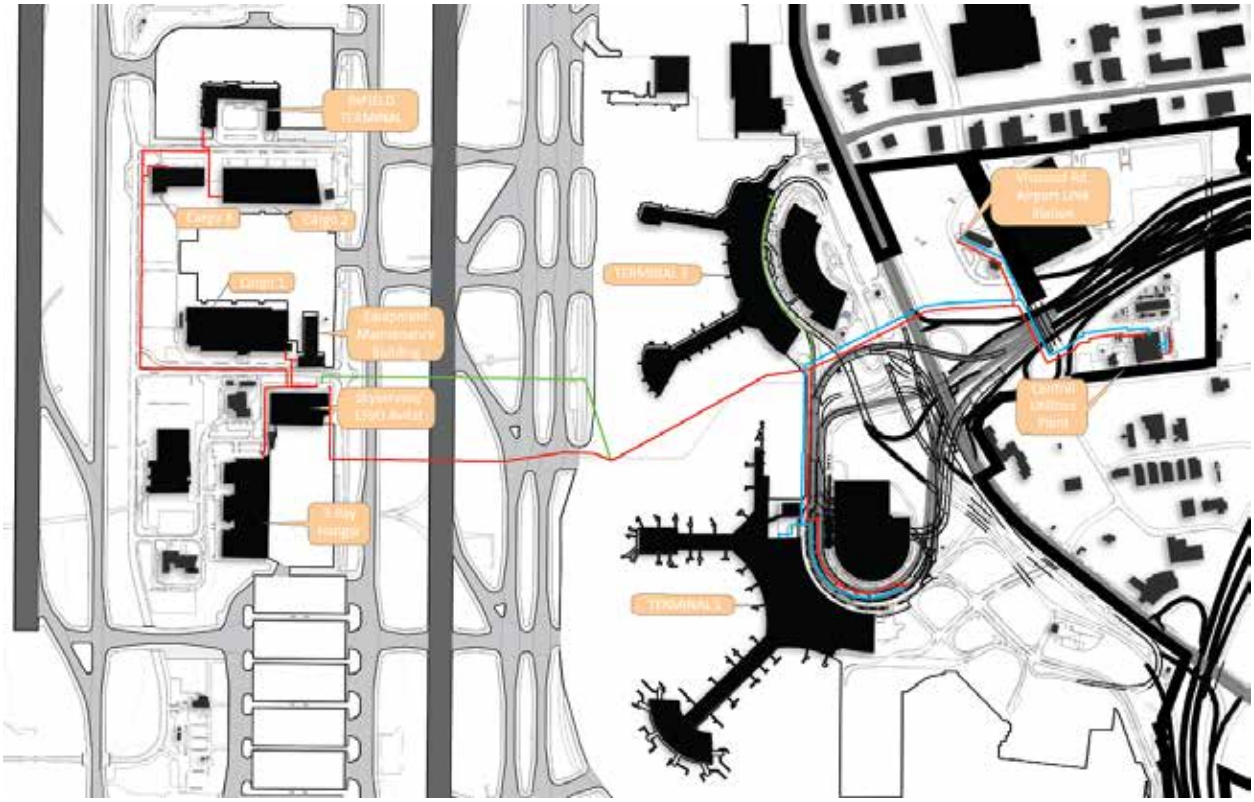

Figure 11-2: Central Utilities Plant – Hot and Chilled Water Services

The distribution system serving Toronto Pearson's infield area has two components. The first is a direct feed from the CUP to the Infield Hot Water Distribution Plant (IHWDP). The second is a set of supply lines that move hot water from the IHWDP to six infield buildings: the Infield Terminal, Three Bay Hangar, Cargo 2, Cargo 3, Air Canada's equipment maintenance building and the Air Canada Cargo 1 building. Two boilers were recently added to the IHWDP to provide a layer of redundancy for infield heating.

12. Land Uses

As a global hub, Toronto Pearson connects with other key airports on five continents within a vast transportation network that helps to foster and expand economies worldwide. At the same time, our airport has a well-defined footprint in the western GTA that is constrained by – and respectful of – the social and economic priorities of neighbouring communities. We're therefore focused on maximizing the productivity of our existing lands as we balance the need to maintain safe, convenient and efficient operations with a commitment to advancing job creation and overall GDP growth in our city, Southern Ontario and the rest of Canada.

Introduction

Toronto Pearson occupies 1,897 hectares (4,688 acres). The vast majority of our lands – 98 per cent – fall within the boundaries of the City of Mississauga; the rest of our footprint is in the City of Toronto. This chapter focuses on how we plan to use and develop our airport over the course of this Master Plan to ensure that the finite footprint in which we operate delivers the greatest possible value to the people and economies that depend on us.

Key Trends

A global hub like Toronto Pearson connects international air routes with metropolitan and regional ground transportation networks. For industries and individual companies considering where to locate relative to a major airport, key considerations include land values, security, logistics and ground transport options.

Enterprises that rely heavily on air connections for the movement of people and goods can clearly be more productive when they locate offices and plants nearby. This is why many firms situate corporate head offices and manufacturing facilities near Toronto Pearson, which has the effect of driving up nearby land values. As land around the airport becomes more expensive and attracts higher-density development, some businesses – notably warehousing facilities and industrial plants – tend to move farther away.

Commercial demand for land near Toronto Pearson will continue to shift as transportation costs, property values and security considerations evolve. If autonomous vehicles diminish the expense of moving goods to and from more distant locations – and if, at the same time, land values close to our airport continue to rise – we can expect more shipping functions to migrate farther from Toronto Pearson. On the other hand, if security processes become more cumbersome, that may drive higher demand for airside locations (see *Framework for Assessing Land Use* on page 107) as firms seek to minimize the number of security-line crossings their staff, equipment and goods must make each day.

Global Benchmarking

Compared to our peer airports around the world, Toronto Pearson uses a large area of land to service a relatively small, albeit steadily growing, volume of traffic. Figure 12-1 shows the total area of various global hub airports, including the land they dedicate to airfield uses such as runways and taxiways. One factor that increases the relative amount of land our airport requires is the fact that we have runways extending both east-west and north-south. While this configuration means that runways and taxiways occupy more land, it also allows us to operate in a wider range of wind conditions (see *Airside System* on page 41).

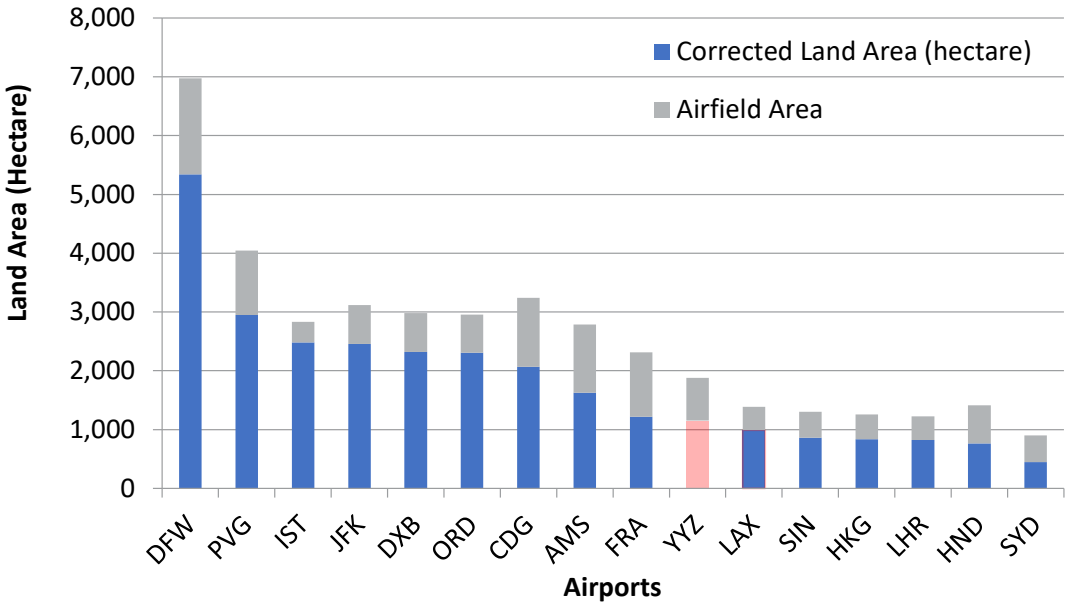

Figure 12-1: International Airports, Land Area Benchmarking

To identify opportunities for greater efficiency and densification, we regularly compare the practices of airports that manage high traffic volumes on relatively small footprints. Toronto Pearson accommodated about 44 million passengers in 2016. By contrast, in the same year London-Heathrow handled about 76 million, Singapore-Changi about 59 million and Hong Kong about 71 million. These airports optimize the productivity of their land by:

- increasing efficiency with automation/mechanization
- using multi-storey facilities to optimize limited space
- relocating to groundside land any activities that don't require airside access
- eliminating unnecessary ground-based navigational aids
- promoting shared-use/multi-tenant/common-use facilities

As our own airport continues to evolve into a top-tier global hub, serving more passengers and a growing economy on a finite parcel of land, we'll continue to monitor global best practices and adapt them to our unique circumstances.

Framework for Assessing Land Use

There are five broad categories of land use at Toronto Pearson:

- airfield – runways, taxiways, aprons and air navigation facilities (see *Airside System* on page 41)
- passenger terminals (see *Passenger Terminal System* on page 55)
- ground access – road and rail connections by which people and goods access our airport (see *Ground Access System* 65)
- environmental protection areas (see *Utilities* on page 99 and *Corporate Responsibility: Environmental Responsibility* on page 127)
- other airport development – including, for example, cargo buildings, aircraft maintenance hangars, aviation fuel facilities, flight kitchens, hotels and car rental facilities, as well as office and commercial buildings; some of these need direct access to runways and taxiways (i.e., on airside land) and others don't

To ensure that Toronto Pearson continues to serve all stakeholders effectively into the future, we need to ensure that our land use decisions are rigorously tested against several strategic priorities. We've therefore developed a hierarchy that considers first the **operational value** of a given use, then its **economic value** and finally its implications for **flow**.

Operational Considerations Regarding Land Use Options

The first two functions listed below are core to Toronto Pearson's operations and are largely non-discretionary; the latter three allow some discretion.

Operational Hierarchy

	Function	Examples
1	Essential for the safe operation of aircraft	Air traffic control, fire hall, airfield maintenance, hangars
2	Essential for efficient air carrier operations	Fuel, cargo, catering, ramp equipment storage, maintenance, waste management
3	Ancillary services for passengers	Hotels, car rentals
4	Other aviation-related services	Aircraft manufacturing and maintenance, business aviation
5	High propensity to travel or ship cargo by air	National or global corporate headquarters, logistics companies

Table 12-1

Economic Considerations Regarding Land Use Options

When the GTAA has discretion over land use decisions – for instance, when we're comparing the relative merits of uses in categories four and five of the operational hierarchy above – the economic hierarchy guides our decisions.

Economic Hierarchy

	Economic Value	Rationale
1	Non-aeronautical revenue	Financial self-sufficiency for the GTAA
2	Jobs and GDP	Consistent with Toronto Pearson's economic development mandate
3	Ancillary services for passengers	Hotels, car rentals
4	Increased land value	Supports strong economic development and growth

Table 12-2

Flow Considerations Regarding Land Use

Land allocation decisions are determined first by the operational and economic criteria outlined above. Having weighed those functional criteria, our next step is to consider geography – how a proposed use in a specific location will enable the safe and efficient flow of aircraft and vehicles to, from and within Toronto Pearson.

Flow Hierarchy

	Priority	Rationale
1	Preserve runway capacity	Maximize strategic value of takeoff/landing slots and minimize runway crossings by ground vehicles and aircraft under tow
2	Logistics efficiency	Minimize distances between local highways, cargo processing facilities and aircraft
3	Increase transit ridership	Appropriately situate land uses with high potential to generate transit ridership

Table 12-3

The GTAA assesses all potential land development in relation to the three hierarchies outlined above. As we make decisions over the course of this Master Plan, we'll give priority to proposed changes or additions that rank high on the operational hierarchy. These will typically require airside land. For example, Toronto Pearson's fire hall, air traffic control tower and deicing facilities must have direct access to taxis and runways. Because those land uses are critical to our operations, they're situated at the top of the operations hierarchy. They take precedence over all other uses, including those that are connected to our operations but have more flexibility in their location – for example, flight kitchens or cargo operations.

To take another example: If a major logistics firm wished to lease an airside site from Toronto Pearson in the infield area, this prospective land use would first be considered in light of its operational implications. Would it displace other uses that are more critical to the airport, such as an expansion of our deicing facilities? If the proposed logistics facility would not prevent a more important operational use, we would take it to the next round of analysis and compare it to other prospective uses within the economic hierarchy. Factors such as job creation,

as well as potential revenue for the City of Mississauga and the GTAA, would then determine whether a lease agreement should proceed.

We compare all land uses to alternatives that either outweigh them, as operational benefits outweigh economic ones, or compete with them on an apples-to-apples basis – for instance, in terms of relative revenue generation or enhancement of traffic flow.

Development Basics

The earlier Framework for Assessing Land Use section (on page 107) of this chapter described how we gauge the relative merits of development proposals that require comparative assessment and potential trade-offs. We undertake such evaluations within a wider rules framework that does not change. All potential development on Toronto Pearson lands is evaluated in light of basic conformity to the following:

- It must be consistent with the approved Land Use Plan and the provisions of the Ground Lease between the GTAA and the federal government.
- It must be compatible with the needs of aviation. For example, it should not emit smoke, attract birds or create any other hazard to aircraft.
- It has to comply with relevant environmental practices and policies – including provincial and municipal regulations, as well as guidelines that the GTAA follows voluntarily as part of our environmental responsibility program (see *Corporate Responsibility: Environmental Responsibility* on page 127).
- It must conform to current Canadian and international aerodrome and related certification standards. These standards include height restrictions for developments close to the airfield (to ensure aircraft have sufficient clearance); the protection of spaces where navigational aids and communications equipment are located; and rules ensuring visibility for air traffic control functions. The GTAA will not approve any land use that interferes with current or future runways, taxiways or navigational systems (although we recognize that advances in air traffic control technology are expected to reduce the amount of land required for navigational aids and related equipment).

