OLIVER WYMAN

JET OPERATIONS AT BILLY BISHOP TORONTO CITY AIRPORT
INFRASTRUCTURE REQUIREMENTS

AUGUST 2015

AVIATION, AEROSPACE & DEFENSE

MARSH & McLENNAN COMPANIES

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Executive summary

- BBTCA currently offers flights on quiet Q400 turboprop aircraft to short-haul business destinations – a mission consistent with the airport's physical constraints and proximity to the heart of downtown Toronto
- Porter Airlines has proposed that jet operations be permitted at BBTCA, and that the runway be extended 200-meters into the water at both ends to accommodate CS100 jet operations
- The runway extension, as proposed, is too short to permit unrestricted CS100 jet operations on a consistent basis to the long-range markets anticipated, resulting in operations at reduced weights and passenger loads on summer days
- To accommodate the operation of CS100 and other jets likely to meet BBTCA noise limits, the runway must be extended at least 171 meters farther into the water than proposed. With the additional extension, the runway length would be 1,829 meters or 6,000 feet
- The proposed project is not being designed to meet new Transport Canada Aerodrome (5th ed) Standards, rather is still being designed to the older (4th ed) standards
- The cost estimate provided to date for Porter Airlines' proposed runway extension is $92 million. However, the total cost of the runway extension and associated airfield modifications along with other required infrastructure modifications, is likely to be up to ten times that figure, or as much as $1 billion
- Financing $1 billion in projects at an airport the size of BBTCA will fundamentally change BBTCA's operating economics – leading to greatly increased airport charges and/or a record high Airport Improvement Fee paid directly by passengers. No other airport the size of BBTCA has spent this much on infrastructure expansion
- Permitting jets to operate at BBTCA and to serve long-range markets from BBTCA will likely lead to a doubling of passenger use of the airport, as long-haul flights are added, short-haul flights are reduced, and total flights increase
- BBTCA's terminal and related infrastructure will need to approximately double in size to accommodate the large increase in passengers. To make room for this expansion, existing hangars and other facilities will need to be relocated to a planned new development site on the other side of the runway most likely reached via a tunnel under the runway
- Very few commercial airports around the world are as small as BBTCA. Those few airports typically permit the operation of small jets where the infrastructure is adequate, but nearly all flights at those airports are limited to destinations under 500 miles away

Introduction

- Oliver Wyman was commissioned by Air Canada to conduct an independent review of Porter Airlines' proposal to extend runway 8/26 at Billy Bishop Toronto City Airport (BBTCA) to permit the operation of jets at the airport
- This study addresses the following questions:
  - What infrastructure modifications are required to accommodate jet operations at BBTCA?
  - What is the likely cost of those modifications?
  - How does BBTCA compare with other similarly-situated airports around the world in terms of operations, infrastructure, and physical limitations?
  - What is BBTCA's role in Toronto's air transportation system?
- This study draws upon the work done in prior studies, professional expertise in airport planning, and Oliver Wyman's expertise in airline and airport issues. It is not intended to replace the detailed planning studies required as part of any major airport expansion project

Contents

1. BBTCA’s historic role in Toronto’s air transportation system and current operations
2. Porter Airlines’ runway extension proposal
3. Infrastructure changes needed to accommodate jets at BBTCA
4. Comparison of BBTCA with other similarly-situated airports around the world
5. BBTCA’s role in Toronto’s air transportation system
6. Conclusions

Section 1

BBTCA’s historic role in Toronto’s air transportation system and current operations

BBTCA was intended to serve as a small airport for quiet STOL (short takeoff and landing) flights near the heart of downtown Toronto

Occupying approximately 85 hectares, BBTCA is a small fraction of the size of conventional commercial service airports

- There are a few other commercial airports outside of North America similar in size to BBTCA (described in this report) and each has restricted flight operations and offers short-haul service
- In comparison, the smallest conventional commercial service airports in North American – New York LaGuardia, Washington National, Chicago Midway, and San Diego – range in size from 267 to 340 hectares. Even the smallest of these constrained urban airports has more than three times the area of BBTCA
- More typically, Toronto Pearson, with 1,867 hectares, covers 22 times the area of BBTCA; Vancouver (YVR), with 1,340 hectares, covers about 16 times the area of BBTCA
- The Canadian Government reports that it has set aside 5,200 hectares at the Pickering site for a future airport and commercial development

BBTCA – 85 hectares

San Diego – smallest US commercial airport >1 million passengers – 267 hectares

Even the smallest of these constrained urban airports in North America has more than three times the area of BBTCA

Note: BBTCA had over 2.4 million passengers in 2014; airport comparison excludes airports in remote communities in Alaska and elsewhere with very limited commercial service
Source: BBTCA Master Plan; airport websites; PortsToronto; Oliver Wyman analysis

BBTCA's physical limitations are the reason for its historical operating restrictions

Apart from its small size, BBTCA's other unusual physical limitations include:

- Close proximity to tall buildings
- Obstacles requiring a steep approach to runway 8/26
- Nearby marine operations
- Taxiway in close proximity to the runway
- Limited vehicle access
- Limited passenger transfer capacity between the Island and the mainland (now being addressed through the construction of a pedestrian tunnel)*

The 1983 Tripartite agreement between the Toronto Harbour Commission, the Government of Canada and the City of Toronto addressed the Airport's physical limitations and close proximity to downtown Toronto by:

- Imposing a noise limit and curfew
- Prohibiting jet operations
- Prohibiting any runway extension
- Limiting operations to turboprop aircraft capable of short takeoff and landing (STOL) operations

Source: BBTCA Master Plan; airport websites

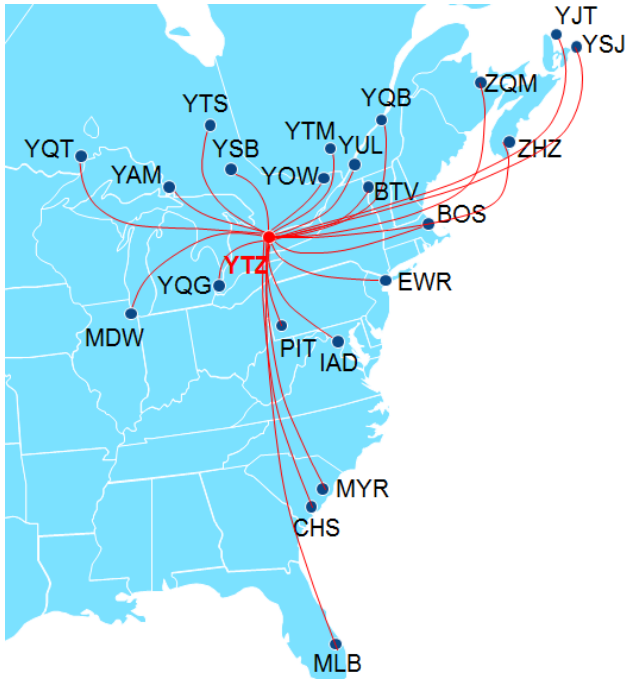
* New pedestrian tunnel opened 31 July 2015

To date, BBTCA has operated as a supplemental airport to Pearson providing convenient service between Toronto and short-haul destinations

BBTCA with over 20 destinations was not intended to serve, and is not equipped to serve, as a Pearson on the Lake, but as a supplemental airport.

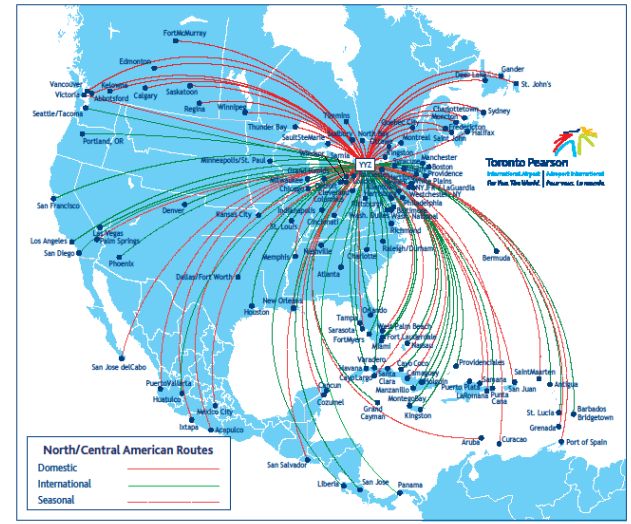
Pearson with approximately 173 destinations in June 2015 has airfield, terminal, and groundside infrastructure designed for long haul flights with larger aircraft.

