BOEING 737-600/700/800/900

The Boeing 737NG (Next Generation) series is the most recent upgrade of this aircraft family which was first delivered in 1997 and has since sold almost 5,000 aircraft. With seating capacity ranging from 108 (-600 model) to over 200 seats (-900 model), the ability of this aircraft to operate to the BBTCA varies broadly based on the model, engine application, payload and destination.

The Next Generation series does not meet the noise levels established within the Tripartite Agreement, but the proposed re-engined model (Boeing 737max) using the geared turbofan technology may be able to meet these standards once it enters service in approximately 2017. Boeing is not currently planning a B737max-6 with the B737max-7 is scheduled to be the smallest model in the series and will have the same seating capacity as existing B737-700 (e.g. 136 seats for WestJet).

The Boeing 737 is notably operated in Canada by WestJet, as well as leisure carriers Sunwing and CanJet, as well as several Transborder carriers. Although over 1,300 B737max have been ordered, none by Canadian carriers at this time.

AIRBUS A318/319/320/321

The Airbus A320 family series covers seating capacity ranging from 107 (318 model) to over 200 seats (321 model) with over 5,000 aircraft delivered since its entry in service in 1988.

The current models in the Airbus A320 family do not meet the noise levels established within the Tripartite Agreement. However, the A320neo (new engine option) using the geared turbofan technology will provide significant performance enhancements, which may allow this aircraft to comply with the Tripartite Agreement requirements upon certification. However, based on an advertised 15 dB below Chapter 4, this would result in the combined sum of all three (3) measurements points as being 265 dB, which remains 5 to 6 dB above the current requirements set in the Tripartite Agreement.

Airbus is not currently planning a A318neo with the A319neo scheduled to be the smallest model in the series. The A320 series is notably operated in Canada by Air Canada, Air Canada Rouge as well as several Transborder carriers. Over 2,000 A320neo have been ordered to date, none by Canadian carriers at this time.

SUMMARY

The following table summarizes key specifications of aircraft currently in operation or scheduled to operate in the foreseeable horizon that are most closely comparable to the CS100. Data relating to performance and noise may vary based on exact configuration of each aircraft.

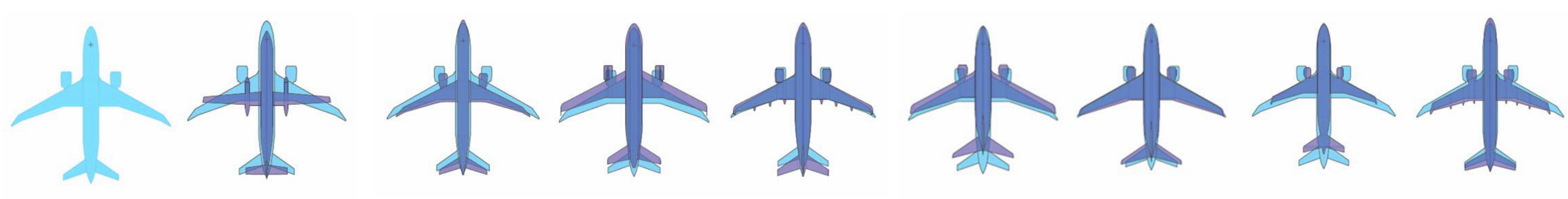
		Aircraft								
		Bombardier		**Mitsubishi**		**Airbus**		**Boeing**		**Embraer**
		CS100	**Dash8-Q400**	**MRJ90**	**A318**	**A319**	**B736**	**B737**	**E175**	**E190**
										