13. Interface with Surrounding Area Plans

The GTAA works to ensure that the lands around Toronto Pearson are developed and used in ways that are compatible with the safe operation of our airport and the aircraft we support. At the same time, we participate in municipal and regional planning processes to help extend the benefits of global connectivity deeper into our surrounding communities. There have been two noteworthy developments since our last Master Plan was published in 2008: the Airport Employment Zone has gained prominence as a leading centre of growth in the regional and national economies, and the Province of Ontario has signalled a shift toward more coordinated planning.

Toronto Pearson's Local Context

Toronto Pearson sits almost entirely within the City of Mississauga, while the easternmost edge of our footprint – 2 per cent of the total – falls inside the City of Toronto's boundaries.

The patchwork of lands around our airport consists of:

- commercial corridors
- low-density employment areas
- office parks
- logistics centres
- residential communities
- major infrastructure
- utilities
- natural systems
- golf courses

The surrounding urban fabric both shapes and is influenced by Toronto Pearson in many ways. Our airport's success depends on people, suppliers and other partners in nearby communities, as well as ground transportation and the public utility infrastructure. And for both residents and businesses in our immediate neighbourhood and across the region, proximity to a global hub airport brings considerable benefits. At the same time, there are dimensions of Toronto Pearson's impact that we work hard to manage and mitigate – through our Noise Management Program, for example, as well as our stormwater management system.

Because our operations are interwoven with neighbouring communities, enterprises, infrastructure and ecosystems, it makes sense to work together. In the planning choices we make – and those we support outside our boundaries – our goal is always to provide world-class connectivity while helping the region's residential communities and employment areas continue to thrive.

Economic Importance of the Airport Employment Zone

The Airport Employment Zone (AEZ), an area of 15,000 hectares with Toronto Pearson at its heart, is home to about 300,000 jobs. It's one of Canada's most significant centres of commercial and industrial activity – second in size only to downtown Toronto, which employs about 465,000 people. Many factors contribute to the economic vitality of the AEZ:

- It's situated at the intersection of several fast-growing municipalities.
- The zone is anchored by Toronto Pearson, which generates 49,000 direct jobs and many more indirectly. (Please see *Corporate Responsibility: Economic Growth* on page 123 for more on our airport's contributions to the regional economy.)
- The diverse businesses that benefit from being close to Pearson – whether hotels or freight forwarders or global corporations – generate significant employment and GDP growth (while also contributing to higher land values).
- Planning policies in nearby municipalities facilitate a wide range of employment types, from office-based management, administration and research to logistics, light industry and utilities.

Policies Regarding the Role of Employment Areas

The Province of Ontario has directed municipalities to reinforce the economic importance of air connectivity by planning for land uses that won't hinder airports' current or future operations[6]. The provincial government's May 2017 Growth Plan update also seeks to protect the value of employment areas[7], discouraging the introduction of sensitive land uses such as residences, parks and some types of farms within their designated boundaries. The rationale is that residences, for instance, could experience adverse effects from noise or carbon-based emissions; moreover, potential tensions between incompatible land uses might compromise the economic performance of employment areas.

A key challenge is to protect the important forms of employment found in lower-density areas (in the AEZ, these typically relate to logistics, warehousing and storage) while also fostering denser communities that can sustain mass transit and spur office development. Current provincial and municipal policies tend to support employment types that have historically been associated with the AEZ, while allowing for other uses in some areas.

As partner governments and the GTAA work together to help the AEZ fulfill its social and economic potential, the balance between traditional and higher-density employment policies will require close attention. The AEZ has the potential to become a more dense, connected and sustainable employment area. Work will be needed to preserve its vital role in job creation, while allowing for complementary uses – such as institutional, small office, retail and other activities not strictly focused on employment – to yield more complete communities.

6 *See Provincial Policy Statement 1.6.9.1.*

7 *According to the Province, "Employment areas are defined as: 'Areas designated in an official plan for clusters of business and economic activities including, but not limited to, manufacturing, warehousing, offices, and associated retail and ancillary facilities.' Not all jobs in a municipality take place in employment areas."*

Encouraging Complete, Sustainable Communities

Like the Province of Ontario and our neighbouring municipalities, the GTAA supports land use plans that foster sustainable communities. We believe such communities benefit everyone by promoting accessible transportation and friendly, livable environments for people of all ages and backgrounds. Fostering complete communities throughout Southern Ontario will require multi-modal transportation connectivity, as well as compact, interconnected built environments reflecting sustainable urban design.

We've demonstrated our commitment to the social, economic and environmental health of our region through a range of initiatives on and around Toronto Pearson lands:

- We've deployed a comprehensive Environmental Management System that drives responsible practices across our operations (see *Corporate Responsibility: Environmental Responsibility* on page 127). One notable component of this environmental program is our stormwater management system, which helps to protect local waterways (see *Utilities* on page 99 and *Corporate Responsibility: Environmental Responsibility* on page 127).
- We also support sustainable land uses and business practices beyond our airport's boundaries. Working with Toronto and Region Conservation, we've created the Partners in Project Green initiative, a community of businesses, utilities and government bodies dedicated to making the Pearson Eco-Business Zone the largest and most dynamic in the world (see *Corporate Responsibility: Environmental Responsibility* on page 127).
- And we helped to establish the Airport Employment Coalition, a network of industries, employers, labour groups and other organizations dedicated to improving transit connectivity throughout the western GTA – particularly in the employment areas around Toronto Pearson.

Developing a Regional Transit Centre

We believe that the proposed Regional Transit Centre at Toronto Pearson (see *Ground Access System* on page 65) will be a powerful driver of more complete communities around our airport. Today, personal vehicles predominate in the AEZ: 95 per cent of employees drive to work. Although economically dynamic, this low-density area has relatively little green space. It offers limited transit options and few safe routes for walking and cycling.

The proposed Regional Transit Centre will have a transformative effect on the area. It will drive a shift to high-occupancy transit modes. It will encourage a built form that is denser and more sustainable. And generally, it will give shape to a more interconnected region with a stronger sense of place.

The existing provincial and municipal planning regimes are consistent with this vision. They provide a framework for enhancing the density and sustainability of the AEZ using the Regional Transit Centre as a catalyst for change.

Goods Movement as an Economic Enabler

The Airport Employment Zone is a point of convergence for some of the most important shipping routes and infrastructure in Canada.

Toronto Pearson handles approximately 50 per cent of Canada's air cargo and is a vital hub connecting regional road and rail infrastructure to air transport routes worldwide. Our airport is located near the junctions of five 400-series highways that facilitate the movement of goods across the province, as well as between Ontario and the United States. The intersection of Hwy 401 and 427, immediately east of our airport, is the highest-value

goods-movement crossroads in Canada. As for rail connections, the AEZ is served by a major CN heavy-rail corridor and the Brampton Intermodal Terminal. This concentration of air, road and rail assets has created a cluster of businesses focused on logistics and cargo in the AEZ.

All provincial and municipal plans focused on the AEZ recognize the importance of the efficient movement of goods. Together, they map out the necessary capacity to support effective freight corridors, as well as attractive options for local transit and active transportation.

Updated Provincial Growth Plan

The Government of Ontario's new suite of land use policy documents came into effect in the summer of 2017[8]. The most important of these for Toronto Pearson and its surrounding areas is the Growth Plan for the Greater Golden Horseshoe (GGH). The plan provides direction on where and how the region will grow, and it includes population and employment forecasts for all upper-tier and single-tier municipalities in the GGH[9].

The 2017 Growth Plan is designed to encourage complete communities: places that are easily walkable and where all the amenities people need – including residences, workplaces, schools, shopping and services – are situated close together. The plan also introduces new language promoting a multi-jurisdictional approach to fostering significant employment areas. It encourages all levels of municipalities to work with the provincial government and other stakeholders on "a coordinated approach to planning for large areas with high concentrations of employment that cross municipal boundaries and are major trip generators, on matters such as transportation demand management and economic development."

Opportunity for Coordinated Planning

Ontario's new policy direction holds great promise for coordinated planning in the AEZ. The Growth Plan's language supporting multi-jurisdictional collaboration is especially significant in this regard. Previously, municipalities had little statutory basis for coordinating their official plans. Now they have a formal process for establishing shared goals and complementary planning strategies.

Despite the major economic significance of our airport and its surrounding employment area, in the past urban and regional planning regimes have devoted relatively little attention to the AEZ. The sheer complexity of the zone – large, multi-jurisdictional, with mixed land uses and multifaceted infrastructure – may have discouraged municipalities from viewing it as a distinct area in need of focused planning.

Whatever the reasons for the relative lack of coordinated planning in the past, Toronto Pearson and the AEZ have achieved considerable success; and now, with thoughtful planning, we have an opportunity to make enormous further gains. The communities of the western GTA can build upon the zone's economic vitality and connectedness by establishing mutually beneficial planning goals for all neighbouring jurisdictions. These coordinated efforts could take a number of forms and address a wide range of issues. We'll continue to actively engage our provincial and municipal partners on this topic for the benefit of the entire AEZ.

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8 These plans were developed through the Co-ordinated Land Use Planning Review that concluded in May 2017. Other documents that came into effect over the summer of 2017 included the Greenbelt Plan, the Oak Ridges Moraine Conservation Plan and the Niagara Escarpment Plan.

9 Ontario municipalities are either single-tier or two-tier. A single-tier municipality assumes all responsibilities set out under the Municipal Act and other provincial legislation. The City of Toronto is a single-tier municipality. A two-tier municipality is composed of an upper-tier – that is, a county or regional municipality – and two or more lower-tier municipalities. The Regional Municipality of Peel, for instance, is an upper-tier municipality that includes three lower-tier municipalities: Mississauga, Brampton and Caledon. Responsibilities are divided between the two tiers.

The Big Picture

As Toronto Pearson evolves into a top-tier international airport, we're becoming an even stronger driver of regional and national prosperity. Our evolution mirrors the continued growth, in both population and economic dynamism, of the Greater Golden Horseshoe. The whole region stands to benefit from a shared focus on competitiveness, employment density, connectivity, transit-supportive development and sustainable urban design.

The core policies reflected in applicable provincial and municipal plans align with our development principles and approach. However, as we continue to advance the proposed Regional Transit Centre at Toronto Pearson, we're aware that local policy frameworks may have to be adjusted in order to account for an initiative of this scale and significance.

We see the following as key considerations to bear in mind as we work with the Province of Ontario and municipalities to develop plans for Toronto Pearson and the AEZ:

- Recent amendments to the provincial Growth Plan support a coordinated multi-jurisdictional approach to planning employment areas.
- Changes to provincial plans and policies place greater emphasis on the Government of Ontario's objective of guiding planning toward sustainable economic growth. While these changes don't apply specifically to Toronto Pearson, they're certainly relevant to our airport's long-term development.
- The official plans of municipalities around Toronto Pearson are supportive of our airport's continued success.
- As the concept of the Regional Transit Centre becomes better defined, we believe the best path forward will be to work with our partners to maximize the potential of the transit centre alongside the overall development of Toronto Pearson – with the ultimate goal of better serving the city, the region, the province and all of Canada.

14. The Southern Ontario Airport Network

Toronto Pearson has joined with 10 other regional airports – Hamilton, Niagara, Windsor, downtown Toronto (Billy Bishop), London, Kitchener-Waterloo, Lake Simcoe, Oshawa, Peterborough and Kingston – to develop a more integrated air transportation network. Our collective aim is to optimize current capacity while promoting investments to meet growing demand in Ontario's industrial heartland. It's part of a broader, multi-stakeholder strategy to improve connectivity and drive economic prosperity across the region – and the nation.

Introduction

Southern Ontario is the most densely populated region in Canada and an engine of the national economy. The region's continued growth – driven by population gains, increased productivity and expanding export markets – is reflected in steadily rising demand for air transportation services. According to recent estimates, more than 110 million passengers and over 1 million tonnes of cargo will flow through Southern Ontario airports in 2043, compared to 49 million passengers and about 470,000 tonnes of cargo today.

In managing these dimensions of growth, Southern Ontario must prepare for an increase in aviation requirements that will be too intense and wide-ranging for any single airport to handle. What's more, as the population and economy grow, so too will congestion on major highways and roadways; this could drastically affect the movement of people and goods into and out of the region, hampering competitiveness and long-term prosperity.

Recognizing the need to meet these challenges, Toronto Pearson and 10 other airports have formed the Southern Ontario Airport Network (SOAN). By working together as a coordinated system, we'll be better positioned to support the social and economic needs of the region, the province and all of Canada.

The SOAN consists of significant commercial airports that vary greatly in scale and service profile but share a common goal: supporting the evolving priorities of Southern Ontario communities while helping to promote and develop further economic opportunities. A few other Ontario airports, notably Burlington Executive Airport and Downsview Airport in Toronto, don't currently belong to the network but play an important role in aviation in the region.

Each SOAN airport supports its immediate community by amplifying local strengths and capabilities in four key areas:

- scheduled and chartered passenger services
- air cargo services
- airport-based businesses that support industry operations – including aircraft maintenance, logistics and supply centres, fuel depots, etc.
- general aviation – including flight training, corporate aircraft, medi-vac flights, etc.

All member airports will continue to make their own strategic decisions in response to local business drivers and community needs. At the same time, the SOAN provides a forum for discussing shared challenges and developing a more comprehensive understanding of air service opportunities – and constraints – across the region. Each airport, in consultation with community stakeholders and relevant levels of government, determines how best to enhance its own operations and economic impact. But insights shared within the network, and the potential to collaborate on initiatives of mutual interest, will guide how members choose to augment air services and further develop their facilities.