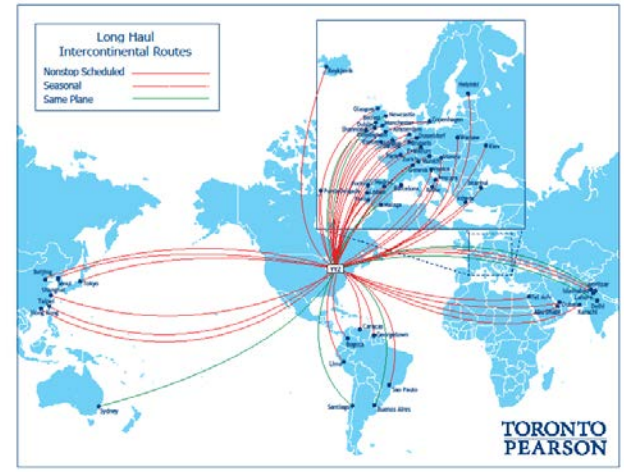
Billy Bishop current route network



Source: OAG schedules (PlaneStats.com); airport websites

Toronto Pearson route network – Top and bottom





Section 2 | Porter Airlines' runway extension proposal

Porter Airlines' runway extension proposal would lengthen the runway, permit jet operations, increase flights, and more than double passengers

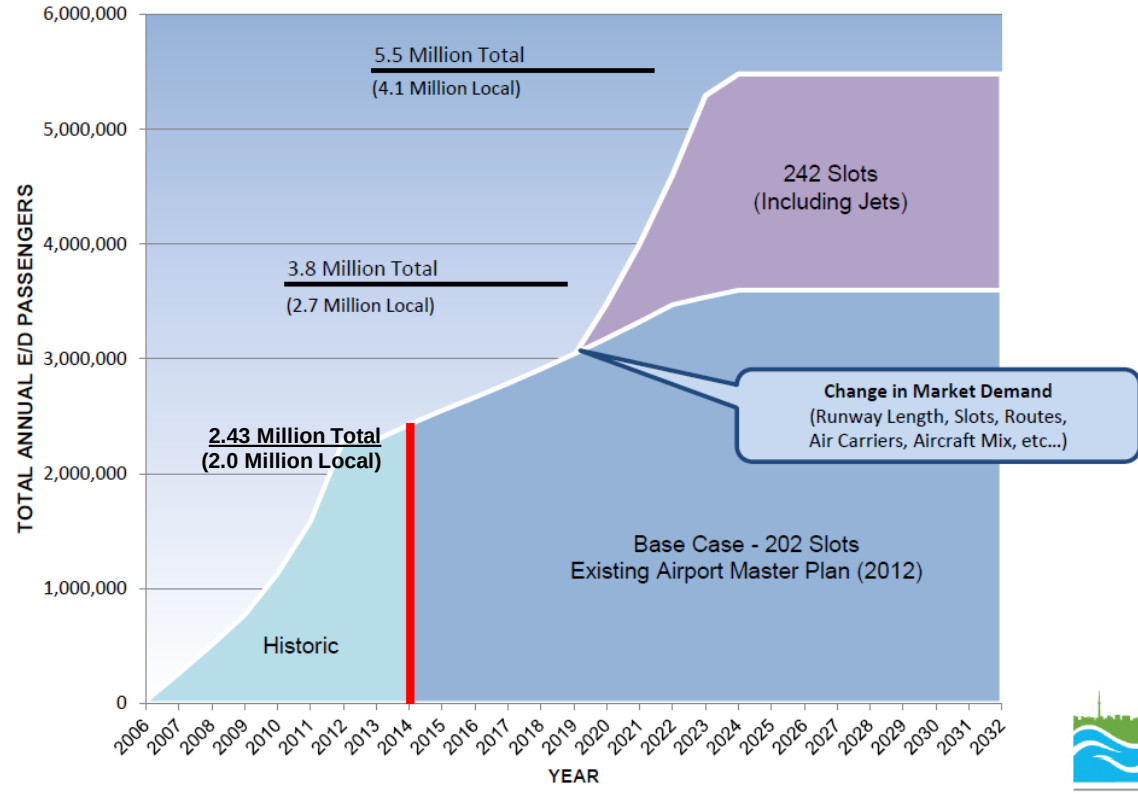
- In April 2013, Porter Airlines proposed to lengthen BBTCA primary runway 8/26 by 168 meters at both ends and to operate Bombardier CS100 jets at BBTCA
- In September 2013, Porter Airlines modified its proposal by requesting that the landmass for the runway extension be increased to 200 meters at both ends
- PortsToronto is currently conducting an environmental assessment of the proposal, which makes the following assumptions:

	2014	Permitted growth under 2012 master plan	Proposed growth with runway extension and jets	Change over 2014
Runway length (meters/feet))	1,216 m/3,990 ft	1,216 m/3,990 ft	1,658 m/5,441 ft[1]	442 meters including a change in overrun usage assumption within extended landmass
Daily commercial slots	202	202	242	40 daily slots (20 round trips)
Total passengers/year (millions)	2.43	3.8	5.5	3.1 million passengers
Total passengers/year excluding transfers (millions)	2.0	2.7	4.1	2.1 million passengers
Types of commercial aircraft	Q400	Q400	Q400, CS100 and other qualifying jets	CS100 and other qualifying jets

1. As reported in PortsToronto Environmental Assessment, prepared by AECOM, April 2015, p. 15, based on 200 meter land extension on either end

The introduction of jets at BBTCA is projected to result in more than double the current number of BBTCA passengers

PortsToronto master plan passenger projection



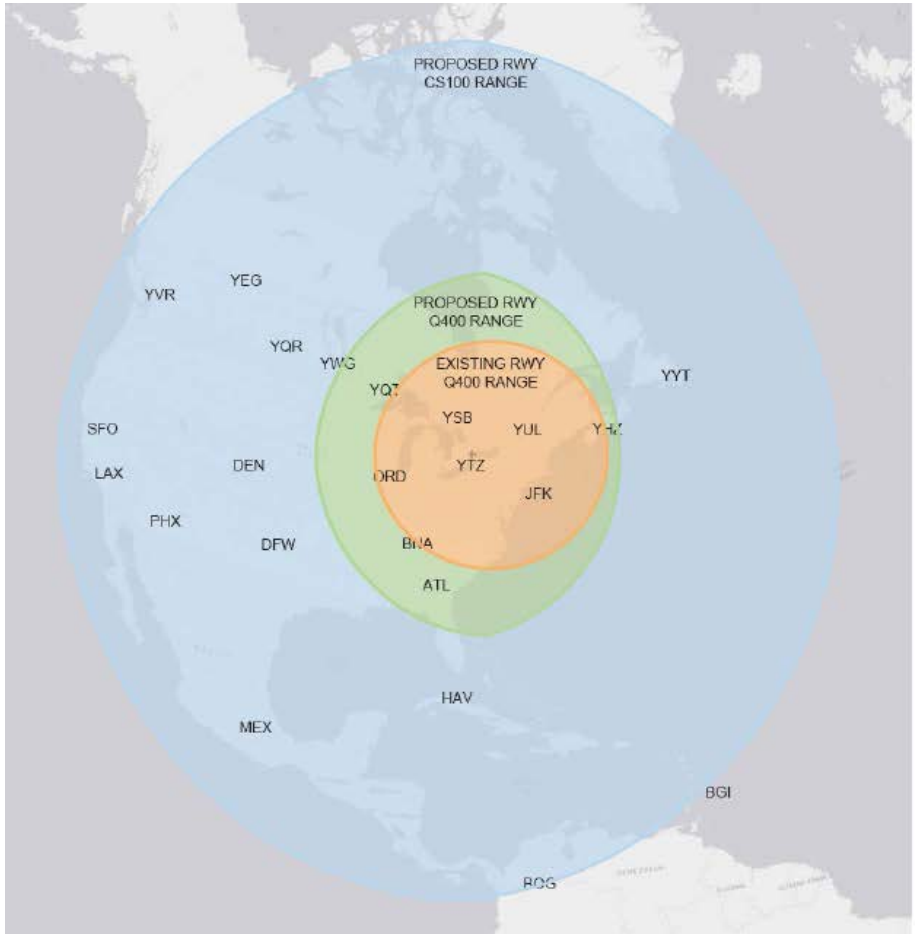
WSP

PORTS TORONTO
Master Planning Exercise
PROPOSED RUNWAY EXTENSION AND INTRODUCTION OF JETS AT BILLY BISHOP TORONTO CITY AIRPORT

Source: Proposed Runway Extension and Introduction of Jets at Billy Bishop Toronto City Airport, Master Planning Exercise and Public Engagement Open House, March 31, 2015

Current proposal's goal is to enable jets to serve long-haul routes from BBTCA, including Vancouver and Los Angeles

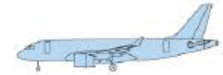
PortsToronto illustration of airports that could be served from BBTCA



Aircraft Range

Existing Runway - Q400 Range 646 Nautical Miles

Proposed Runway - Q400 Range 1,018 Nautical Miles



Proposed Runway - CS100 Range 2,312 Nautical Miles

Source: Proposed Runway Extension and Introduction of Jets at Billy Bishop Toronto City Airport, Master Planning Exercise and Public Engagement Open House, March 31, 2015

The current proposed plan does not include many infrastructure changes needed for jet operations