Entry in Service		**2014**	**In Service**	**2015**	**In Service**	**In Service**	**In Service**	**In Service**	**In Service**	**In Service**
Physical										
Length	m	35	32.8	35.8	31.44	33.84	31.2	33.6	31.68	36.24
Width	m	35.1	28.4	29.2	34.1	34.1	34.3	35.8	26	28.72
Height	m	11.5	8.4	10.5	12.56	11.76	12.6	12.5	9.73	12.08
Pax (Typical)	#	110	74	92	107	124	110	126	78	98
Performance										
Maximum Take-Off Weight (MTOW)	kg	58,513	29,574	39,600	68,000	75,500	66,000	70,080	37,500	47,790
Engine Thrust	kN	103.5	3,410 kW (Power)	78	106	120	101	117	61	82
Range (@MTOW)	km	2,778	2,063	1,670	5950	6,850	5,970	6,370	3,704	4445
Runway Length (ISA, MTOW, SL)	m	1,463	1,468	1,490	~1,800	~2,150	~1,800	~1,600	2,244	2,056
Noise										
Takeoff	EPNdB	-	84.0	-	94.9	93.8	90.7	95.4	84.4	91.8
Approach	EPNdB	-	93.1	-	92.4	94.6	95.6	95.8	91.9	92.4
Flyover	EPNdB	-	78.6	-	84.1	84.5	81.3	81.4	95	86.3
Cumulative	EPNdB	<259.5	255.7	-	271.4	272.9	267.6	272.6	271.3	270.5

Table 4.2 CS100 Comparable Aircraft Summary Table

05. CAPACITY ASSESSMENT

This section reviews the “ultimate” capacity of the airport based on existing operational conditions and in accordance to the Tripartite Agreement. It is followed by a scenario based review of the incremental effect associated with the lifting of restrictions on jet aircraft operations.

FREQUENCY REGULATION / SLOT CAP

A key determinant of the airport’s capacity is the slot cap on scheduled movements. The slot cap is in place in order to ensure the overall airport’s compliance to the terms of the Tripartite Agreement, which states that the TPA must “regulate the overall frequency of aircraft movements in order to contain the actual 28 NEF Contour within the boundary of the official 25 NEF Contour for 1990.”[12] There are two exceptions to this statement and they are indicated between the two points marked X and Y as showed in Chapter 8 of this report.

The *Billy Bishop Toronto City Airport Capacity Report (February 2010)* assessed a range of operational scenarios before retaining a slot count of 202 daily commercial movements which are based on the following considerations:

- Restricted night movements (6:45-7:00 and 22:00-23:00) for existing commercial movements (7 movements) as well as some General Aviation Movements between 22:00 and 23:00.
- 90% of commercial movements operated by Dash8-Q400 (or Q300) with remaining 10% assumed to be Dash8-100/200 (or equivalent)
- Provisions for a range of general aviation activities including helicopter movements that can operate in addition to the commercial movements cap.

A slot coordinator was appointed to manage the slot allocation process following the increase in the slot cap from 120 to 202 movements. As of 2013, the slots are distributed as follows:

- Porter Airlines: 172 slots (including grandfathered rights on night movements)
- Air Canada: 30 slots (no night movements)

[12] See Chapter 7 for additional considerations to noise

Since the Tripartite Agreement does not specify the number of slots, this number could change over time based on changing operational conditions, the fleet mix in operation and the noise modelling tool and assumptions used by Transport Canada.

For the purposes of this study, a base assumption, agreed to with the City of Toronto staff, is that the 202 slot cap will remain as a known constraint based on advice from the Toronto Port Authority that it does not anticipate changes to the existing slot cap. Future studies may undertake additional noise modelling as more information becomes available on the noise levels of the CS100 and other new aircraft, and once Transport Canada determines the appropriate parameters for modelling this aircraft. However this work is beyond the scope and timing of this review.

AIRSIDE CAPACITY

The determination of an airport's capacity is based on a range of considerations from airside to landside. The proposed extension of runway 08-26 will not increase aircraft movement capacity, but provides the opportunity for larger jet aircraft to operate. These aircraft have with more seating capacity hence increased busy hour passenger movement demand will require increased capacity of terminal and groundside facilities.