Figure 14-1: Members of the Southern Ontario Airport Network

Opportunities

Untapped Air Travel Demand

Outside of Toronto, there are five airports in Southern Ontario that provide scheduled service to travellers: Hamilton, Kingston, London, Waterloo and Windsor. Their combined catchment area generates roughly 45 per cent of Southern Ontario's GDP – yet they facilitate only 5 per cent of scheduled passenger flights. This disconnect between growing economic vibrancy and current volume of air travel points to an opportunity.

Southern Ontario airports, by better leveraging available capacity, should be able to support additional service to a range of domestic and selected leisure destinations (e.g., Cuba, the Dominican Republic and Orlando, Florida, among others). With carefully developed offerings, regional airports can potentially provide more choice to consumers, serving as an effective and convenient alternative to Toronto Pearson for travellers and businesses in their areas.

General Aviation and Flight Training

General aviation refers to any civil aviation activity beyond the scheduled and chartered flights that constitute most commercial air travel. It encompasses everything from medi-vac services to aircraft used for recreational tours.

Regional airports play an important role in supporting general aviation across Southern Ontario, and many have made it central to their plans for future growth. Flight training in particular could be an important driver of these

airports' success in the years ahead. Advanced education is critical to the region's air industry and connectivity; it also has the potential to generate a significant number of high-quality jobs.

Indeed, as demand for air travel increases in Southern Ontario and beyond, the aviation industry will need to recruit qualified workers in a wide range of roles. Pilots in particular are already in strong demand globally. And with more than 50 per cent of pilots in North America expected to retire in the next 15 years, opportunities for these skilled professionals – and the flight schools that train them – will continue to grow.

Airport Land Development

A number of SOAN airports have the ability to develop lands under their control for a variety of uses. For example, they could potentially add maintenance and repair facilities, aircraft-related manufacturing businesses, or fixed base operators providing general aviation services.

As Southern Ontario's economy continues to grow, opportunities to develop airport lands will likely become increasingly attractive. With thoughtful planning, regional airports should be well positioned to create high-value clusters of aviation-related activity. These clusters will not only generate rental revenues for participating airports but will also drive investment, businesses and jobs in their communities – which in turn will further boost demand for air travel.

The Network's Vision

SOAN members have a clear vision of the value they aspire to deliver together over the next three decades:

- The Southern Ontario Airport Network supports the aviation needs of the region.
- Southern Ontario is a premier location for aviation business and investment.
- General aviation activity has grown throughout the network, and the resultant labour needs are being supported.
- Greater ground transportation connectivity to and between network airports reduces congestion and greenhouse gas emissions in the region.
- Aviation growth is managed responsibly in collaboration with local communities.

SOAN members acknowledge that realizing this long-term vision will take 10 years or longer to fully develop. Finding ways to work together today is a vital first step toward making better use of the network's collective capacity.

Why SOAN Matters

Each SOAN member is developing its own detailed action plan, but these individual plans will be informed by – and supportive of – long-term, region-wide needs. The potential benefits of this approach are substantial. Better use of all airports' capacity will:

- increase air service choices for passengers and businesses across the region and in nearby parts of Ontario
- support better movement of people and goods across the region by decreasing road traffic congestion
- enable a more agile collective response to emerging industry trends (for example, the growing demand for pilot training)
- increase job opportunities and economic productivity in the region, the province and all of Canada

The growth of SOAN will also help to advance Toronto Pearson's continuing evolution into a top-tier international airport. Our peer group of global hubs, in addition to expanding worldwide connectivity, is deeply embedded in regional networks. They magnify – and benefit from – social and economic impacts in their own backyards.

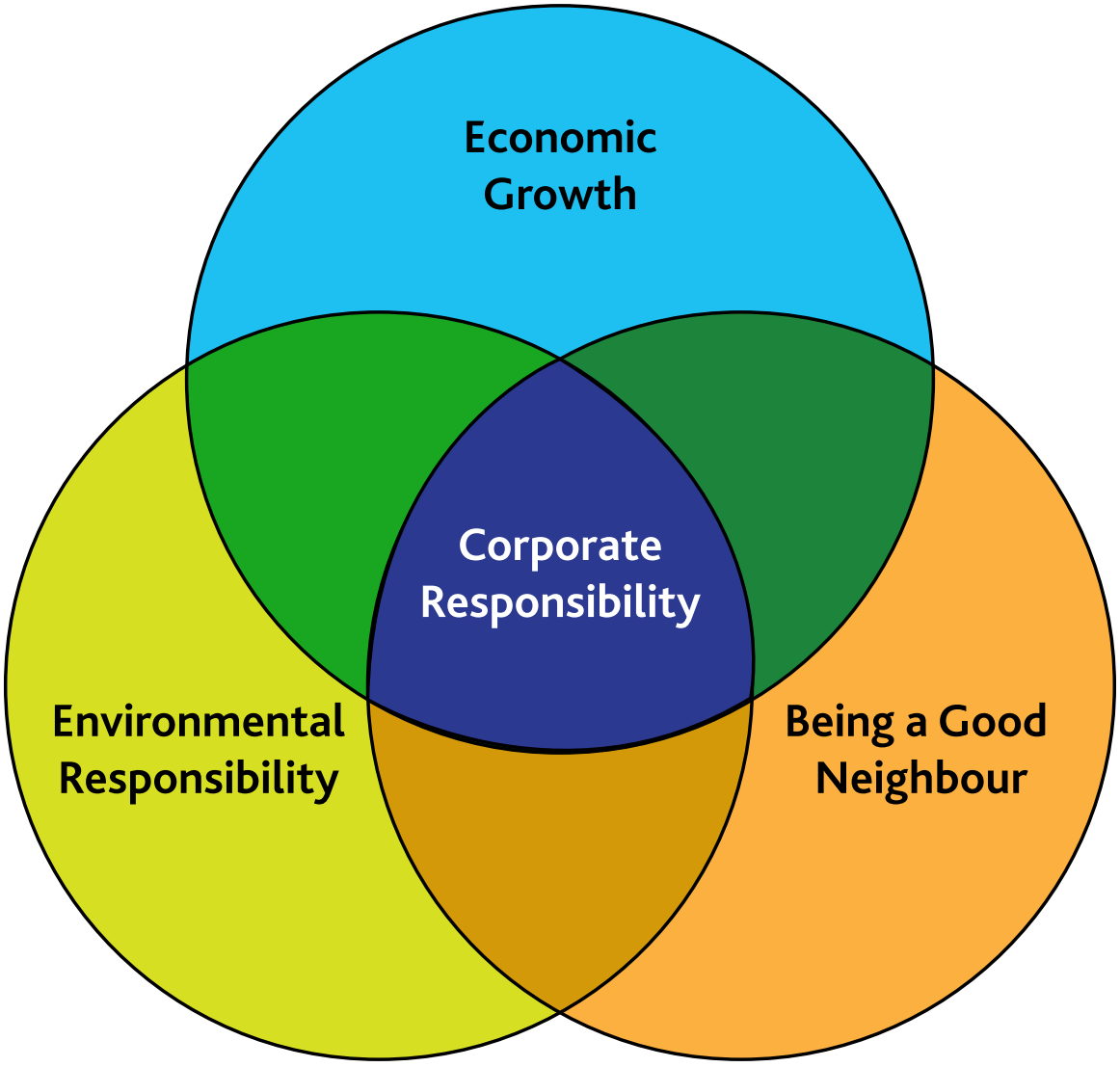
The connections a leading global hub airport provides don't end at the terminal doors; they extend deep into the surrounding region. And the reverse is equally true: regional airports deliver far greater value if they not only serve smaller communities well but also offer a portal to the wider world. A strong regional air system and a strong international hub go hand in hand.

Toronto Pearson and our fellow SOAN members are working together to ensure we can respond to – and help to create – the opportunities that come with growing regional prosperity. As we confer regularly among ourselves and with our stakeholders, we're exploring new ways to optimize our existing assets while planning for future demand – to ensure the communities of Southern Ontario reap the full advantages of both domestic and international connectivity.

Corporate Responsibility

At Toronto Pearson, we embrace our obligation to manage growth sustainably. In pursuing our vision to be the best airport in the world, we respect the needs and values of all our stakeholders while balancing the vital dimensions of social, economic and environmental responsibility. This commitment framed all activities and operations covered by our previous Master Plan, and it has only deepened as we've created a new roadmap for the future. We've been able to draw on a recent in-depth study of our airport's economic impact, as well as more robust reporting on greenhouse gas emissions. The current plan also reflects the strengthening of outreach efforts as we engage with our neighbours on a range of issues – notably noise management, where we foresee a reduction in impact over the next few years.

The following chapters examine Toronto Pearson's contribution to economic growth (Chapter 15), our continued efforts to minimize environmental impact (Chapter 16) and our sense of social responsibility (Chapter 17) in promoting open dialogue and building fruitful partnerships with our surrounding communities.



15. Corporate Responsibility: Economic Growth

Our airport is a major employer in the GTA and an economic engine for the region, the province and the entire country. Today, about 49,000 people are directly employed at Toronto Pearson – an increase of about 22 per cent from 2011. Our contribution to regional prosperity can be measured beyond direct employment: Toronto Pearson's operations enable or facilitate a total of 332,000 jobs in Ontario, generating $42 billion in economic activity annually – or 6.3 per cent of the province's GDP.

Toronto Pearson also anchors the Airport Employment Zone (AEZ) – the second largest employment area in Canada, with more jobs than the central business districts of Vancouver, Montreal or Calgary. As Figure 15-1 shows, although employment creation associated with our airport is concentrated in the GTA, it extends to other parts of the province as well.

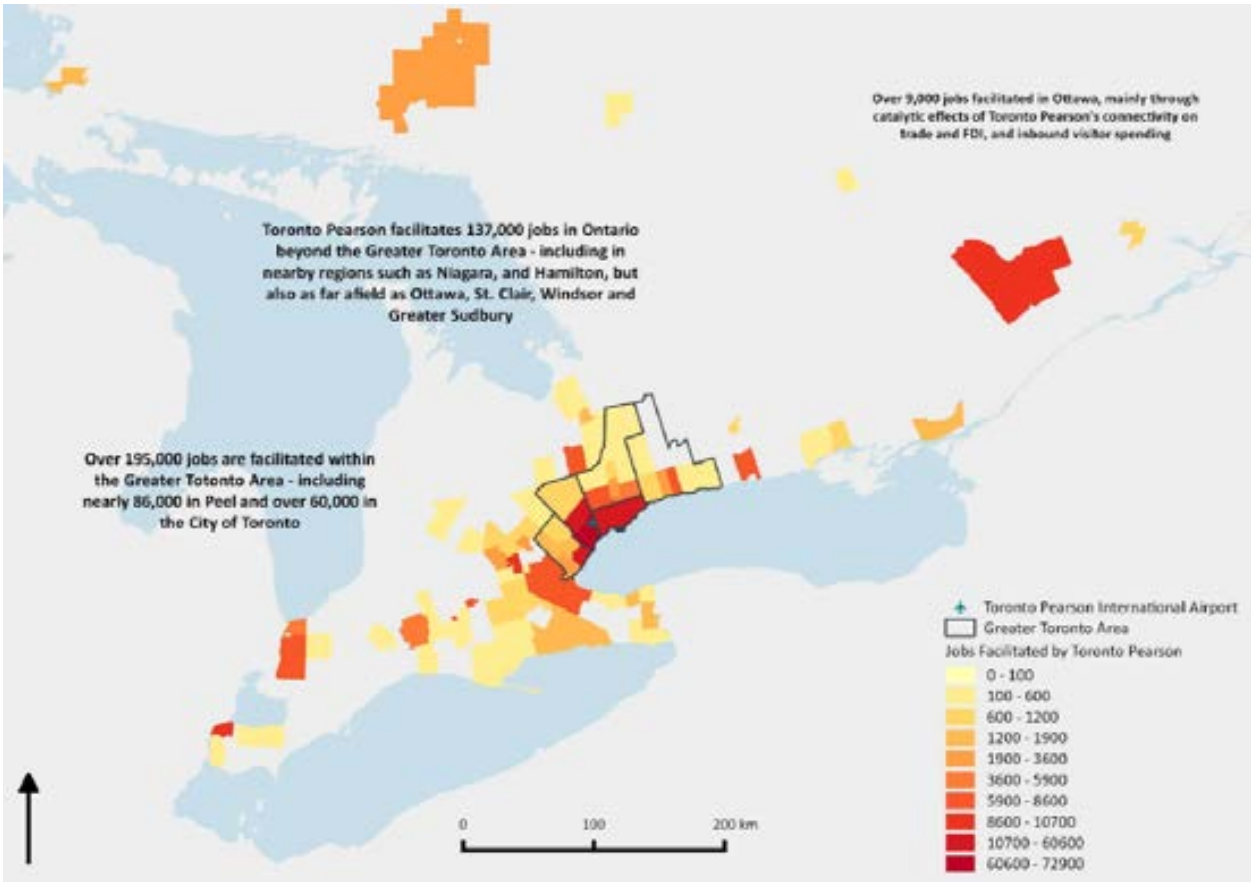


Figure 15-1: Location of Toronto Pearson's Economic Impact

Toronto Pearson

As demand for air travel grows, if we fail to respond with adequate facilities and levels of service, congestion will worsen and the effective cost of flying to and from Toronto Pearson will increase. The negative consequences will affect not only our airport, but the local, regional and national economies that depend on us for connectivity.

In a recent analysis focused on London Heathrow, the Frontier Economics consultancy concluded that time lost to congestion effectively added an 18 per cent premium to the average airline ticket. Should traffic delays and their associated frustrations push up airfares to and from Toronto Pearson, we'll become less competitive, and our potential to deliver broader economic benefits as a top-tier international airport will be constrained.