- Detailed information has not been provided about the specific elements and costs included in the proposed runway extension project[1,2,3]
- However, it appears that multiple essential project elements are not included and will need to be added to:
  a) Meet new safety area rules associated with new Transport Canada standards
  b) Meet runway/taxiway separation rules
  c) Provide required runway strength
  d) Expand the terminal to handle greater peak and non-peak passenger volumes
  e) Deal with lost or restricted aircraft parking positions
  f) Address inadequate curb frontage
  g) Address other congestion issues based on the projected passenger volume in comparison with the small airport size

1. Much of the information reviewed for this study was contained in the Airbiz Aviation Strategies Ltd., Porter Airlines Proposal Review, Final Report, 27 November 2013, pp. 7, 8, 14, 119
2. Additional information reference information used was from "Proposed Runway Extension and Introduction of Jets at Billy Bishop Toronto City Airport, Master Planning Exercise and Public Engagement Open House, March 31, 2015" and from Ports Toronto Environmental Assessment, prepared by AECOM, April 2015
3. More detailed information on the project, based on discussions with Ports Toronto, will not be available until late October 2015

The proposed runway extension – even the 200 meter landmass extension version – would not enable the CS100 to operate on an unrestricted basis

- The proposed runway extension is based on runway length requirements for the CS100 aircraft, which is still in testing. Those requirements are subject to change based on actual operating requirements
- Comparable small constrained urban airports such as New York LaGuardia, Washington National, Chicago Midway, and San Diego all have runway lengths of at least 1,981 meters (6,500 ft.) – more than 300 meters longer than Porter's proposed extended runway
- Based on the preliminary runway length requirements, the CS100 will not be able to operate on an unrestricted basis, but will face capacity and range restrictions depending on weather conditions

	Runway length (meters/feet)	**Longer than current BBTCA** (meters)	**Longer than proposed BBTCA** (meters)
BBTCA − Current	1,216 m/3,990 ft.	–	
BBTCA + 200 on both ends[1]	1,658 m/5,440 ft.	442	–
New York LaGuardia	2,134 m/7,000 ft.	918	476
Washington National	2,134 m/7,000 ft.	918	476
Chicago Midway	1,981m/6,500 ft.	765	323
San Diego	2,865 m/9,400 ft.	1,649	1,207

Source: Airports

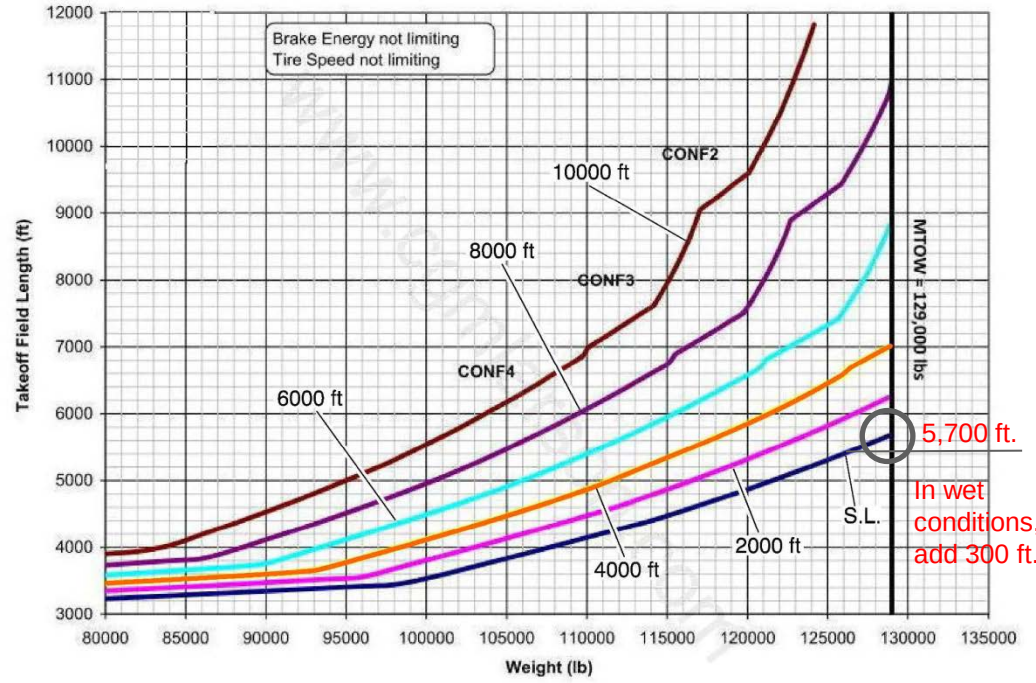
[1] The total proposed runway length of 1,658 meters/5,440 feet reflects intensified utilization of the existing landmass, so that the runway is actually 442m longer than existing vs what would initially appear to be only 400m of additional length

The proposed runway extension, in its current form, will not provide the Toronto community with a consistent level of jet service to longer-range markets

- The proposed runway length to accommodate the CS100 is approximately 5,400 ft.
- Based on preliminary information provided by Bombardier, the 5,400 ft. length would only be capable of accommodating the CS100 on a dry runway on a standard 15^0 C day
- Typical summer temperatures in Toronto average highs of around 30^0 C or more. At this temperature, the CS100 would need 5,700 ft. to take-off at maximum weight to reach Vancouver, LAX, and other destinations announced by Porter
- Weather statistics for Toronto show that in summer the runway may be wet up to 25% of the time due to rain. In wet conditions, the required runway length increases to around 6,000 ft. for take-offs at maximum weight
- The proposed 5,400 ft. runway would therefore limit take-off weights, through a combination of higher temperatures and wet runway, for possible unrestricted use in the range of 50% of the time during typical summer conditions

5,700 ft. take-off field length is required on summer day – even in dry conditions

ISA + 15^0 C (i.e. 30^0 C), no runway slope, dry conditions, no wind



Source: Airport Planning Publication, BD500-3AB48-12000-00 (CS100/300), Bombardier, 30 March 2012

The current proposal results in a useable landing length of only 4,500 ft., which is too short for the CS100 to land at maximum landing weight

- Under the current proposal, there is a displaced threshold on each end of the runway to accommodate approach surface clearances over the Marine Exclusion Zones. This means that the full length of the runway cannot be used for landings
- Because of the Marine Exclusion Zones, the useable landing runway length is 4,500 ft. in each direction. Steeper than normal approaches are also required
- While the CS100 only requires 4,500 ft. to land at maximum landing weight in dry runway conditions, it requires over 5,100 ft. on a wet runway
- Even though the aircraft will rarely be at maximum landing weight, the landing length required will still typically approach 5,000 ft. on a wet runway – 500 ft. more than the useable length of the extended runway
- Weather statistics for Toronto show that in summer the runway may be wet up to 25% of the time due to rain. In winter, the runway will often be contaminated with slow and slush, so designing for dry runway conditions would appear to be very shortsighted and limiting to operations
- As with takeoffs, the proposed runway configuration will not provide the Toronto community with a consistent level of jet service

Source: Airport Planning Publication, BD500-3AB48-12000-00 (CS100/300), Bombardier, 30 March 2012

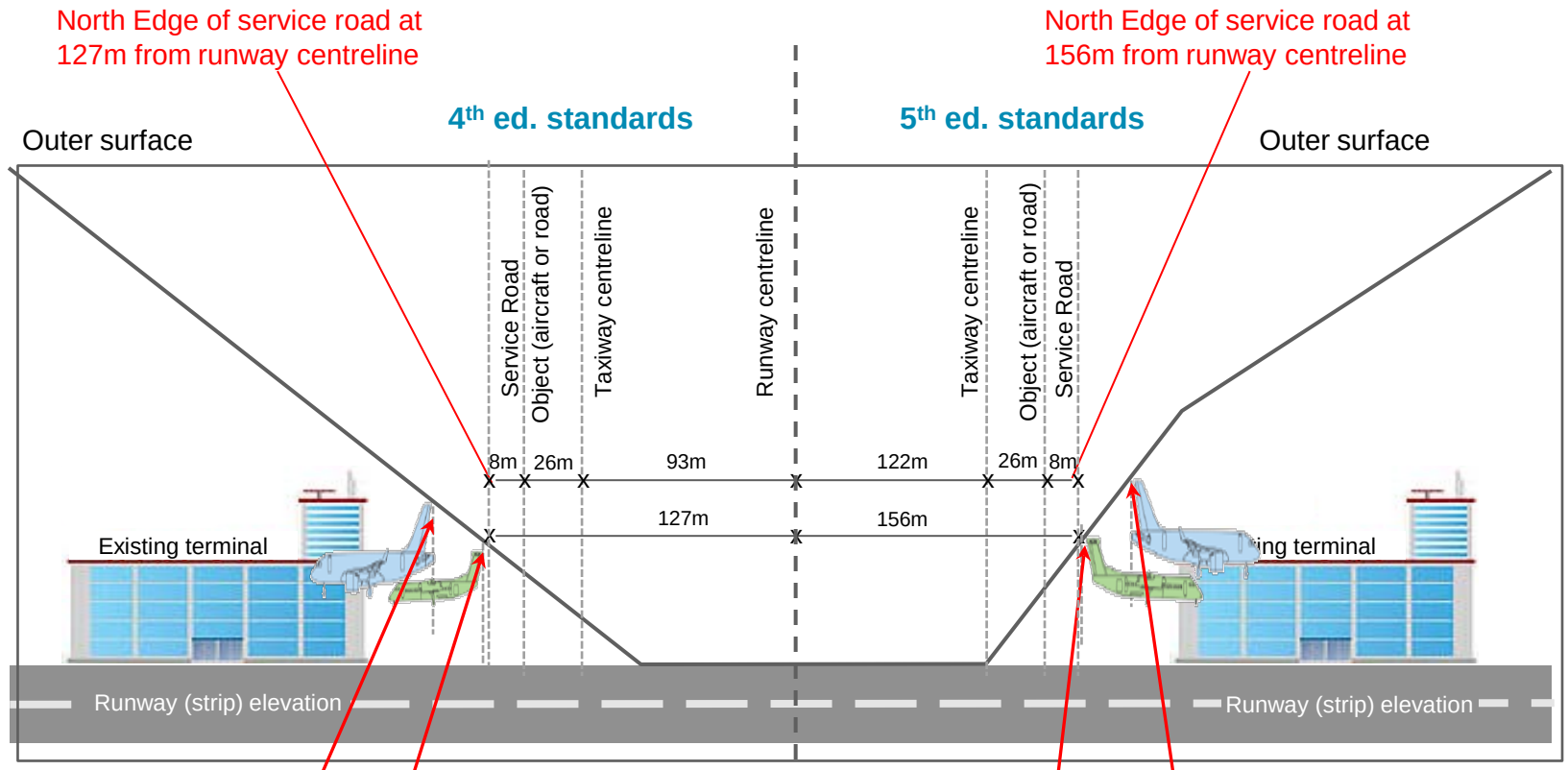
The current proposal will not meet new Transport Canada Aerodrome Standards that will apply to this project