Furthermore, because the runway extension is not associated with a parallel taxiway, aircraft requiring the full length of Runway 08-26 on take-off will effectively need to backtrack on the runway to the runway end. This will be amplified for departures off Runway 26 since Taxiway Delta will not be accessible when the runway gets reclassified as Code 3. This will reduce the hourly capacity of the runway to an extent that will be dependent on the timing of operations requiring the full runway-length.

The 2012 actual total annual demand was over 1.9 million passengers[13] including the existing transfer passenger rate is assumed to be 25%. This results in groundside demand of about 1.4 million passengers annually (passengers that depart or arrive at the BBTCA). The cap of 202 commercial movements creates an artificial demand limit on the facilities. All slots are currently operated by Dash8-Q400 with 70 seats[14]. However, although weekday slots are generally well utilized, schedules for Porter Airlines and Air Canada indicate that the slots are used at about 50% of their maximum levels on Saturdays, and at about 75% of the maximum levels on Sundays.

[13] http://www.torontoport.com/About-TPA/Media-Room/Press-Releases/TPA-2012-Year-End-Results.aspx

[14] WestJet operates a 78-seat version, Air Canada Jazz operates a 74-seat version.

Under the present scenario, assuming a planning load factor of 85% for all operations, an estimate of the annual airport capacity is approximately 3.8 million passengers. Of those passengers, it is assumed that 25% are transferring from an arrival flight to a departing flight, which results in about 1million annual transferring passengers and about 2.8 million annual passengers who will interface with groundside facilities at BBTCA.

A key consideration when assessing facility requirements is the busy hour capacity. Using similar assumptions as the current annual capacity, namely a load factor of 85%, and assuming that all gates are used 1 or 2 times during a given hour, the hourly capacity is estimated at approximately 870 passengers per hour based on the current layout of 10 aircraft gates. Taking into account an average transfer rate of 25% the demand on groundside would be approximately 650 passengers per hour, each way. Under a scenario where all seats are filled during a busy hour, demand could grow up to approximately 765 passengers per hour, each way.

When considering the introduction of the CS100 (107 seats), assuming the same slot count and overall utilization, this leads to an incremental increase in capacity. The current operational model of the Dash8-Q400 involves short-haul flights (under 500Nm) with quick turnarounds which allows for up to 12 turns[15] a day per aircraft. The CS100 will primarily be used on medium-haul routes, but it will provide Porter Airlines the ability to modulate its capacity during busy hours on short-haul business sectors, if required, and to connect transferring traffic to onward medium-haul destinations (e.g West Coast, Florida, Caribbean) throughout the day. Overall, this would lead to the operations of fewer sectors across the day with an estimate of 3 turns per day per aircraft (as estimated by Porter Airlines). A conservative scenario of 25% of all slots utilized by the CS100 aircraft was developed. When retaining the assumption of an 85% load factor, the annual passenger movement capacity of the airport becomes approximately 4.3 million passengers, an increase of 500,000 passengers or approximately 14% over existing capacity which corresponds to a low growth scenario per the assumptions used in the HLT Advisory Report[16]. Assuming that the introduction of the CS100 would lead to an increased utilization of available slots during the weekend, the annual capacity of the airport could grow to 4.6 million and 4.8 million passengers under a medium and high growth scenario respectively per HLT Advisory assumptions.

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[15] A turn is defined as the transition between an arrival and a departure.

[16] Economic Impact Considerations of an Expanded Billy Bishop Toronto City Airport

During the busy periods, the ability to park up to 4 CS100 concurrently could increase capacity to approximately 1,240 passengers per hour in each direction (910 passengers O/D[17]), an increase of approximately 50%. The following table provides a summary of the key findings of this high level scenario based assessment.