Economic Impact Study

In 2016, the GTAA commissioned Frontier Economics to conduct a second comprehensive study of Toronto Pearson's economic impact, building on work conducted three years earlier. The resulting report focused on the jobs our airport generates and facilitates, and looked at how those employment opportunities are distributed across Southern Ontario.

Measuring Economic Impact

Toronto Pearson's economic influence consists of:

- Primary impact – measured by the direct, indirect and induced jobs created by airport operations.
- Wider economic benefits – jobs made possible as visitors travel to our region by air and spend money as tourists or engage in trade and investment activities. These are also known as catalytic impacts.

Primary Impacts. Our airport's primary impact includes three categories of jobs:

- Direct jobs are located at or near Toronto Pearson and support our operations. For instance, the operator of a deicing truck and an employee of one of our retail shops are both direct employees. Our estimate of the amount of direct employment relies on Statistics Canada data and a survey of employers. We've concluded that Toronto Pearson facilitates 49,000 direct jobs.
- Indirect jobs are those associated with our airport's supply chain: the goods and services required for day-to-day operations. This category includes, for example, workers who transport jet fuel by road or rail, or mechanics who service airline catering trucks at garages in nearby communities. Using multipliers produced by Statistics Canada, we estimate that our facility enables 33,000 indirect jobs.
- Induced jobs are created as people in the previous two categories spend their earnings on goods and services in the wider economy. Again using multipliers produced by Statistics Canada, we've concluded that approximately 19,000 induced jobs can be attributed to our operations.

Combining all three categories, Toronto Pearson's primary economic impact represents about 101,000 jobs. According to our projections, by 2030 that figure will reach 136,000.

Wider Economic Benefits. When air travellers arrive in the GTA from elsewhere – whether they come as tourists, to do business, or to visit family or friends – they spend money on goods and services, boosting GDP and facilitating employment in our region. Industries that particularly benefit from spending by visitors include retail, food and beverage, cultural attractions, recreation and accommodation services. By 2030, we expect that this spending by visitors will support 131,000 jobs.

In addition to facilitating direct spending by travellers, Toronto Pearson's global connectivity drives the economic dynamism of our region in larger ways. Frequent direct flights to a wide range of international destinations effectively reduce the costs – in time and money – of movement between the GTA and economies around the world. Our airport's efficient, convenient connections support face-to-face business meetings, worksite and facility visits, attendance at trade shows and industry events, and other activities that encourage commercial relationships and foreign direct investment. They also support cargo movements on behalf of Canadian importers and exporters (see *Cargo and Logistics* on page 87).

Sectoral Economic Impact. The previous sections described Toronto Pearson's economic impact mainly in geographic terms – for example, the number of jobs our operations create in the GTA. Another way to consider the benefits of air connectivity is to measure its effects on productivity in a range of Canadian industries.

Research indicates that easy access to both domestic and international air links has positive effects on multi-factor productivity for most sectors. By the same token, improving air connectivity is likely to drive increased productivity across the board.

If we consider the hospitality industry, for instance, the frequency and reach of international connections affect productivity for hotels and related enterprises. As more direct overseas services are added at Toronto Pearson, it means more people in the world's fast-growing tourism markets – notably those in China, India and the Middle East – are likely to find a trip to Canada convenient and appealing. Studies show that long-haul international tourists typically plan longer stays and spend more per night on accommodations than domestic and short-haul visitors. These factors combine to boost overall output for the industry.

Agriculture is another sector of the Canadian economy powerfully affected by air connectivity. The ability to export agricultural products frequently and reliably – and to a growing range of markets – drives productivity. To choose just one example: Canada produces two-thirds of the world's lentils, many of them grown in Saskatchewan. India is a major consumer. And Toronto Pearson provides the vital link between Regina and Delhi, shipping a large proportion of the $1.1 billion in pulse crops that travel to India from Canada each year.

In addition to helping Canadian agricultural enterprises export crops, Toronto Pearson also facilitates growth in the research and technological capabilities that are increasingly vital to food production. Canada is a world leader in innovative farming practices, and our agricultural sector has a history of robust research and development programs. Saskatchewan, for instance, is home to a large biotechnology cluster that focuses on crop breeding, fractionation and processing technologies, dairy research and other specialized topics. As connectivity through Toronto Pearson helps Canadian firms export efficiently and attract foreign investment, they can make further investments in innovation. This in turn drives productivity, in a cycle of leadership, competitiveness and economic growth.

The Annual Impact of an International Route

Another way to express the economic impact of our airport is to consider the benefit in an entire year of a single international route. We estimate that each time a carrier offers a new daily service between Toronto Pearson and a location such as London, Mexico City, Shanghai or Delhi, it adds about $54 million to the Ontario economy and facilitates 400 jobs.

Combining Primary Impacts and Wider Economic Benefits

Our demand projections indicate that by 2037, Toronto Pearson will be serving 85 million passengers per year (see *Demand Forecasts* on page 29). At that level of traffic, our airport could potentially facilitate employment for approximately 700,000 people within the timeframe of this Master Plan (although the balance among the various types of job creation – direct, indirect, induced and catalytic – may change over time). This would represent about 8 per cent of all employment in Ontario.

16. Corporate Responsibility: Environmental Responsibility

We're committed to practicing environmental leadership as our airport evolves to meet the needs of a growing regional population and an expanding economy. We understand that environmental performance is a pillar of our social licence to operate: the GTAA's stewardship role is therefore central to our commitment to meeting and surpassing the expectations of neighbouring communities. We're dedicated to reducing and mitigating Toronto Pearson's environmental impact, both on the local ecosystem and in terms of our contribution to global climate change.

Our Environmental Program

In addition to complying with all standards and regulations that apply to our airport, Toronto Pearson has adopted an Environmental Management System (EMS) to help us set performance targets and pursue continuous improvement in our sustainability practices. Our EMS is certified by the International Organization for Standardization (ISO 14001:2015). The GTAA's complete environmental policy is available on our **website**.

The air carriers, concession holders and other commercial businesses that operate at Toronto Pearson work with us to advance our sustainability initiatives. Their leases and service agreements with the GTAA formalize a commitment to doing their part to help our airport meet targets in areas such as energy conservation and waste reduction.

Our EMS focuses on three key areas:

Climate Change. Reducing our contribution to the global effects of greenhouse gas (GHG) emissions, and taking measures to ensure our facilities are ready for the expected future effects of climate change.

Healthy Environment. Mitigating the environmental impact of airport operations by managing issues such as stormwater runoff and the prevention of wildlife strikes by aircraft.

Resources. Tracking the resources we use and the waste we generate, as part of a broader evolution toward a circular economy that minimizes waste and derives maximum value from the materials we consume before we dispose of them.

Present and Future Impacts

All projects described in this Master Plan, from roadway adjustments to terminal expansions, are subject to potential environmental assessments. These are conducted in line with the GTAA's environmental management system; in many cases they're also required by the Canadian Environmental Assessment Act (CEAA 2012).

Our in-house environmental assessment team studies the expected impacts of any given project and identifies effective mitigation measures. Our assessment process meets the requirements of Section 67 of CEAA 2012, which applies to projects undertaken on federal lands. Some of our development initiatives are not subject to CEAA 2012; in these cases we still conduct an assessment, in keeping with the GTAA's own environmental policies and goals. Our assessment and mitigation work focuses on the priorities described in the previous section: climate change, healthy environment and resources.

Climate Change

Aviation produces about 2 per cent of carbon dioxide emissions worldwide, according to the United Nations Intergovernmental Panel on Climate Change. While demand for air travel has been growing at about 5 per cent annually in recent years, focused efforts across the aviation industry have helped keep emissions growth to about 3 per cent.

Collectively, we have more work to do, and there is a growing commitment among leading airports, carriers and other aviation industry players to pursue responsible action on climate change. Toronto Pearson is an active participant in this movement, leading a climate change program that focuses on two areas: mitigation and adaptation.

Mitigation Efforts

Our mitigation work focuses on reducing Toronto Pearson's GHG emissions. Recent efforts in this area include:

- *GHG Management Policy.* Adopted in 2009, this policy establishes a path for reducing emissions – most importantly those associated with the operation of aircraft, but also the emissions produced by any large facility that depends on heating, cooling and electricity consumption. The success of our policy was confirmed in 2016, when Toronto Pearson earned Level 3 Airport Carbon Accreditation from Airports Council International, an organization that sets operational standards and best practices. This accreditation recognizes our work to measure emissions, diminish our carbon footprint and engage third parties in our climate change mitigation efforts.
- *Lowering Fuel Consumption.* Reducing aircraft fuel burn is the most effective way to cut GHG emissions. It also delivers substantial cost savings in carriers' largest area of operating expenditure. Toronto Pearson and our airline partners work together to promote processes and technologies aimed at lowering fuel burn and emissions. We've designed our airside infrastructure to minimize the time aircraft spend with their engines idling. We also structure our processes and facilities so that landing aircraft can shut down as quickly as possible after touchdown, while departing aircraft can get off the gate and into the air with minimal idling time. In recent years, we've introduced specific runway and taxiway design measures to reduce fuel consumption (see *Airside System* on page 41).
- *Participation in Regulatory Discussions.* Aircraft emissions are regulated by the International Civil Aviation Organization (ICAO), a United Nations body. Transport Canada contributes to the development of ICAO regulations in collaboration with air carriers, aircraft and engine manufacturers, and Environment Canada. The Canadian Airports Council, of which the GTAA is a member, also contributes to international regulatory discussions. This wide-ranging participation among industry leaders helps to establish appropriate targets and encourage information sharing about emerging engine, biofuel and other technologies. Involving all key players in an ongoing conversation builds momentum around the reduction of emissions across our industry.

Adaptation Efforts

Our adaptation initiatives focus on determining the potential implications of climate change for our region, and on enhancing Toronto Pearson's preparedness for the conditions we foresee.

- *Understanding the Future.* To assess how evolving climatic conditions are likely to play out in Southern Ontario over the next 20 years, we scale global models down to a regional level. We refine our projections by incorporating physical features – such as the Great Lakes and the Niagara Escarpment – into our analysis. By 2035, we expect to see warmer temperatures overall. During the summer months, this will mean more heat waves and more intense summer rainstorms. In winter, we expect to see more mixed precipitation events such as freezing rain.
- *Assessing Our Preparedness.* Equipped with data-based forecasts about the conditions Toronto Pearson can expect over the timeframe of this Master Plan, we've undertaken an engineering vulnerability assessment using a risk management tool developed by Engineers Canada: the Public Infrastructure Engineering Vulnerability Committee Protocol. This analysis has determined that our existing stormwater facilities (see *Utilities* on page 99) and the Spring Creek triple-box culvert have the capacity to meet Toronto Pearson's needs through the 2050s – although anticipated levels will exceed original capacity specifications. We continue to identify and address possible engineering vulnerabilities in other airport assets relative to future climate scenarios.

An Eco-Friendly Business Zone

The GTAA is proud to be a leading participant in Partners in Project Green (PPG), an initiative we launched in 2008 in collaboration with the Toronto and Region Conservation Authority. Dedicated to creating the world's largest sustainability-focused industrial and commercial zone, PPG is a business-led initiative that engages a growing community of companies, utilities, government bodies and institutions. Together, members are responsible for more than 12,000 hectares of industrial and commercial land surrounding Toronto Pearson. The partnership focuses on enhancing energy performance, waste management, water stewardship and stakeholder engagement on environmental issues. Our collective goal is to develop the Pearson Eco-Business Zone into an area that's recognized internationally for competitive, high-performance, environmentally friendly business strategies.

Moving Forward

The GTAA's environmental program will guide our decision-making and collective efforts as we move forward with the projects and practices described in this Master Plan. We'll continue to engage with our environmental partners and all levels of government, applying rigorous assessment processes to mitigate the impacts of any renovations, expansions, new builds or operational adjustments undertaken through 2037.

17. Corporate Responsibility: Social Impact and Responsibility

Toronto Pearson plays a vital role in the life of our neighbouring communities. Travellers, businesses and globally focused organizations rely on us to provide connections to the world. Airport employees look to us to maintain a safe and supportive work environment. Community members and their governments count on us to operate in a responsible and sustainable manner. And everyone naturally expects our airport to communicate transparently and act consistently in the public interest. Being a good neighbour means balancing these diverse and occasionally competing expectations by engaging with the communities we're here to serve – recognizing that their values, concerns and priorities are also ours, as stewards of a critical cornerstone of the nation's infrastructure.

Community Outreach

A Good Place to Work and Live

To ensure that all residents have equal opportunity to participate in the social and economic life of their community, the City of Toronto has identified 31 Neighbourhood Improvement Areas (NIAs) as targets for attention and investment[10]. Toronto Pearson is an important source of employment for several NIAs in the west end of the city. For example, an estimated 3 per cent of employed people in the Jane-Finch area, which intersects several NIAs, work at Toronto Pearson; this is markedly higher than the citywide average of 1 per cent. Residents of nearby Weston-Mount Dennis and Lawrence Heights are also disproportionately employed at Toronto Pearson.

In addition to offering employment opportunities today, Toronto Pearson invests in local communities to support their economic vitality into the future. A key vehicle for community investment is the **Propeller Project**, our Community Investment Program. Launched in 2017, this program has two distinct funding streams, each with unique objectives for social impact.

The Uplift Fund. As the largest employer in the Airport Employment Zone (AEZ), our airport has a unique opportunity to demonstrate leadership in providing equal access to employment. Although Toronto Pearson's operations support 49,000 direct jobs – and many more indirectly (see *Corporate Responsibility: Economic Growth* on page 123 for more on our economic impact) – some of the neighbourhoods closest to our airport continue to face unemployment rates higher than the provincial average.

Through the Uplift Fund, we're working with a network of corporate partners and employment-focused community organizations to address this complex issue. We've undertaken a range of research, advocacy and programming initiatives, all focused on understanding barriers to employment and advancing equity in our communities. We're working to connect talented people in our neighbourhoods with the skills and networking opportunities that will help them secure meaningful, high-quality jobs in the AEZ and beyond.