- The proposed runway extension will not meet new Transport Canada standards just released and scheduled to take effect September 2015.
  - These new standards, will not affect existing airports as long they do not make any changes to the airport's classification or to its airfield facilities[1]
- Important changes in the requirements applicable to new projects such as this include the following:
  - Wider runway strip
  - Wider runway safety area
  - Greater runway to taxiway separation
  - Departure surface requirements
- Implementation of the new standards will have the following effects[2]:
  - Increasing width of fill for extension into the water
  - Eliminating aircraft along south side of terminal
  - Requirement for a departure surface forces Marine Exclusion Zone to grow significantly in distance from end of runway
- There are additional implications generally less severe than the above

	4th edition Code 3C NP	5th edition AGN IIIB NP
Runway Strip	75m	122m
Graded Strip/Runway Safety Area	45m	75m
Runway to taxiway separation	93m	122m
Obstacle Limitation Surfaces		
Approach surface - width	150m	244m
Approach Surface - divergence	15%	15%
Approach surface – slope – 1st sec	2.5%	2.5%
Approach surface – slope – 2nd sec	2.5%	2.9%
Departure surface - width	n.a.	75m
Departure surface - divergence	n.a.	15%
Departure surface - slope	n.a.	2.5%
Transitional surface – 1st section	7 : 1	4 : 1
Transitional surface – 2nd section	7 : 1	7 : 1

Notes:
1. Transport Canada just released the 5th edition of TP312 Standards ~~on~~ 31 July 2015, to be effective 15 September 2015. With this released, any new changes to the airport will need to conform to these new standards. There will be a phase in/grace period for current projects underway that will allow these "started" projects to continue per the 4th edition standards.. However, these projects will need to have construction award within 12 months of release of the 5th edition and construction completed within 24 months of release. This project (as assessed by Oliver Wyman) would therefore not be expected to qualify for exemption under this phase-in/grace period as the timelines will need to be much longer than this given the complexities of the runway extension works. Though based on discussions with Ports Toronto, they indicate that they have the appropriate agreements with Transport Canada to complete the project under the TP312 4th edition standards.
2. The Q400 and the CS100 under 4th ed. are both Code C aircraft. Under the 4th ed. the runway for the Q400 & CS100 would be designated as a Code 3C non-precision runway, though the Q400 is currently operating under 2C at YTZ. Under the 5th ed., the Q400 and CS100 would now be AGN IIIB aircraft. The runway under 5th ed. would still be a non-precision runway, but a number of the design parameters would be quite different than in the 4th ed. case as illustrated in the table, and these are all much more demanding for the 5th edition.

Illustration of impact of new standards – Wider protection areas for runway/taxiway mean that the taxiway, service road, and aircraft must be farther from the runway centerline



CS100 tail at 158m from CL
Aircraft does NOT fit on south side of terminal

Q400 tail at 134m from CL
Aircraft OK

CS100 tail at 169m from CL
Aircraft does NOT fit on south side

Q400 tail at 156m from CL
Aircraft does NOT fit on south side

Source: 4th and 5th editions of TC TP312 Standards

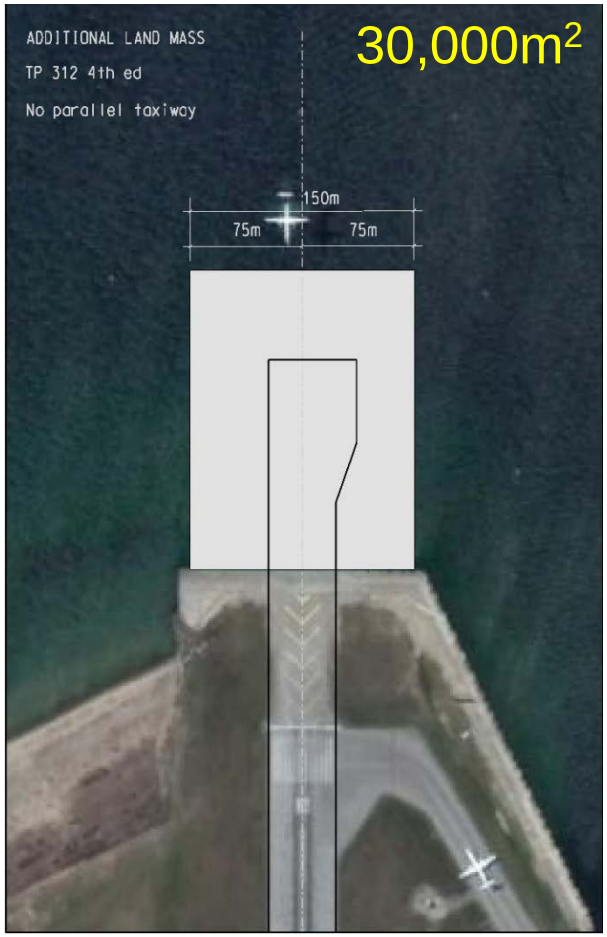
Illustration of impact of new standards – New standards mean that neither the Q400 nor the CS100 will be able to park on the south side of the terminal

Current 4th ed. standards

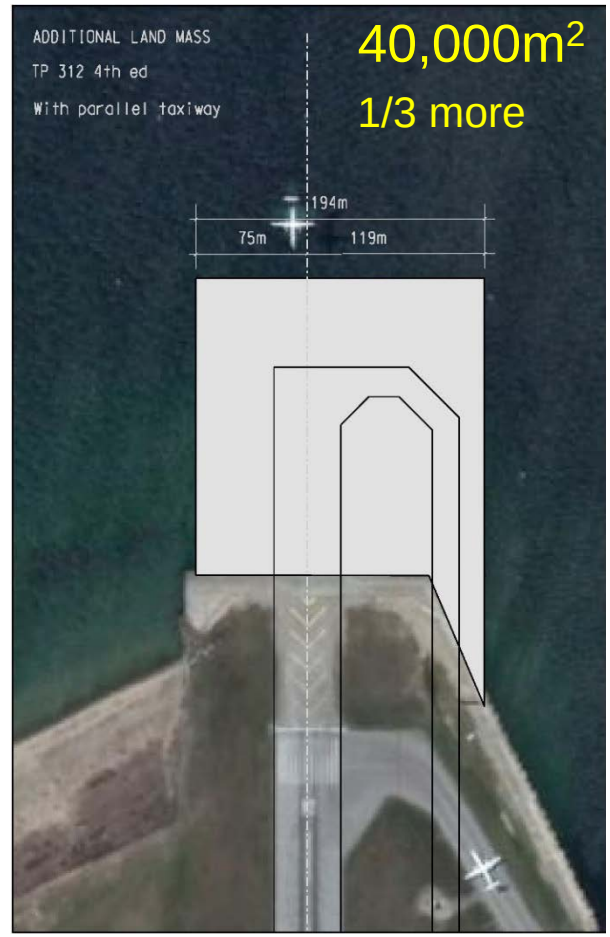
New 5th ed. standards

Illustration of impact of new standards – New standards mean that much wider lake fill will be required

The Current Proposal – Current 4th ed. standards



The Current Proposal with taxiway recommended by Airbiz – Current 4th ed. standards