	Dash8-Q400 only	Dash8-Q400 (75%) / CS100 (25%)
Slot Distribution Scenario	100% - Dash8-Q400	75% - Dash8-Q400
Load Factor Scenario	85%	85%
Transfer Rate Scenario	25%	25%
Annual Passenger Movements Capacity	3.8 million – Total 2.8 million – O/D 1.0 million - Transfer	4.3 million – Total 3.2 million – O/D 1.1 million - Transfer
Hourly Passenger Movements Capacity	870 Pax – Total (Each Way) 650 Pax – O/D (Each Way) 220 Pax – Transfer (Each Way)	1,240 Pax – Total (Each Way) 910 Pax – O/D (Each Way) 330 Pax – Transfer (Each Way)

Table 5.1 Airside Capacity – Summary Table

TERMINAL CAPACITY

In order to process the passenger capacity defined by the airside and apron parking plans, the passenger terminal must provide adequate processing and holding facilities for each step in the passenger journey. A previous study, completed by Airbiz in 2010, found that the existing passenger terminal has approximately a 720 passenger per hour capacity for origin/destination activity, which is sufficient to process the maximum hourly capacity induced by airside facilities and the existing fleet mix of Q400 aircraft.

Under a scenario where the CS100 operates during the busy hour, there would be a need to upgrade

[17] Passengers for who Toronto City Centre is the point of departure or arrival.

terminal facilities to enhance the total processing rate of key facilities. The specific needs of each processor were not reviewed within this study. However the areas of anticipated expansion would include:

- Check-In
- Security screening
- Outbound and Inbound Baggage Systems
- Hold Rooms
- US Customs and Border Protection (USCBP) Facilities (No current facilities)
- Canadian Border Services Agency (CBSA) Facilities

Consultations with Porter Airlines have confirmed that they have considered some of these facility enhancements at a very high level, but that their planning is in the early stages as they have tied the expansion requirements to the approval of the proposal to allow the CS100 to operate at BBTCA. The ability to expand existing passenger terminal facilities to the north and south in incremental phases appears to have a nominal impact on the adjacent areas. Further expansion capacity also appears to exist within the current footprint of the terminal building.

GROUNDSIDE CAPACITY

Excluding any considerations of the road access system and parking facilities which was not considered as part of this review, the key bottleneck of airport capacity on groundside currently is the ferry service. Previous studies found that about 800 passengers could be processed across the channel every hour which was sufficient to meet the demand under a scenario where the Dash8-Q400 was the only commercial aircraft operating. As previously reported, the main benefit of the upcoming commissioning the pedestrian tunnel is the ability to allow a steady-flow of passengers to/from the passenger terminal building or the curb on groundside. This contrasts with the present situation of four distinct arrival waves creating a sudden stress on processing facilities, which leads to increased wait times and reductions in the level of service provided by the carriers.

Under a scenario where the CS100 is introduced into commercial operation, the busy hour demand would have exceeded the capacity of the ferry terminal without the use of the pedestrian tunnel. Under this scenario, the pedestrian tunnel becomes essential in eliminating the ferry service capacity constraint.

The pedestrian tunnel will consist of six elevators on the mainland side and three banks of escalators and two elevators on the island side.[18] The capacity of the pedestrian tunnel has been advised to be 1,066 passengers per hour each way by the TPA.

[18] Meeting Minutes 29 May 2012 – Construction Period Liaison Committee – Forum Equity Partners

06. INFRASTRUCTURE REQUIREMENTS

This section reviews the infrastructure requirements associated with the Porter Airlines proposal. Whilst the lengthening of Runway 08-26 is the key aspect of the proposal, the review considers associated impacts from airside to groundside, including the passenger terminal building.

The review uses industry literature, material provided by Porter Airlines and high-level consultations with Transport Canada as a basis of study. It should be noted that Transport Canada has not received a formal request to consider the proposal from Porter Airlines from the Toronto Port Authority. As such Transport Canada were unable to comment on the particular details of the proposal by Porter Airlines. Any input from Transport Canada, was therefore of a generic nature and has been used to guide the interpretation of the current aerodrome standards and recommended practices (TP312E). Any exemptions or possible exemptions that may be considered with respect to the BBTCA and/or the Porter Airlines proposal were not addressed by Transport Canada.