Through the Uplift Fund, Toronto Pearson has been a lead sponsor of Escalator: Jobs for Youth Facing Barriers.

10 NIAs are defined as those that score below average on a neighbourhood equity index measuring characteristics such as average income, rates of unemployment, levels of high school completion and voter turnout.

Developed by the not-for-profit CivicAction, this unique program works with private-sector employers to identify obstacles to hiring young people and see what can be done to overcome them. Our airport is also a Catalyst sponsor of Scientists in Schools, funding a three-year partnership through which more than 10,000 students at 25 local schools will experience half-day enrichment workshops in science, technology, engineering and math (STEM) courses.

The Nest Fund. Toronto Pearson also invests in organizations that are working on the ground to strengthen our local neighbourhoods – especially through initiatives related to employment, the environment and community vitality. Through the Nest Fund, we support our partners in:

- startup incubators and employment programs that help people connect with economic opportunities – and create new ones
- programs for children and youth in diverse fields, including science, sports and the arts
- parks, playgrounds and infrastructure adjustments that make the built environment friendlier and more accessible
- conservation and environmental citizenship programs in communities and schools

These initiatives and many others we support are all aimed at making the neighbourhoods around Toronto Pearson even more dynamic and inclusive.

Noise Management Program

The GTAA is committed to being a good neighbour even as we strive to meet the needs of a rapidly growing region that depends on us for international air connectivity. Managing the noise associated with our operations is part of a broader commitment to being a positive and cooperative force in our local communities.

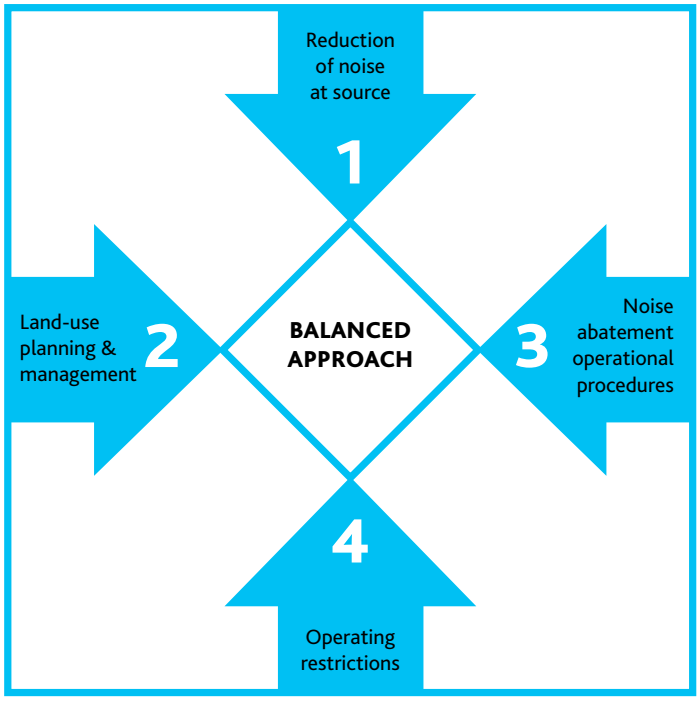


Figure 17-1: ICAO Balanced Approach to Aircraft Noise Management

Noise management is also among the issues covered in the GTAA's Ground Lease with Transport Canada. Our Noise Management Program includes multiple strategies designed to limit Toronto Pearson's noise impacts and foster open, productive discussion with our neighbours.

- *Land Use Planning.* We work with neighbouring municipalities to support planning that's compatible with our operations, including through the designation of an Airport Operating Area (see the following section, as well as *Interface with Surrounding Area Plans* on page 111).
- *Operating Restrictions.* We use preferential runway assignments and a night flight program to limit the hours and areas in which aircraft noise impacts may be experienced (see *Operating Restrictions* on page 135).
- *Noise Abatement Procedures.* We use technology and well-defined operational measures to reduce noise during takeoffs and landings (see *Noise Abatement Procedures* on page 137).
- *Enforcement.* We investigate, audit and report on potential violations of our noise commitments. Although the GTAA is responsible for noise mitigation, Transport Canada enforces penalties when they are deemed appropriate (see *Noise Enforcement* on page 139).
- *Noise Management Office.* In addition to continuously monitoring levels and investigating complaints, the Noise Management Office keeps the public apprised of activities such as runway construction or low-flying aircraft that may cause temporary increases in noise levels (see *Noise Enforcement* on page 139).
- *Consultation and Outreach.* We connect regularly with local communities to better understand our neighbours' concerns and to share information about our operational choices and constraints, our noise mitigation efforts and our role as a responsible neighbour (see *Community Relations* on page 139 and *Stakeholder Engagement* on page 141).

Land Use Planning and Noise Contours

We work collaboratively with our airport partners to minimize noise impacts from Toronto Pearson operations without compromising safety. We're also committed to working with neighbouring communities through constant conversation, education and consultation.

Our comprehensive Noise Management Program comprises the following elements:

- *Land Use Planning.* Identifies an Airport Operating Area for municipalities to factor into their planning.
- *Noise Operating Restrictions.* Include a night flight program and preferential runway assignments.
- *Noise Abatement Procedures.* Minimize immediate community impacts during takeoff and landing.
- *Enforcement Office.* Investigates, audits and reports on potential violations of the noise program.
- *Noise Management Office.* Investigates complaints, monitors noise levels and acts as an information resource.
- *Consultation and Outreach.* Builds awareness and understanding about our airport's role in the community.

Land Use Planning. A key part of the Noise Management Program is to limit the number of people affected by noise resulting from aircraft operations. One way we've addressed this is to create a fixed Airport Operating Area (AOA). The AOA is included in the official plans of Peel Region and the cities of Brampton, Toronto and Mississauga.

We influence proposed developments for the area in the following ways:

- Reviewing and providing comments on subdivision and proposed development plans, official plans, official plan amendments, rezoning, site plans and committee of adjustment applications.
- Participating in land use policy development at the regional and municipal levels.
- Liaising with federal and provincial governments on matters related to land use in the vicinity of the airport.

Noise Exposure Forecast (NEF). Transport Canada's NEF model is the official methodology used to quantify noise exposure in the vicinity of Canadian airports for land use planning purposes. NEF values represent a cumulative noise index that quantifies long-term aircraft noise exposure based on a typical busy summer day, when both aircraft noise levels and community sensitivity tend to be at a maximum.

The NEF model takes into consideration:

- the number of arrivals and departures at the airport
- the distribution of arrivals and departures across various runways
- the mix of aircraft types used by operators
- site-specific arrival and departure procedures

To account for the greater sensitivity toward aircraft noise at night, the NEF model also applies a penalty to all operations occurring during nighttime hours. The resulting NEF contour lines are drawn on a map by connecting points of equal noise impact that represent selected NEF values.

It is reasonable to say that the NEF is an imperfect measure of noise impact – and even as a land use planning tool, it has drawbacks. Around the world, airports and governments are working to develop better tools for predicting aircraft noise impacts for land use planning. The GTAA will be collaborating accordingly with Transport Canada and other Canadian airports.

It is important to point out that the assumptions used to model the original 30 NEF contour, as well as the AOA that was subsequently defined in the 1990s, reflect a different airport facility, operating pattern and aircraft mix than today's. For example, in 1990 Toronto Pearson had three active runways; now we have five. In addition, our carrier traffic included a much higher share of noisy aircraft. And the north/south runway was used more often, as we had sufficient airside capacity to operate more often on a preferential runway basis.

Multiple Scenario Envelope Approach. The GTAA is proposing to adopt an innovative approach to generating Noise Exposure Forecasts that is consistent with best practice around the world, as well as with the method adopted by several other major Canadian airports.

The traditional approach to NEF modelling assumes, for planning purposes, a peak-day flight schedule based on average annual operating conditions – that is, average runway allocation, night/day split and flight tracks. This is somewhat like setting the thermostat in your home for the average annual temperature in Toronto.

The new NEF approach takes the same peak-day flight schedule and bases it on the varied operating conditions we experience over the course of a year and are likely to see again in the future. This yields an aggregate or Multiple Scenario Envelope (MSE) NEF noise contour reflecting all of those varied conditions.

This is a non-preclusion approach, in that it ensures we do not find ourselves in the future with an operating pattern and noise footprint at Toronto Pearson that we have not protected for – with the consequence that we're precluded from meeting the aviation demands of an economically prosperous region, province and nation.

In light of this new approach, it's only right that the GTAA should consult with neighbouring municipalities, other interested communities and additional stakeholders to provide more details about the new MSE approach, and to answer questions and conduct further analysis as required.

In the interim, the current 30 NEF contour is as shown below in Figure 17-2.

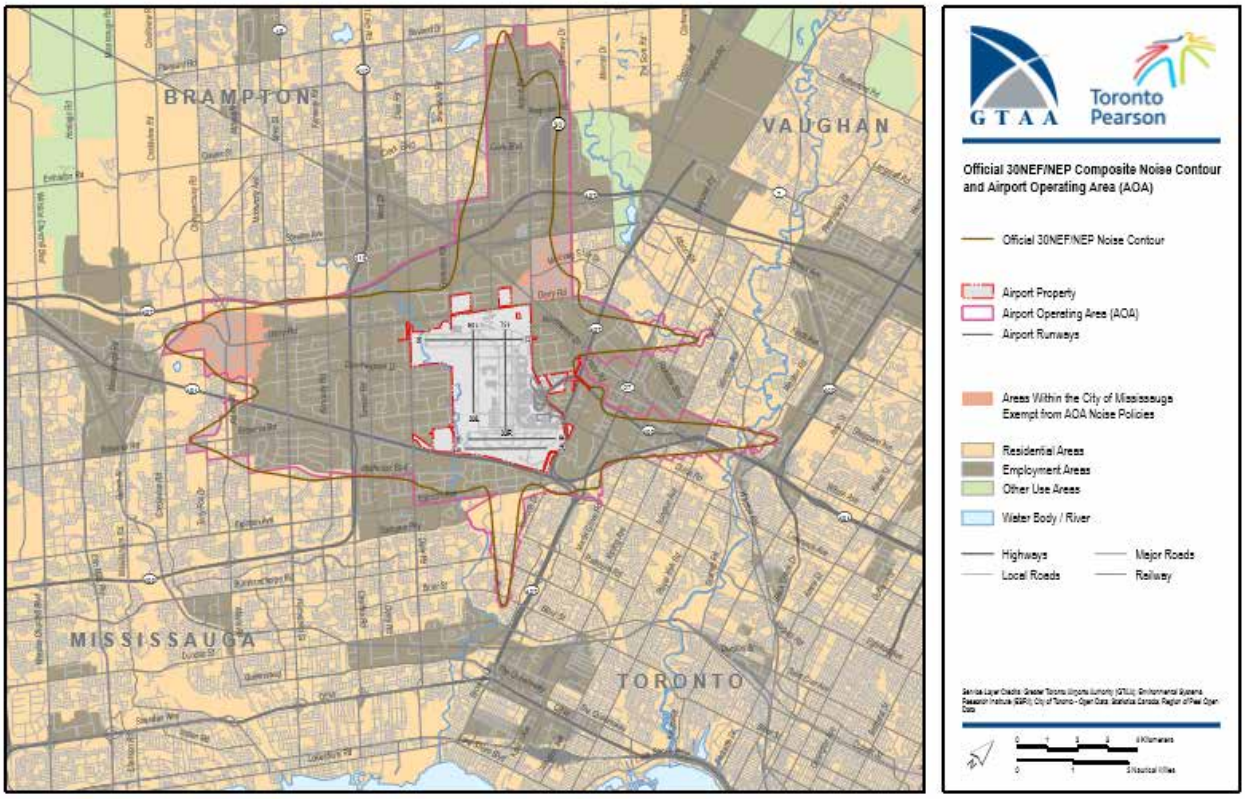


Figure 17-2: Current Official 30 NEF/NEP Composite Noise Contour and Airport Operating Area

Operating Restrictions

The Noise Management Program limits Toronto Pearson's noise emissions in terms of both geography and time. We set especially stringent limits in parts of the airfield that are closest to surrounding communities and therefore could cause disruption. We also restrict the amount of noise our operations can potentially create at night.

Engine Run-Up Restrictions

Run-ups are tests conducted on the ground to ensure aircraft engines are operating properly. After an engine has undergone a part replacement or other maintenance, operators will typically verify its performance by "running it up" to takeoff power. This is an important safety procedure – and a noisy one. Toronto Pearson has placed restrictions on when and where engine run-ups may be performed. All such tests must be pre-approved by the

GTAA. They can only take place at designated locations – and with aircraft in prescribed orientations – to minimize noise impacts on residential communities.

Aircraft Category Operating Restrictions

Aircraft vary in the amount of noise they emit, and planes have generally become quieter as technology has improved. To encourage noise reduction across the industry, the International Civil Aviation Organization (ICAO) has been setting noise standards since 1973, using effective perceived noise level in decibels (EPNdB) as its key unit of measure. The ICAO publishes each new noise standard as part of a widely used environmental protection document[11]. An aircraft's noise performance is denoted by the document chapter whose standard it meets; for instance, a Chapter 4 aircraft is quieter than a Chapter 3 aircraft. Figure 17-3 shows the years in which past standards were introduced and how all perform relative to the current Chapter 4 standard.