New 5th ed. standards

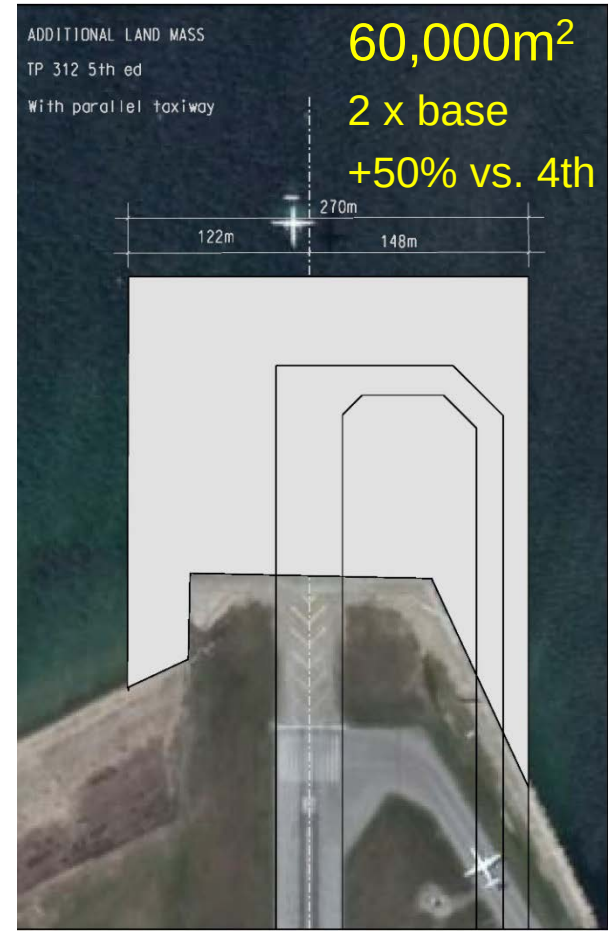
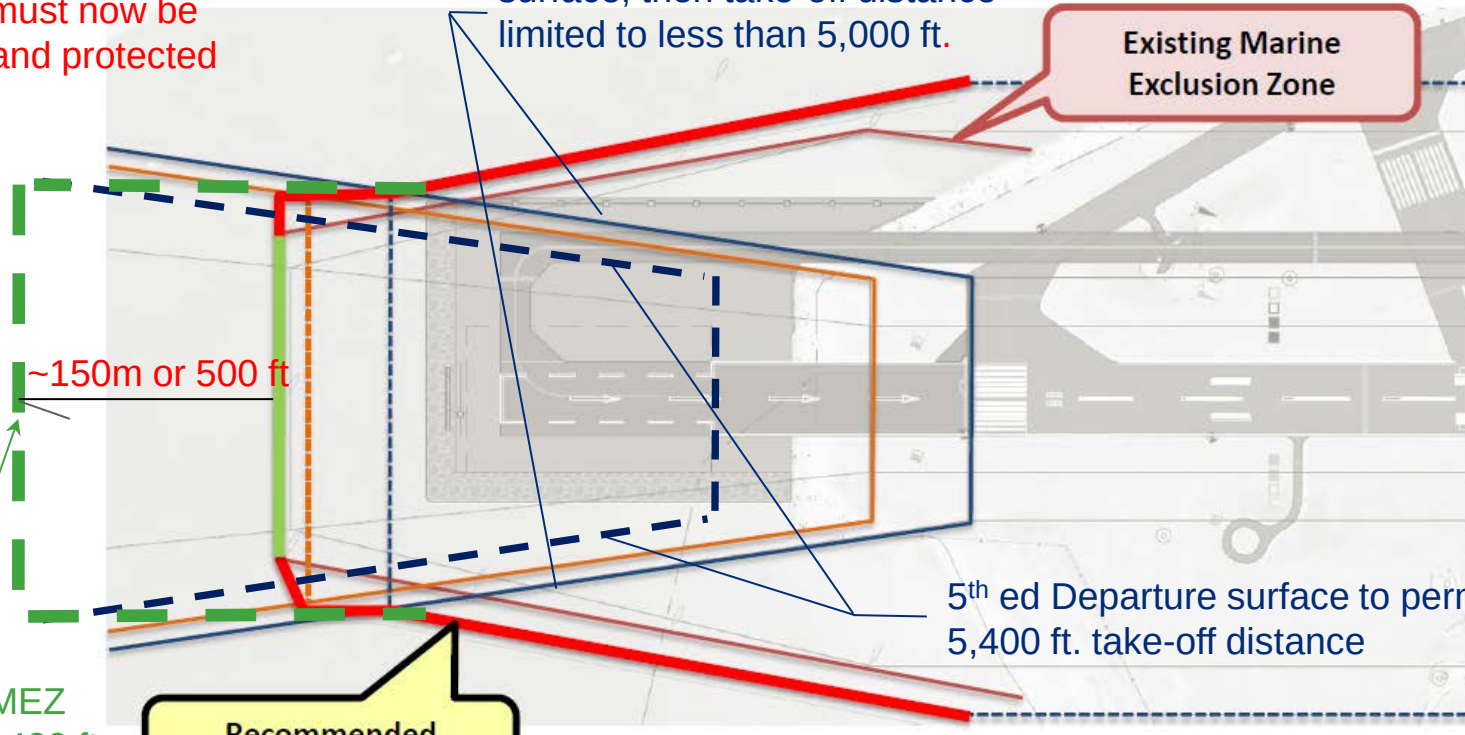


Illustration of impact of new standards – New standards mean that Marine Exclusion Zone for Runway 08 will need to be extended about 150 meters

Proposed Marine exclusion zone

Per TP312 5th ed, Departure surfaces must now be declared and protected

If this is declared Departure surface, then take-off distance limited to less than 5,000 ft.



PORTS TORONTO
Master Planning Exercise

Source: Proposed Runway Extension and Introduction of Jets at Billy Bishop Toronto City Airport, Master Planning Exercise and Public Engagement Open House, March 31, 2015

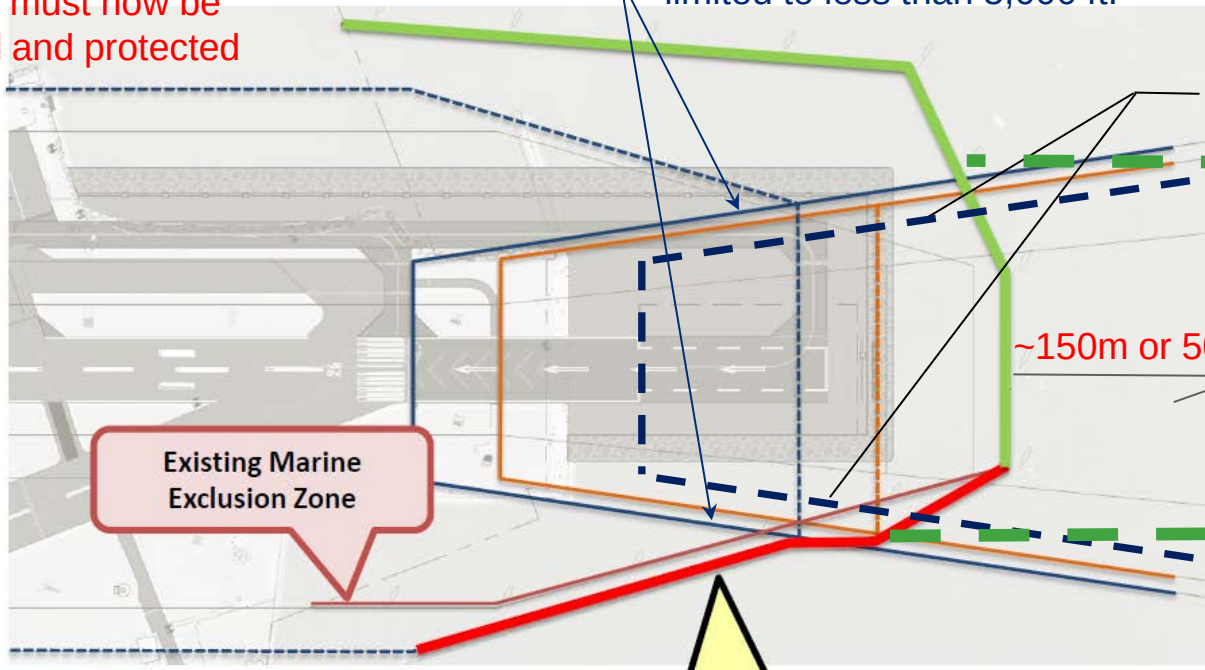
Illustration of impact of new standards – New standards mean that Marine Exclusion Zone for Runway 26 will need to be extended about 150 meters

Marine Exclusion Zone (Runway 26)

Per TP312 5th ed, Departure surfaces must now be declared and protected

If this is declared Departure surface, then take-off distance limited to less than 5,000 ft.

5th ed Departure surface to permit 5,400 ft. take-off distance



PORTS TORONTO
Master Planning Exercise

Source: Proposed Runway Extension and Introduction of Jets at Billy Bishop Toronto City Airport, Master Planning Exercise and Public Engagement Open House, March 31, 2015

The current airfield pavement does not meet the weight requirements for jets

BBTCA has not released any information about the cost of upgrading current airfield pavements to handle the weight of jets.

Technical details are as follows:

- The current airfield pavements are rated at PCN[1] 11 according to information provided in (Airport Master Plan 2014, WSP, updated July 2014)
- The Q400 is rated at ACN[2] 16 at maximum weight, though due to the runway length, all operations are at much lower weights (probably in the range of ACN 13–14, which is still overloading existing pavements, but only marginally)
- No pavement information has been released to date about the CS100, but based on aircraft of similar size and weights like the E190/195, A318, and B717, expectations are that the CS100 would be rated around ACN 27-30 +/- *
- The current pavements appear to be in need of repair
- These pavements will also need to be strengthened to accommodate the CS100; this might be accomplished by a 75–100 mm (3”–4”) overlay, which must be considered in the overall costing of the runway extension project

Aircraft Classification Number (ACN) for select aircraft

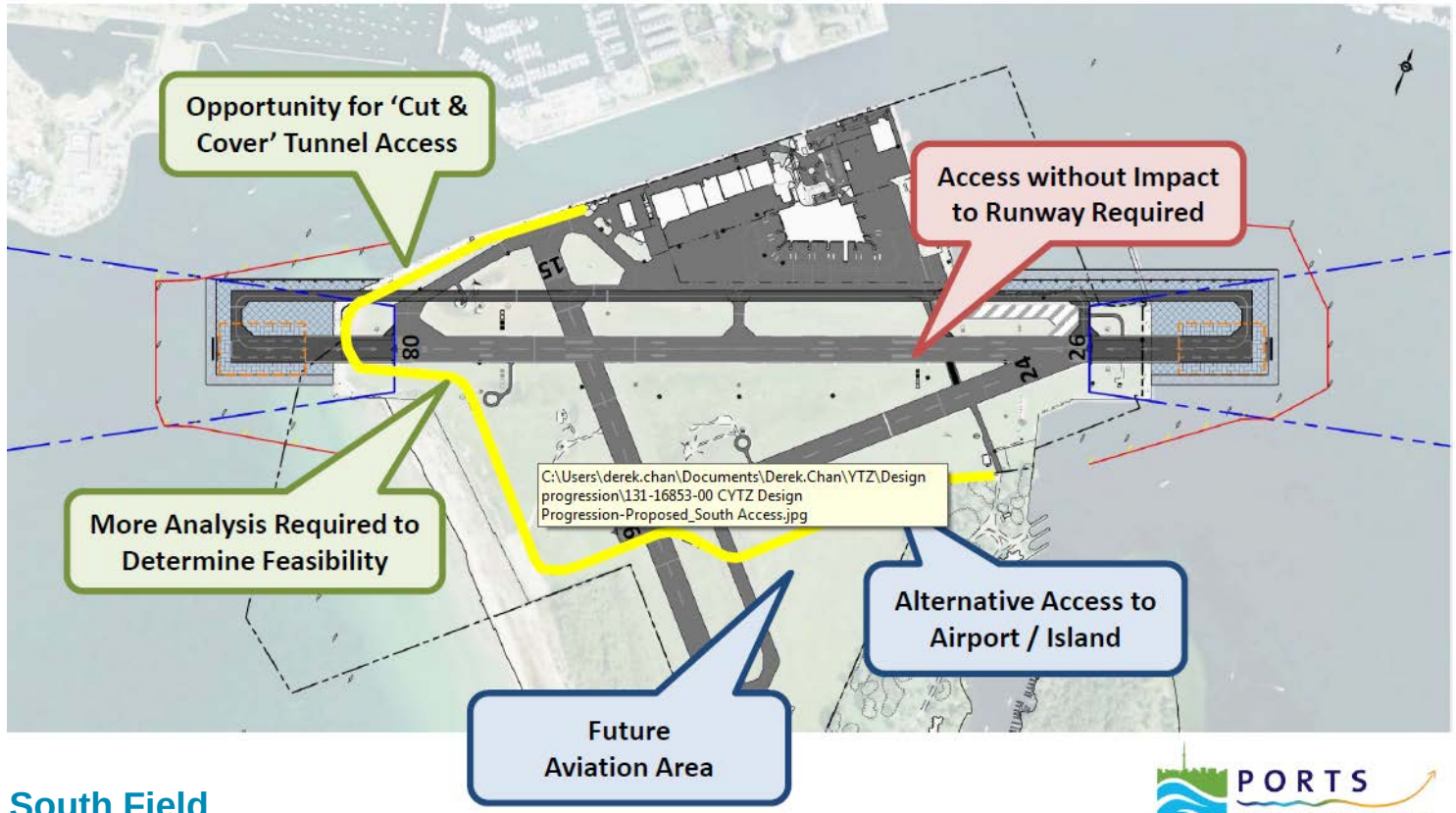
			Flexible pavement subgrade CBR (%)			
			High	Med.	Low	Very low
			A	B	C	D
Aircraft	Maximum weight (kg)	Tire pressure	15	10	6	3
Embraer 190/195	49,000	1.1	28	30	33	35
B717–100, 200, 300	55,000	1.1	32	34	38	40
A318–100	62,000	0.9	29	31	35	41
CS100[3]	53,324	1.3	26.7	27.3	30	35
	60,535	1.3	29.5	30.2*	33.6	38.7

For Soil Conditions at BBTCA

Source: Aircraft Classification Numbers (ACN’s), Transport Canada, Technical Evaluation engineering, Ottawa, Ontario, Canada, July 2001.

1. Pavement Classification Number (rating used in aviation to indicate strength of pavement)
2. Aircraft Classification Number (rating used in aviation to classify aircraft into categories of pavement strength required – ACN should be lower than PCN otherwise aircraft overloads pavement
3. CS100 ACN data obtained from Bombardier publication BD500-3AB48-22000-00 Issue No. 002

Because of the need to expand the terminal and meet new Transport Canada standards, some facilities will need to be relocated to South Field, a planned new aviation area at the south end of the Island



Access to South Field

PORTS TORONTO
Master Planning Exercise

To avoid frequent runway crossings, a vehicular under-pass or tunnel providing access to the new aviation area will likely be required

Source: Proposed Runway Extension and Introduction of Jets at Billy Bishop Toronto City Airport, Master Planning Exercise and Public Engagement Open House, March 31, 2015

Additional issues with respect to the new TP312 5th edition standards could increase the project costs even further

- Given the larger required runway-taxiway separations, NO aircraft would fit along the south side of the current terminal
  - To accommodate the increase in traffic, it may be necessary abandon the current runway and completely rebuild it further to the south
  - This action would alleviate the potential aircraft parking restriction on the south side of the terminal
- Likewise, the addition of jet operations could require approach lighting for each end of the runway
  - It has been acceptable to date to NOT have approach lighting extending out into the water for the Q400 operations, but the inclusion of jets results in higher approach speeds
  - With Toronto's notoriously bad winter conditions, as well as poor weather conditions associated with summer rain storms, it will be important to consider appropriate runway approach lights in the project

The actual cost of the proposed runway extension will be much higher than the initial estimate, as much as 10 times larger

- The cost estimate for the proposed runway extension, as provided in the project review by Airbiz* commissioned by the City of Toronto, is $92 million on an order-of-magnitude basis for the 200m landmass extension at each end.
- This figure does not include multiple essential project elements which must be added as well as the impacts of the new Transport Canada standards. On an order of magnitude basis, the missing and revised project components are estimated as follows:

	Project element	Estimated cost ($MM)[2]
1	Base cost of extension per Airbiz report[1]	$100
2	Additional cost of landmass due to new standards and parallel taxiway	$100
3	Additional cost of landmass to extend to 1,830m (6,000 ft.) runway	$ 50
4	Rehab of existing pavements and strengthening for CS100	$20+
5	Terminal expansion to handle extra 2–3 MM annual pax.	$100
6	Terminal replacement to deal with 5th edition standards	$50+
7	New vehicle tunnel to access areas south of runway	$300+
8	Cost to relocate existing north side hangars to south side	$60+
9	Access and roadway changes for parking, taxis, buses, ..	$100
10	Additional utilities, power, sewer, etc.	$50+
11	Potential costs of completely rebuilding the runway to move it further to the south	$50+
12	Approach lighting system on each end of the runway	$10+
	TOTAL estimate	**$1,000+/-**

- With the Tripartite Agreement expiring in 2033, it would be very expensive to amortize the investment over the remaining term

This is not a $ 100 MM project, but closer to $1 BN project once everything is done

1. Airbiz Aviation Strategies Ltd., Porter Airlines Proposal Review, Final Report, 27 November 2013, p. 119. See also pp. 7, 8, 14
2. Source of estimates provided by Bianconi & Associates – Airport Planners