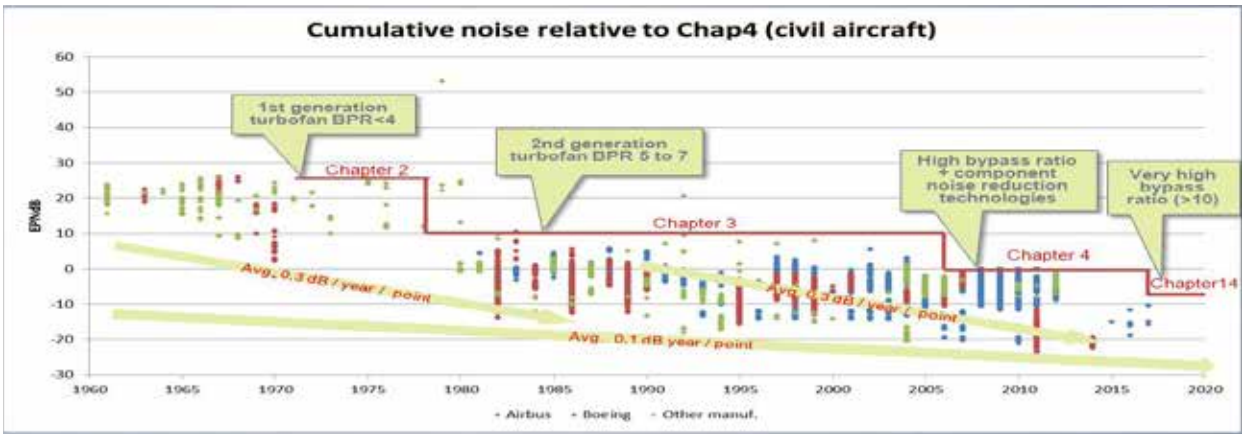


Figure 17-3: ICAO Chapter Introduction Timeline Source: Airbus

Toronto Pearson encourages the use of quieter aircraft as new technology becomes available. However, airlines are responsible for the rate at which their fleets are updated. Currently, 95 per cent of the aircraft that use our airport are rated Chapter 4 or equivalent. By the end of 2017, all newly built aircraft will be required to meet a higher ICAO standard: Chapter 14. We expect to see rapid adoption by carriers of aircraft that perform at this level. Indeed, many of the aircraft already operating at Toronto Pearson meet the requirements of Chapter 14.

Table 17-1 shows our airport's current fleet composition and the range of aircraft we expect to accommodate by the end of this Master Plan. We project that by 2037, Chapter 14 planes will account for 61 per cent of aircraft movements at Toronto Pearson. The proportion of Chapter 4 aircraft movements will decline from about half today to roughly a quarter by 2037. Trends in the aviation industry suggest that the combined carrier fleet we serve will become considerably quieter overall.

11 *International Civil Aviation Organization (ICAO) Annex 16 – Environmental Protection.*

Year	Chapter 3	Chapter 4	Chapter 14	Turboprop	Total
2016	69 / 5%	743 / 51%	371 / 26%	254 / 18%	1,437
2037	4 / 0.2%	517 / 27%	1,186 / 61%	230 / 12%	1,945

Table 17-1: Toronto Pearson Fleet Composition by ICAO Noise Chapter Eligibility

Night Flight Restriction Program. Transport Canada restricts flights to and from Toronto Pearson between 12:30 a.m. and 6:30 a.m. Under the Night Flight Budget system, which aims to limit nighttime noise, only about 3 per cent of landings and departures take place during restricted hours.

In addition to the general operational limits set by Transport Canada, we also restrict the use of noisier aircraft at night. Because Chapter 2 planes are significantly louder than later generations of aircraft, they aren't permitted to operate between midnight and 7:00 a.m.

Preferential Runways. Between midnight and 6:30 a.m. daily, we further limit noise by applying the Preferential Runway system, which situates takeoffs and landings farther away from the most densely populated residential neighbourhoods nearby. It's important to note that this system is preferential, not mandatory. There are many factors to weigh as we decide which runways to use (see *Airside System* on page 41). Our primary considerations are safety related: wind, weather and, of course, runway availability (which can vary depending on snow and other conditions). Because larger aircraft need longer runways to become airborne, some planes are limited in the runways they can use. At night we add noise to our list of runway-allocation considerations.

In 2015, Toronto Pearson embarked on a noise mitigation engagement program in partnership with NAV CANADA. Together, we solicited community input on potential ideas to explore. The Preferential Runway program is one of six suggestions flagged by community participants for study and possible enhancement.

Noise Abatement Procedures

Aircraft can take various measures to reduce the noise they emit when flying relatively low, either on approach or when departing an urban area. Toronto Pearson requires pilots to follow a standard set of noise abatement procedures unless instructed otherwise by air traffic control – which happens rarely, and only for safety reasons.

Departing Aircraft. Airports have standard instrument departure (SID) protocols comprising a set of simple procedures for all aircraft departing a given facility. These protocols reflect local terrain and air traffic control imperatives. Toronto Pearson's SID includes a turn at 3,000 feet (about 915 metres) in altitude, as well as an instruction for departing planes to throttle back at a particular point in their trajectory – when it becomes safe to do so – in order to reduce noise.

Arriving Aircraft. The standard terminal arrival route (STAR) is the inbound counterpart of the outbound SID. Toronto Pearson's STAR includes noise abatement considerations requiring aircraft to begin their final approach at a minimum altitude of 2,400 feet (about 730 metres) to avoid extensive flight time close to neighbouring communities. Our protocol also requires that aircraft minimize the use of reverse thrust upon landing.

These noise abatement rules apply to jet aircraft at all times, and to propeller aircraft between 11:00 p.m. and 7:00 a.m.

Noise Monitoring

Toronto Pearson has been monitoring noise in neighbouring communities and in areas under our flight paths since the 1970s. Today we use an Airport Noise and Operations Monitoring System (ANOMS) to integrate data and guide our operational decisions.

Noise monitoring terminals (NMTs) are vital parts of our monitoring apparatus. Installed in carefully selected locations surrounding our airport, they gather raw data on aircraft noise levels. We currently have 26 NMTs in all.

Eight of our NMTs were installed in 2017 with guidance from members of Toronto Pearson's Community Environment and Noise Advisory Committee (CENAC). A working group within CENAC chose the new NMT locations based on a range of factors, including annual traffic levels, the differential between background noise and aircraft noise, proximity to flight paths and community input about noise in the area.

Noise Levels in the Community

Because Toronto Pearson is federally regulated, strictly speaking our airport is not bound by municipal noise by-laws. And because federal laws place no maximum limits – or time restrictions – on noise levels, we set appropriate parameters for our operations by consulting with experts and key stakeholders. We aim to strike an optimal balance between the concerns of nearby communities and the transportation needs of the region, province and country.

Using Appropriate Noise Measures. The MSE NEF model (see *Land Use Planning and Noise Contours* on page 133) is a standard methodology for measuring noise around airports. It's a cumulative measure that reflects the relative intensity of aircraft noise impacts in various locations across a year of operation. While the MSE NEF is a useful tool for land use planning, when it comes to measuring specific noise events, or gauging trends in an area's experience of noise conditions, other measures may be more useful. Over the course of this Master Plan, the GTAA will likely employ a number of different metrics to help our neighbours and other stakeholders understand noise impacts around Toronto Pearson, and to assess the potential implications of new developments or changes in our operations.

Single-event metrics can highlight the properties of a noise episode that's relatively brief, such as a specific aircraft landing. A single-event metric might be, for instance, the maximum noise level an aircraft reaches when flying overhead. A combined measure of the duration and loudness of an aircraft landing – to account for the overall level of potential disruption – can also be described as a single-event metric.

Several single-event metrics in a given time period can be combined to create a larger metric in order to infer a pattern – for instance, if one neighbourhood periodically experiences aircraft noise that exceeds a given decibel threshold, while an adjacent area experiences the same effect but less frequently. Each neighbourhood's experience of these events can be captured as the total number of events above a given decibel level, denoted as NA. The NA scores of different areas can be used to create a contour map similar to the NEF map on page 135.

NA contour maps have become increasingly helpful in discussions of airport noise, as they're clear and easily understood by non-experts. They essentially set a threshold for concern and state how frequently a neighbourhood was at risk of being affected. NA contour maps also help airports understand when a change in conditions or operations is having a significant effect on people in surrounding communities.

Traditionally, airports focused mainly on how loud their operations were. This drove improvements in aircraft technology, with the result that aviation operations worldwide are now considerably quieter. At the same time, airport traffic in many places – certainly at Toronto Pearson – has increased. This means that our noise impacts may appear constant according to a cumulative measure like the NEF, even if our whole facility is operating more quietly. Part of the value that NA contours offer is that they capture the frequency with which our operations

actually make an audible difference in surrounding areas. This allows us to focus our efforts, both operationally and in terms of land use planning, where they'll make the most difference to people's experience in the neighbourhoods where they live and work.

Noise Enforcement. When a noise event falls outside the parameters we've set with our partners, the Noise Management Office investigates and, where necessary, levies a penalty. At Toronto Pearson, we examine two kinds of violations:

- *Noise Abatement Procedure Violations.* Thanks to constantly improving aviation technology – and also because airlines train their pilots to follow all applicable standards and guidelines –nearly 100 per cent of flights at Toronto Pearson comply with our noise abatement procedures. To detect and respond to rare violations, we continually monitor and report on how well airside activity is conforming to our policies. In the event that an area resident submits a complaint suggesting that our operations have departed from agreed practices, we can refer back to the Noise Management Office's monitoring records to determine whether the event constitutes a violation – and, if so, what happened exactly and how we should respond.
- *Night Flight Restriction Violations.* Any aircraft movement that occurs at Toronto Pearson during restricted hours without the necessary permissions is in violation of the Night Flight Restriction program. In such cases, a penalty of up to 16 times the normal landing fee may be levied.

Community Relations

The GTAA is committed to working with our partners and the communities around our airport to ensure that the Noise Management Program continues to meet community needs even as Toronto Pearson keeps pace with demand for air connectivity across our growing region.

Part of our regular community engagement work around noise management includes conversation, education and consultation with residents in all neighbourhoods affected by airport operations. Some of our forums include:

- the Toronto Pearson Noise Management Office
- Community Environment and Noise Advisory Committee (CENAC) meetings
- community open houses
- public consultations on new initiatives or upcoming changes
- Community Advisory Committees to guide airport studies on topics affecting nearby communities

The Noise Management Office is a point of contact for anyone with questions about Toronto Pearson's operations and aircraft noise. The Office's dedicated team is responsible for educating the public about our ongoing noise mitigation efforts, and more generally for ensuring that we listen to, understand and address the concerns of our neighbours.

Noise Management Action Plan and Continuous Improvement

The GTAA's commitment to continuously improving the Noise Management Program is reflected in a set of concrete steps we've developed and implemented with vital input from CENAC. The resulting Five-Year Noise Management Action Plan has set the following goals:

- Review and validate our current Noise Management Program.
- Make recommendations for improvements to the program.
- Introduce new measures in keeping with our commitment to proactive noise mitigation.
- Increase transparency and accountability by setting clear objectives, identifying the activities we'll undertake to advance them and conducting evaluations of each initiative.
- Guide the work of the Noise Management Office, Toronto Pearson's Community Relations team, our aviation partners and CENAC.

There are two significant mitigation studies currently underway as part of the GTAA's commitment to continuous improvement in this area: the Toronto Noise Mitigation Initiatives and the Toronto Pearson Noise Management Benchmarking Study. Both are expected to conclude in late 2017 and will form the foundation for our 2018–2022 Noise Management Action Plan.

18. Stakeholder Engagement

Toronto Pearson is a strategic transportation asset tasked with supporting steadily growing regional and national demand for air travel. In delivering this goal, our airport is supported by, and accountable to, a complex network of stakeholders. It begins with the millions of passengers who travel through our terminals each year – and the millions more, across Canada and worldwide, who may do so in the future. Then there are the 49,000 people who are directly employed at Toronto Pearson, along with countless others in nearby communities whose livelihoods and quality of life depend on the access we provide. Our network also includes the many organizations that operate at Toronto Pearson, as well as all levels of government, from local municipalities to the Government of Canada.

All of these relationships overlap and interconnect, forming an ecosystem of engagement, guidance, concern and support that shapes every decision we make. In particular, as we manage our airport's current activities and future planning, we must also balance benefits with impacts, such as the effect of aircraft noise on nearby communities. As the various dimensions of this Master Plan are implemented, we will continue working to engage and educate community members about all aspects of Toronto Pearson's operations and potential environmental impacts.

Introduction

Toronto Pearson is part of a global aviation sector that is constantly evolving its policies, practices and technologies. At the same time, we operate in a prosperous region that is growing in terms of both economic prosperity and cultural diversity. Our business partners and stakeholders represent a complex network of organizations and individuals that all play critical roles in helping us maintain and improve our connections to local communities, deliver best-in-class customer service, and operate responsibly and safely.

We're constantly at the table with our business partners and stakeholders, discussing current operations and how we can work together to support future growth. They play a critical role in keeping us abreast of the latest changes, challenges and opportunities affecting Toronto Pearson, our surrounding neighborhoods, the regional economy, and aviation globally. We gather feedback from and collaborate with our diverse stakeholders and business partners through a wide range of initiatives, including industry meetings and committees; passenger and community surveys; employee forums; public meetings, workshops and educational open houses; events at the airport and in the community; tours of our facilities; and social media outreach. Taken together, these various efforts help ensure we're in the best possible position to plan strategically and act responsibly.

Stakeholders and Business Partners

Toronto Pearson's stakeholders include passengers and other airport users, along with anyone who influences or is affected by our operations. This extends to our surrounding communities, our aviation and business partners, governments, people who work at Toronto Pearson and all those with economic ties to our airport – including air carriers, service providers, businesses and organizations with a need for connectivity, and institutional investors. Figure 18-1 shows the stakeholder and business partner groups we engage with regularly.