Assumptions with respect to cost estimates

	Project element	Estimated cost ($MM)[2]
1	Base cost of extension per Airbiz report[1] adjusted for inflation and rounded up to	$100
2	Additional landmass: New landmass to meet new 5th ed standards and parallel taxiway is double the width of original landmass, so additional assumed to cost same as original	$100
3	Additional landmass for 1,830m (6,000 ft.) runway: This requires further 170m extension in total and assumes deeper water further out.	$ 50
4	Rehabilitation of existing pavements and strengthening for CS100: Rough order of magnitude (ROM) based on past similar projects and accounting for higher costs of working on the island	$20+
5	Terminal expansion: Existing terminal about 15,000m^2 handling 3M pax. This is utilization rate of 500m^2/M passengers is very high utilization (compared to industry benchmark of 10,000m^2/M passengers for mixed domestic/international terminals). Assume additional terminal facilities required in range of 15,000+m^2 to handle growth, to cost in range of $6,000+/$m^2$ (based on current costs at YVR)	$100
6	Terminal replacement to deal with 5th edition standards: Assumption that up to half of existing terminal may need to be removed to meet 5th ed standards to park aircraft along south side (unless exemptions obtained)	$50+
7	New vehicle tunnel to access areas south of runway: Existing tunnel cost nearly $100 MM and is approximately 200m in length. New tunnel under runway would need to be minimum 500m to get under runway/taxiway or up to 700m if started on mainland. A similar tunnel (about 700m at YVR recently estimated to costs $400 MM), so this $300 MM may be very conservative	$300+
8	Cost to relocate existing north side hangars to south side: Very rough cost based on 15,000m^2 x hangar cost of $2,000/$m^2$ x 2 to account for aprons, access, groundside, services, etc.	$60+
9	Public parking and access and roadway changes, taxis, buses, etc.: Expansion will require at least 1,000 parking spaces (at $50,000/space for structured parking, so at least $50 MM required). This is probably quite conservative.as more spaces likely will be required to replace ones to be lost on island due terminal expansion. Add in roadway changes, land acquisition, etc. and this figure would be in ballpark	$100+
10	Additional utilities, power, sewer, etc.: ROM based on past experience	$50+
11	Completely rebuild runway and move to the south - ROM based on past experience	$50+
12	Runway approach lighting on each - ROM based on past experience	$10+

1. Airbiz Aviation Strategies Ltd., Porter Airlines Proposal Review, Final Report, 27 November 2013, p. 119. See also pp. 7, 8, 14
2. Source of estimates provided by Bianconi & Associates – Airport Planners

Section 3

Infrastructure changes needed to accommodate jets at BBTCA

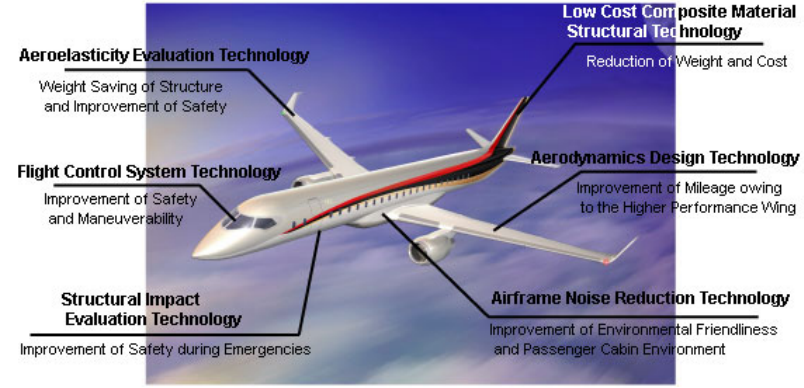
Any assessment of future jet operations should include other jets besides the CS100

- Bombardier's CS100 quiet operating performance is largely the result of incorporating Pratt & Whitney's new very high-bypass geared turbofan engines
- The same engine technology is also being incorporated on other new jets, including:
  - Mitsubishi MRJ70 and MRJ90 Regional Jets
  - Embraer's re-engined EMB175, 190 and 195 E2-Jets
  - Airbus A319neo, A320neo, and A 321neo Jets
  - Sukhoi Superjet 130 Jets
- The Boeing 737MAX, the next generation Boeing narrowbody aircraft, will also generate much less noise, largely as a result of incorporating CFM International's new LEAP technology engines
- Many of these next generation aircraft are expected to meet BBTCA's noise restrictions, and will be in service throughout North America
- Runway length requirements for these newer, quieter jets will generally be similar to the CS100 for those of similar size, i.e. around 6,000 ft.
- Larger, heavier versions (like the CS300, A320neo, 737MAX) will generally require up to 8,000 ft. at max weight, though they could operate at reduced weights and in a more regional service

Examples: Other small jets likely to meet BBTCA's noise restrictions

Embraer E-Jet E2 family

Mitsubishi MRJ



Note: Airbiz Aviation Strategies Ltd., Porter Airlines Proposal Review, Final Report, 27 November 2013

Designing a multi-hundred million dollar runway extension with only one jet aircraft in mind, ordered by one airline operating at BBTCA, does not maximize public benefits

- By the time the runway extension is completed, other airlines will seek to serve BBTCA using other types of quiet jets in their fleets
- For example, both WestJet and Air Canada have ordered the 737 MAX which will incorporate new quiet engine technology
  - WestJet has ordered 65 of the MAX 7 and 8
  - Air Canada has ordered 61 of the MAX 8 and 9, and needs to replace its 319s and E190s with newer technology aircraft similar to the CS100/E2/MRJ
- Sky Regional, the Air Canada affiliate that currently operates at BBTCA, currently operates both Q400s and EMB-175s, making it a prime candidate to order the quiet next generation version of that aircraft
- Most major US airline fleets will include aircraft that comply with BBTCA's noise restrictions
  - SkyWest has ordered 100 +100 options of the MRJ and should show up in United and Delta services
  - SkyWest has also ordered 100 E2-175s which will also show up in these same carriers regional services
- To maximize public benefit, any runway extension should be designed to accommodate quiet jets likely to be used by other carriers

Relying on a single carrier is a highly risky strategy for any major airport infrastructure investment

- Airports which serve as the hub for a single airline have experienced substantial declines in passengers, and smaller hub airports have been most at risk:

Airport	Primary airline during decline	Initial year	Initial year passengers	2013 Passengers	Change
Cincinnati	Delta	2007	15,424,882	5,511,538	-64%
Pittsburgh	US Airways	2000	17,146,314	7,577,022	-64%
St. Louis	TWA	2000	29,892,806	12,272,304	-59%
Memphis	Delta	2007	11,049,410	4,583,392	-59%
Islip	Southwest	2007	2,330,120	1,321,360	-43%
Colorado Springs	Frontier	2007	2,050,968	1,291,826	-37%

The economics of this infrastructure project are daunting and unprecedented

- Our research has found no other airport of BBTCA's passenger volume that has undertaken a $1 billion infrastructure project
- The investment is even more problematic in view of BBTCA's already extremely high airline user fees
- Although no financial feasibility information has been provided, basic financial math raises serious questions that need to be further explored. A detailed financial feasibility is required, as it appears the result will be record-high airport charges and Airport Improvement Fund (AIF) fees
- For example, using rough numbers, annual debt service and operating/maintenance costs for $1 billion in infrastructure are likely to be in the range of $100 million annually
  - In 2014, BBTCA handled approximately 2.4 million passengers. With the runway extension and related infrastructure, BBTCA is expected to grow to 5.5 million annual passengers
  - Dividing $100 million by 5.5 million passengers means that the cost of using the airport for each arriving and departing passenger would increase by $18 beyond BBTCA's current high charges. That **incremental** figure exceeds the **total** airport charge levels for nearly all airports in North America
  - Dividing $100 million by 3.1 million passengers – the incremental number of passengers this new infrastructure would accommodate – means that the cost of providing the infrastructure for those incremental passengers would be nearly $32 for each arriving and departing passenger
  - Alternatively, the BBTCA AIF, currently set at $20 per passenger, could rise by $15–20 to the highest in Canada
  - Average one-way Toronto domestic ticket prices in the range of $206[1] are not compatible with airport charges at these high levels

1. Statistics Canada, average domestic airfares, Toronto enplanements, 2nd quarter 2014

Section 4

Comparison of BBTCA with other similarly-situated airports around the world

Other very small commercial airports around the world – comparing BBTCA with London City, Bromma-Stockholm, and Belfast City

- Several small commercial airports comparable in size to BBTCA and located in Europe permit commercial jet operations
- In each case, short runways, noise emissions, and operating restrictions limit the vast majority of flights to turboprops and small jets serving airports within about 500 miles
- None of these airports serves as the primary airport for the region, and none serves long-haul destinations