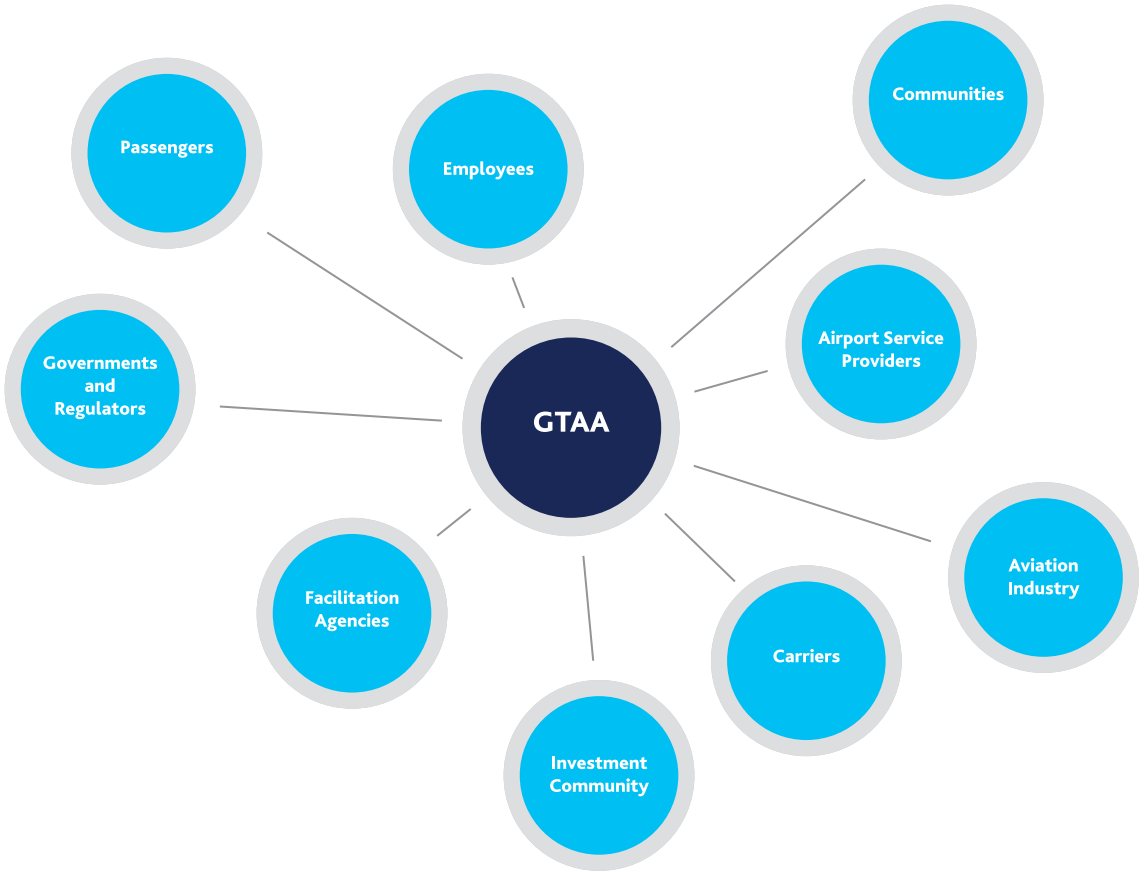


Figure 18-1: Key Airport Stakeholders

How We Engage

Our relationships with business partners and stakeholders vary, and so do the ways in which we communicate and collaborate with them. Some partners engage with us regularly to support strategic alignment of business objectives. Others intensively partner with us to discover and take advantage of new economic opportunities. Many of our stakeholders simply want to be kept informed about specific aspects of our work, such as our environmental responsibility initiatives, our noise-related commitments, or our financial goals and performance.

We're not only accountable to our stakeholders and business partners; we believe their involvement makes our policies, plans and practices better, helping us pursue Toronto Pearson's vision of becoming the best airport in the world. We constantly evaluate and modify how we engage with specific groups on the issues that matter most to them. We strive to keep our communications relevant, and our collaborations effective and rewarding. And we're equally committed to ensuring we have good mechanisms for incorporating stakeholder feedback into our work – especially our sustainability planning, programs and performance measurement frameworks.

Overview of Stakeholder and Business Partner Engagement

Each year, we engage on a broad range of issues. The Corporate Sustainability section of the GTAA Annual Report presents an overview of these interactions, including topics of discussion, communication channels and frequency. This yearly update, supported by detailed data on key indicators, provides insight on how Toronto Pearson's stakeholder engagement philosophy is put into action.

Stakeholder and Business Partner Engagement Related to the 2017–2037 Master Plan

Several key engagement objectives guide Toronto Pearson's planning process:

- Design and deliver an engagement program that informs our operations and planning, including the Master Plan.
- Fulfill the GTAA's commitment to actively involve community and other stakeholders in planning work.
- Inform stakeholders about the purpose, content and process of the Master Plan.
- Provide stakeholders with adequate information about – and opportunities to offer feedback on – the Master Plan and our airport's future growth.
- Ensure that our communications about the process are clear and consistent.
- Respect the rights of stakeholders to voice their opinions, and to have those opinions considered in the planning process.
- Promote a cooperative, information-led relationship between Toronto Pearson and our stakeholders.

The engagement program around this Master Plan has multiple components. Our activities to date include the following:

We've published reports to share evidence, ideas and plans for meeting future demand. Recent GTAA publications include *Toronto Pearson – Growth, Connectivity, Capacity: The future of a key regional asset* (2015), *Pearson Connects: A Multi-Modal Hub to Prosperity* (2016), and *Growing Canada with a Mega Hub Airport* (2016).

We've convened discussions about specific strategic initiatives. We've gathered partners and stakeholders to discuss how collaboration among airports in Southern Ontario can help to address growing demand for aviation services across the region (see *The Southern Ontario Airport Network* on page 117). We've invited input and ideas regarding our intention to build a Regional Transit Centre on airport lands that would serve as the second major mobility hub for the Greater Toronto and Hamilton Area. And we've shared our vision to support regional growth by evolving Toronto Pearson into a top-tier international airport, with connectivity to more than 80 per cent of the world's economy.

We've gathered feedback on our plans from municipalities, business groups and stakeholder committees. Over the last two years, we've shared and invited feedback on the ideas and strategies laid out in this Master Plan. This engagement has happened through:

- sessions with planning staff in surrounding municipalities
- presentations to municipal and regional councils
- meetings of the GTAA Consultative Committee (GTAACC) and the Community Environment and Noise Advisory Committee (CENAC)
- communications with industry, business and community organizations
- open houses for Toronto Pearson tenants and service operators
- one-on-one briefings for elected and unelected government officials – federal, provincial, municipal and regional
- industry, business and regional development organizations

We've invited feedback from neighbours and community members. The GTAA has designed and delivered a comprehensive community consultation program to share key components of the Master Plan and let our neighbours know how Toronto Pearson is preparing to meet future demand for air travel. As we've shared our plans, we've also been soliciting feedback and guidance on how we can best manage the impact of our operations as we respond to the region's evolving air transportation needs.

Community Consultation Tools and Approaches

Our multi-stage community consultation process has included:

Toronto Pearson Residents' Reference Panel. Comprising 36 community members, the Residents' Reference Panel met throughout the spring and fall of 2017. Members were selected at random to broadly represent the demographics of the Greater Toronto Area in terms of gender, age, home ownership and other criteria. The composition of the Panel was designed to ensure that residents from neighbourhoods affected by aircraft noise were well represented. We recruited members through a civic lottery process conducted via mailings to 20,000 households. The mailed packages also included a survey (see *Survey on Noise Fairness and Airport Growth* on page 145).

The Residents' Reference Panel learned from a range of experts and community stakeholders, and participated in public workshops and information sessions. These efforts led to the production of a report that includes the following:

- a set of values supporting the panel's vision of responsible growth
- a list of issues that the GTAA should attempt to address in its growth planning
- criteria for evaluating options to mitigate and manage aircraft noise
- additional recommendations concerning transit, noise management, environmental stewardship and public communications and engagement

More information about the Residents' Reference Panel is available at TorontoPearson.com/RRP.

Survey on Noise Fairness and Airport Growth. Through a survey on Noise Fairness and Airport Growth, we worked to understand what our neighbours think is fair when it comes to balancing noise mitigation priorities with the region's air connectivity needs. To gather a broad perspective from the community, we distributed the survey to 20,000 randomly selected households across the Greater Toronto Area. The survey was also available online and promoted through Toronto Pearson's social media channels. More than 2,500 individuals completed the survey. The results were shared with the Residents' Reference Panel to inform its considerations on responsible growth.

Conversations About Our Future: Public Workshops. In mid-2017, Toronto Pearson held five public workshops in Toronto, Mississauga, Brampton, Oakville and North York, attended by 535 residents in total. Attendees were asked to help shape the airport's growth plan, and to inform our approach to managing and mitigating noise.

During the workshops, representatives of Toronto Pearson presented key components of this Master Plan, including demand forecasts to 2037 (see *Demand Forecasts* on page 29) and the Land Use Plan (see *Land Use Plan* on page 151). We also tabled current or proposed initiatives to accommodate regional growth, including the Southern Ontario Airport Network (see *The Southern Ontario Airport Network* on page 117) and the planned Regional Transit Centre (see *Ground Access System* on page 65). Following these presentations, attendees participated in facilitated conversations to provide feedback on key questions relevant to the development of the Master Plan, including:

- the benefits and drawbacks of the airport's growth
- what steps the community would like to see the GTAA take to:
  - provide new transit options for the airport and region
  - engage and inform residents about its operations
  - strengthen its commitment to the environment
- how to address the concerns of residents adversely affected by aircraft noise
- the top three measures Toronto Pearson could take to ensure it grows responsibly

More information about these workshops is available at **TorontoPearson.com/Conversations.**

Conversations About Our Growth: Community Events. Seeking to engage as broad a cross-section of residents as possible, the GTAA participated in more than 45 community events throughout the region, talking about our airport's growth plans with community members and gathering their feedback on how we can grow responsibly. At every event, we let people know about the Public Workshops and the Noise Survey, encouraging them to participate. More than 7,000 residents engaged in conversation and signed up to receive continued updates on the Master Plan.

What We Heard from the Community

To all community members who shared their perspectives with us through our various public engagement processes (and who chose to provide their contact information), we sent a follow-up communication describing the input we'd received. We offered participants a summary of what we'd heard from residents and how those insights were incorporated into the Master Plan. In cases where residents' input was not incorporated into the plan, we explained why.

Table 18-1 presents an overview of common themes that emerged in our conversations with communities during this engagement process.

What We Heard from the Community	How the Idea is Addressed in the Master Plan
Aviation Demand – "Why does Toronto Pearson need to grow? What is driving this demand for the airport to grow to serve 85 million passengers?"	Economic, social, demographic and technological trends all influence demand for aviation services. The 2017–2037 Master Plan has developed a new set of 20-year forecasts for passenger traffic, cargo volumes and aircraft movements that considers a broader range of factors driving demand for air transportation. *Demand Forecasts* (page 29) offers more detail about how we generate our forecasts. *Corporate Responsibility: Economic Growth* (page 123) describes the projected economic benefits of this growth.
Airport Growth – "Traffic at Toronto Pearson is doubling, and the GTAA should do more to limit or reduce aircraft movements."	While passenger traffic is forecast to nearly double, we don't expect aircraft movements to do the same. Airlines continue to deploy larger, fuller planes, so more people and goods will move on fewer flights. In fact, Toronto Pearson expects average annual aircraft movement growth of about 1.4 per cent over the next 20 years, which is in line with the population growth of the Greater Toronto Area. *Airside System* (page 41) and *Passenger Terminal System* (page 55) outline how our terminals and airside facilities will accommodate the growth we anticipate over the next 20 years.
Regional airports – "The GTAA should reduce the number of aircraft movements at Toronto Pearson by shifting operations to other airports, starting with cargo."	The GTAA has worked with other airports in the region to launch the Southern Ontario Airport Network (SOAN). While it's ultimately an airline's decision where to operate, these airports are working together to support the growth in aviation demand that affects our entire region. *The Southern Ontario Airport Network* (page 117) offers more information about SOAN. On average, only about 18 dedicated cargo planes land at Toronto Pearson each day, representing 1.5 per cent of total airplane movements. Today, most cargo is shipped in the bellies of passenger flights. *Cargo and Logistics* (page 87) analyzes future cargo operations at Toronto Pearson.
Managing impacts – "The GTAA needs to do more to manage its environmental footprint and measure its impacts, including air quality and greenhouse gas emissions."	The GTAA is committed to reducing and mitigating Toronto Pearson's environmental impacts – on the local ecosystem and neighbouring communities, and in terms of our contribution to climate change. In addition to complying with all standards and regulations that apply to our airport, Toronto Pearson has adopted an Environmental Management System (EMS) to help us set performance targets and pursue continuous improvement in our sustainability practices. *Corporate Responsibility: Environmental Responsibility* (page 127) details how we deliver on our environmental commitments.
Managing impacts – "The GTAA needs to explore more ways to reduce the impacts of aircraft noise, particularly at night."	The GTAA recognizes community concerns and is initiating a Five-Year Noise Management Action Plan (2018–2023) to help address noise impacts on surrounding communities. *Corporate Responsibility: Social Impact and Responsibility* (page 131) explains our Noise Management Program.