Airport	Operating restrictions	Typical aircraft	Destinations served	Annual passengers	Runway length (meters)	Distance to city center	Passenger focus
Billy Bishop	Noise emission limit and noise based movement limit; limited to turboprops	Q400 turboprops	Within about 500 miles	2.43 MM	1,216	< 3 km to Toronto CC	Business
Belfast City	Annual movement and seat caps	Turboprops and small/med jets incl: ERJ-175/195, A319/A320	Within about 500 miles	2.5 MM	1,829	5 km to Belfast CC	Business
Bromma – Stockholm	Movement cap, incl. number of operations with > 60 seats, noise limits, limited operating hours	Turboprops and small jets incl: Avro RJ75/RJ100	Within about 500 miles	2.4 MM	1,600	8 km to Stockholm CC	Business
London City	Movement limits per hour based on day and time, noise category of aircraft	Turboprops and small jets incl: Avro RJ85/100, EMB 170/190	Within about 500 miles	3.65 MM	1,500	11 km to London; closer to Canary Wharf	Business

Sources: Airport and UK websites, OAG airline schedules, Google maps

Comparing BBTCA to other very small commercial airports around the world – Chicago Meigs Field, now closed

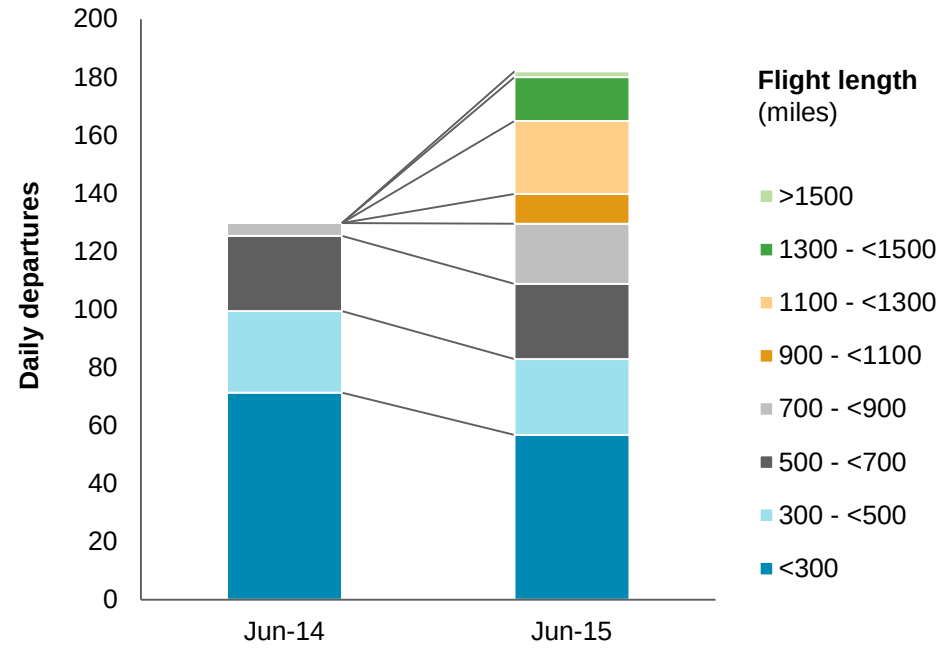
- Meigs Field, located on a manmade island adjacent to downtown Chicago, was the busiest single runway airport in the US in 1955
- The airport had regional scheduled service on turboprop aircraft up to 44 seats
- At 1,189 meters (3,900 ft.), Meigs' runway was nearly the same length as at BBTCA
- In a controversial move, the Mayor determined that the airport was too close to downtown for safe operations, closed the airport and converted it to parkland
- The City of Chicago continues to be served by two much larger airports – Chicago O'Hare and Chicago Midway

Note: "Meigs field USGS 2002" by United States Geological Survey (USGS)

The impact of introducing jets at BBTCA – lessons from Dallas love field

- For many years, Dallas Love Field, located close to downtown Dallas, Texas was restricted to short-haul flights
- As of October 2014, long-haul fights were permitted
- Total airport gates remained limited to 20 gates
- From June 2014 to June 2015:
  - Daily departures increased 40% from 130 to 182
  - Daily seats increased 49% from 16,808 to 25,066
  - Passengers increased 56% from 745,869 in April 2014 to 1,162,898 in April 2015 (latest data available)
  - The percentage of flights from the airport longer than 500 miles increased from 23% to 55%
- Dallas Love Field was able to handle this growth because it has an area of 530 hectares (over 6 times the area of BBTCA) and 2 runways 2,347 and 2,683 meters long. The terminal is 5 times the size of the current BBTCA terminal

Daily departures from Dallas Love Field by flight length (miles)



Permitting jets to operate at BBTCA will greatly increase passenger numbers, and convert BBTCA to a long-haul airport, with fewer flights to close-in destinations

Sources: OAG airline schedules, Dallas Love Field passenger statistics

Section 5 | BBTCA's role in Toronto's air transportation system

BBTCA offers short-haul flights on smaller aircraft to important business markets – consistent with its physical limitations, small size, and proximity to downtown Toronto

Source: OAG schedules for August 2015

BBTCA capabilities are supplemented by Toronto Pearson, which has full capabilities for longer-haul domestic and international flights

In June 2015, Toronto Pearson had flights to the following destinations…

Abbotsford	Cayo Coco	Ft. McMurray
Abu Dhabi	Cayo Largo Del S	Gander
Addis Ababa	Charlotte	George Town
Amsterdam	Charlottetown	Georgetown
Antigua	Chicago O'Hare	Glasgow
Aruba	Cienfuegos	Grand Cayman
Athens	Cincinnati	Grenada
Atlanta	Cleveland	Halifax
Atlantic City	Columbus	Harrisburg
Austin	Copenhagen	Hartford
Baltimore	Curacao	Havana
Barbados	Dallas/Ft Worth	Helsinki
Barcelona	Deer Lake	Holguin
Beijing	Denver	Hong Kong
Bermuda	Detroit	Houston
Birmingham	Dubai	Indianapolis
Bogota	Dublin	Islamabad
Boston	Edinburgh	Istanbul
Brussels	Edmonton	Jeddah
Budapest	Fort Myers	Kansas City
Cairo	Frankfurt	Karachi
Calgary	Fredericton	Kelowna
Camaguey	Freeport	Kingston
Cancun	Ft. Lauderdale	Lahore

….and 100 other destinations

Source: OAG schedules for June 2015

New Union Station-Pearson Express provides quick access to/from downtown Toronto for long-haul travelers

- The 25-minute UP Express ride provides excellent access to/from downtown Toronto for long-haul travelers
- Toronto travelers have the best access to air service of any major city in North America, with short-haul flights from BBTCA and both short-haul and long-haul flights from Pearson only 25 minutes away by rail

Other major North American cities compared with Toronto – in terms of single-train fast airport access from the city center

Rank	City	2010 population (MM)	Comparable train access from center city
1	Mexico City	21.2	NO
2	New York	19.1	NO
3	Los Angeles	12.8	NO
4	Chicago	9.5	Train takes approximately 45 minutes with about 20 stops
5	Dallas-Fort Worth	6.4	NO
6	Philadelphia	6.0	Yes, but departs only every 30 minutes
7	Houston	5.9	NO
8	Toronto	5.6	**Yes**
9	Washington	5.6	NO to IAD, which has full range of international flights; yes to DCA which has flight range limits and no border control capabilities
10	Miami	5.6	NO

Source: US Census, airport and rail websites, other city websites

BBTCA is not physically capable of serving as a Pearson on the lake – It cannot and need not become a full service airport

- An 85-hectare airport surrounded by marine operations and located less than 3 km from the heart of one of North America's largest cities cannot serve as a full-service airport
- The few other commercial airports of similar size (none of which are located in North America) have various restrictions and are limited almost entirely to operations within a 500-mile range
- Fortunately, there is no need for BBTCA to serve as a full-service airport. Pearson already serves that role and is easily accessible by UP Express from the heart of downtown Toronto. When demand warrants, the Pickering site could also serve that role

Section 6 | Conclusions

Conclusions

- The proposed runway extension project does not include the related infrastructure additions and costs which will be required to support the additional flights and passengers envisioned
- If the decision is to make BBTCA a long-haul, jet capable airport, it should be designed and built to the latest Transport Canada Standards (TP312 5th edition) rather than 4th edition standards to afford the highest level of operational safety for the airport
- Key proposed changes to the plan should include the following:
  - Incorporate a 1829m (6000 ft) runway capable of providing reliable year round service to the destinations proposed. This runway could be constructed to the south of the existing runway to meet the latest runway/taxiway separation and pavement thickness standards
  - Convert the existing runway to a parallel taxiway. This taxiway conversion/new runway combination would be much easier to build and would provide sufficient space for associated terminal development to the north of this system
  - Consider runway approach lighting to provide a higher level of reliability for approaches and to give pilots better guidance during poor weather conditions
  - With the proposed changes, passenger volumes will more than double in 10 years to 5.5 million, driving other infrastructure changes (terminal expansion for additional gates and passenger holding areas, parking and other related changes)
    - Increasing the terminal footprint will necessitate relocation of existing airport infrastructure south of the runway
  - The estimated cost of the runway extension along with related infrastructure required could approach $1B


OLIVER WYMAN