What We Heard from the Community	How the Idea is Addressed in the Master Plan
	On average, only about 18 dedicated cargo planes land at Toronto Pearson each day, representing 1.5 per cent of total airplane movements. Today, most cargo is shipped in the bellies of passenger flights. *Cargo and Logistics* (page 87) analyzes future cargo operations at Toronto Pearson.
Managing impacts – "The GTAA should be exploring how it can use its runways to offer respite to communities most impacted by its operations."	Many top-tier international airports operate runway programs designed to provide respite from aircraft noise. The GTAA is open to exploring these programs in consultation with our surrounding communities. *Corporate Responsibility: Social Impact and Responsibility* (page 131) and *Stakeholder Engagement* (page 141) provide more detail on how we're working with communities.
Communications – "The GTAA needs to be more transparent and proactive in its communication to local residents."	The GTAA has strong ties to our surrounding communities and engages with residents through a number of channels. We understand the importance of timely, transparent and effective communications, and we're committed to continuously improving our communications and engagement programs. *Corporate Responsibility: Social Impact and Responsibility* (page 131) and *Stakeholder Engagement* (page 141) provide more detail on how we're working with our communities.
Transportation – "The GTAA should demonstrate local leadership and pursue its vision for a regional transportation centre in consultation and collaboration with the appropriate authorities."	As a worldwide connector of people and businesses by air – and a driver of economic prosperity in our region – we see enhanced access to ground transportation and transit as a priority for our airport. This is why the GTAA is proposing to build a Regional Transit Centre at Toronto Pearson that would serve as a major transit hub for the western Greater Toronto and Hamilton Area – with the potential to transform the region. *Ground Access System* (page 65) provides details about the proposed Regional Transit Centre.
Community Development – "The GTAA needs to give back to the communities that are most impacted by Toronto Pearson's operations."	The GTAA invests heavily in local communities to help support their social and economic vitality. Our Community Investment Program reinvests 1 per cent of pre-tax profits – qualifying the GTAA for Imagine Canada's Caring Company Program, which "sets the standard for corporate giving in Canada." *Corporate Responsibility: Social Impact and Responsibility* (page 131) provides more details on Toronto Pearson's Community Investment Program.

Table 18-1: Key Themes from the Community Consultation Process

19. Conclusions and Recommendations

From our comprehensive analysis, we've developed the most likely scenario for Toronto Pearson in 2037: some 85 million passengers will travel through our airport annually, and we'll connect our region and all of Canada with the world by facilitating more than 630,000 aircraft movements. In addition, nearly 970,000 tonnes of cargo will move through our facilities each year.

These projections could vary somewhat, either upward or downward, and we've made this Master Plan flexible so we can respond accordingly. By increasing the productivity of Toronto Pearson's land and facilities, we're confident that we can meet future demand using our existing footprint and runways while minimizing our impact on neighbouring communities. We'll also continue to innovate, keeping pace with rising demand by embracing new business models and adopting new enabling technologies.

In concluding our collaborative work on the various aspects of this Master Plan, we've arrived at a clear set of success factors and priorities for how Toronto Pearson should move forward:

1. Maximize the economic benefits our airport delivers to the city, region and nation while minimizing greenhouse gas and other emissions, and mitigating and ameliorating as effectively as possible the impact of aircraft noise on surrounding communities.
2. Work with our partners in the Southern Ontario Airport Network to ensure all users of our collective services – passengers, carriers, cargo shippers and other aircraft owners – have a range of convenient and efficient airports to choose from.
3. Fundamentally change ground access patterns for passengers and airport employees in favour of higher-occupancy, lower-emission vehicles. We aim to achieve this through a combination of supply-and-demand and land use policies, anchored by the proposed Regional Transit Centre – as well as continued adaptation to new technologies and business models in urban mobility. The Toronto Pearson Regional Transit Centre would be served by emerging regional rail services, providing another access option from more distant parts of Southern Ontario and preserving valuable runway capacity for long-haul flights.
4. Leverage the Regional Transit Centre to improve mobility for people in surrounding communities (especially along the GTA's Northern Arc), boosting the region's productivity and competitive advantage while supporting collaboration among all levels of government on land use and transportation throughout the Airport Employment Zone.
5. Implement short-term measures to address current challenges affecting ground access and curb congestion, including examining ways to reduce the number of intra-airport vehicle trips.
6. Harness the trend towards larger, high-density, more fully occupied aircraft, as well as advances in air navigation technology, to potentially divert some short-haul demand to ground-based modes of transport, maximizing the productivity of our existing runway system.
7. Work, in collaboration with air carriers, government agencies and other business partners to respond to their strategies to build a global hub at Toronto Pearson and serve a projected 85 million passengers in 2037.
8. Continue to be responsible and effective stewards of our relatively limited land assets, securing sufficient space to meet the projected demand for airside, passenger terminal and ground access facilities. And with respect to the residual lands set aside for other airport development, allocate and develop these assets to maximum strategic benefit by adopting a hierarchy of operational, economic and locational priorities and related sub-area plans.

20. Land Use Plan

The Land Use Plan for Toronto Pearson International Airport was developed in accordance with the provisions of Section 7.02 of the Ground Lease dated December 2, 1996, between the Greater Toronto Airports Authority and Her Majesty the Queen in Right of Canada, represented at that time by the federal Minister of Transport. Once approved by the current Minister of Transport, Infrastructure and Communities, it will comprise the Approved Land Use Plan for our airport. The plan sets out five categories, each with general descriptions of appropriate land uses – as well as examples, where appropriate, of the types of activity or development proposed by the GTAA. The Land Use Plan covers the Demised Premises of the GTAA as of December 2, 2017.

Airfield

This category of land is used for the movement of aircraft and related operations. It comprises both existing facilities and areas reserved for future development to accommodate:

- runways
- taxiways
- navigational aids
- supporting access roads
- agricultural uses (subject to bird hazard considerations)
- additional support facilities (as airport zoning permits)

Other uses permitted in this area include Toronto Pearson's fire training facility, an Environment Canada meteorological facility, the Wildlife Control Centre and a decommissioned rifle range, once used by police forces in the region.

The airfield category also reserves land for a future sixth runway to the south of existing Runway 05-23.

Passenger Terminals

This category accommodates Toronto Pearson's current passenger terminals, as well as future expansion and activities related to our passenger facilities. Permitted uses in this area include:

- administrative offices
- car rental agencies
- hotel development
- government inspection functions
- long-term and short-term parking
- passenger processing (including on aircraft aprons)
- police and security functions
- public transit/automated people mover systems
- retail and food and beverage concessions
- taxi, limousine and other ground transportation services

Other Airport Development

This category provides for additional airport-related facilities and activities, including:

- air carrier ground service equipment maintenance
- air carrier training facilities
- air traffic control (tower and area control centre)
- aircraft deicing operations
- aircraft fuelling facilities
- aircraft maintenance
- airport administration and maintenance
- airport rail link/transit right-of-way
- airside waste disposal
- automated people mover
- business aviation services
- Canada Border Services Agency
- car rental storage
- cargo and logistics operations
- Central Utilities Plant and other utility infrastructure
- commercial office, industrial and retail development
- employee and public parking
- fire halls and other emergency services
- flight kitchens
- hotel/convention centre
- other aviation support facilities

Given the broad scope of the other airport development category, the GTAA has adopted a series of hierarchies that apply to land use within it. (These hierarchies and their application are discussed in greater detail in *Land Uses* on page 105.)

Operational Considerations Regarding Land Use Options

The first two functions listed below are core to Toronto Pearson's operations and are largely non-discretionary; the latter three allow some discretion.

Operational Hierarchy

	Function	Examples
1	Essential for the safe operation of aircraft	Air traffic control, fire hall, airfield maintenance, hangars
2	Essential for efficient air carrier operations	Fuel, cargo, catering, ramp equipment storage, maintenance, waste management
3	Ancillary services for passengers	Hotels, car rentals
4	Other aviation-related services	Aircraft manufacturing and maintenance, business aviation
5	High propensity to travel or ship cargo by air	National or global corporate headquarters, logistics companies

Table 20-1

Economic Considerations Regarding Land Use Options

When the GTAA has discretion over land use decisions – for instance, when we're comparing the relative merits of uses in categories four and five of the operational hierarchy above – the economic hierarchy guides our decisions.

Economic Hierarchy		
	Economic Value	**Rationale**
1	Non-aeronautical revenue	Financial self-sufficiency for the GTAA
2	Jobs and GDP	Consistent with Toronto Pearson's economic development mandate
3	Ancillary services for passengers	Hotels, car rentals
4	Increased land value	Supports strong economic development and growth

Table 20-2

Flow Considerations Regarding Land Use Decisions

Land allocation decisions are determined first by the operational and economic criteria outlined above. Having weighed those functional criteria, our next step is to consider geography – how a proposed use in a specific location will enable the safe and efficient flow of aircraft and vehicles to, from and within Toronto Pearson.

Flow Hierarchy		
	Priority	**Rationale**
1	Preserve runway capacity	Maximize strategic value of takeoff/landing slots and minimize runway crossings by ground vehicles and aircraft under tow
2	Logistics efficiency	Minimize distances between local highways, cargo processing facilities and aircraft
3	Increase transit ridership	Appropriately situate land uses with high potential to generate transit ridership

Table 20-3

Passenger Terminal Access Lands

This category includes lands along Hwy 409 transferred by the Province of Ontario to the Government of Canada and subsequently leased to the GTAA pursuant to our ground lease. It permits uses such as ground access and related activities within Toronto Pearson's footprint and/or on connecting roads. The category also accommodates the building, installation, operation, repair, maintenance or replacement of:

- utility equipment and services
- an airport rail link, an intermodal transfer station and an automated people mover, together with related equipment, systems and infrastructure
- navigation, weather, communications or surveillance equipment; electronic landing systems, including visual aids; and any other new or improved systems and infrastructure required for aircraft navigation
- any additional transportation-related use

Environmental Protection Areas

This land use category covers areas of Toronto Pearson where development should not take place without appropriate environmental mitigation efforts. It includes natural features such as creek valleys, as well as human-built elements such as stormwater detention ponds. The category also encompasses lands reserved for a potential creek diversion to facilitate construction of a parallel north runway.

Future developments in this area include both aquatic and terrestrial habitat improvements – consistent with airport safety and efficiency – as well as the creation of a pedestrian/cycle trail.

Notable Areas on the Land Use Plan Map

Two sets of crosshatched lands are identified in Figure 20-1.

"Other Airport Development with Passenger Terminal Facilities" denotes lands that could either be developed for passenger terminal facilities or for other airport uses. Further planning, analysis and consultation with business partners and government agencies are necessary before a final decision on the direction of long-term passenger terminal expansion. Hence the need to protect for both options: infield and north of Terminal 3.

"Access Lands with Passenger Terminal Facilities" denotes lands protected for the development of a passenger terminal integrated with the proposed Regional Transit Centre.

Toronto Pearson International Airport 2037 Land Use Plan

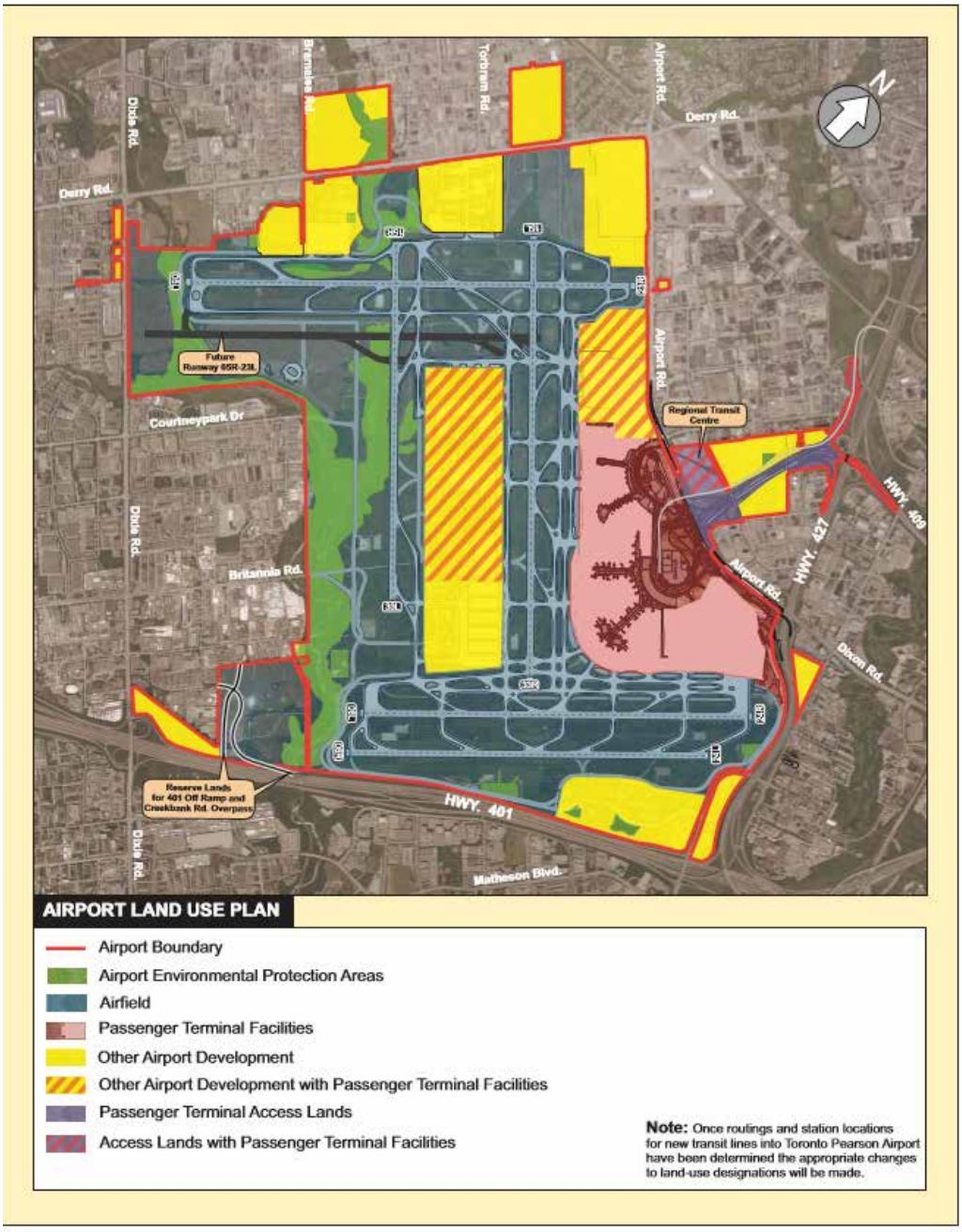


Figure 20-1: Land Use Plan

Toronto Pearson

For more information, please visit
torontopearson.com/masterplan

www.torontopearson.com