RUNWAY LENGTH REQUIREMENTS

The runway length required to enable commercial operations varies significantly based on a range of factors. A key determinant is the selection of the critical design aircraft, which for this proposal is the Bombardier CS100. Other key operational and environmental factors include:

- Destination (i.e. range)
- Payload (i.e. passengers, bags and fuel)
- Temperature and wind conditions

Because of the variability of payloads and environmental conditions, it is complex and costly to plan for all potential operational occurrences of an aircraft operation. Airlines will accept operational limitations for infrequent constraints rather than pay on a cost recovery basis for additional capital and operations expenditure to accommodate all contingencies. The preliminary information available for the Bombardier CS100 confirms the ability of this aircraft to operate within the parameters of the proposed runway extension under standard conditions and subject to the final declared distances.

OBSTACLE LIMITATION SURFACES

Obstacles Limitation Surfaces (OLS) define the limits to which objects may project into the airspace. This is done to allow the aerodrome to operate safely and to minimize the dangers presented by obstacles to an aircraft. Obstacles are typically surveyed periodically to ensure the OLS is not penetrated as this can impact an aircraft either during an entirely visual approach or during the visual segment of an instrument approach. The OLS surfaces also prevent the aerodrome from being restricted by the growth of potential obstacles in and around the aerodrome.

These surfaces are protected at BBTCA for Runway 08-26, the main east-west runway and only one on which Dash8-Q400 and CS100 can operate at BBTCA, by the enactment of Airport Zoning Regulations (AZR) SOR/85-515 in accordance with the Aeronautics Act. It prohibits the erection of any new structure which would violate any of the defined surfaces. Under these regulations, the runway, runway strip, approach surfaces, transitional surfaces and outer surface are defined. For BBTCA, despite currently operating runway 08-26 under Code 2 classification, the AZRs are based on a Code 3 classification.

Although Transport Canada did not specifically comment on this proposal, they advised that “the current AZRs will not protect for a longer runway. If protection is required for a longer runway, the AZR would have to be amended.”

Furthermore, BBTCA currently operates with exemptions from Transport Canada in regards to the OLS approach surfaces. For runway 08, the exemption allows the approach surface at 4.8% while for runway 26, the exemption allows the approach surface at 6.38%. Transport Canada has not discussed the implications of a change to Code 3 operations on these existing exemptions.

The proposed layout as set-out in the Porter Airlines proposal retains the approach surfaces at their existing locations which would ensure the integrity of the Marine Exclusion Zone (MEZ) subject to approach exemptions being confirmed by Transport Canada. For take-off operations, declared distances (e.g. TORA, TODA) should be confirmed with Transport Canada to ensure that appropriate clearances from obstacles are also provided.

RUNWAY-END SAFETY AREAS (RESA)

Runway-End Safety Areas (RESA) are defined by ICAO as “An area symmetrical about the extended runway centre line and adjacent to the end of the strip primarily intended to reduce the risk of damage to an aeroplane undershooting or overrunning the runway”. Since 1999, what previously was a recommendation of a 90m runway-end safety area beyond the runway strip became a requirement from

ICAO. An additional recommended practice was then introduced for a 240m length RESA for Code 3 and 4 runways (those which are 1,200m or longer). The runway end safety areas are required to have a minimum width twice of the associated runway, extend away from the runway, be centred on the extended runway centreline and have a minimum length of 150 m to the end of the RESA (except under special circumstances). Since the Canadian Aerodromes Standards and Recommended Practices (TP312E) were last updated in 1993, the provisions of Runway-End Safety Areas remain a recommendation within the Canadian context. The following chart highlights the key features of Runway-End Safety Areas based on the ICAO minimum requirements standards.

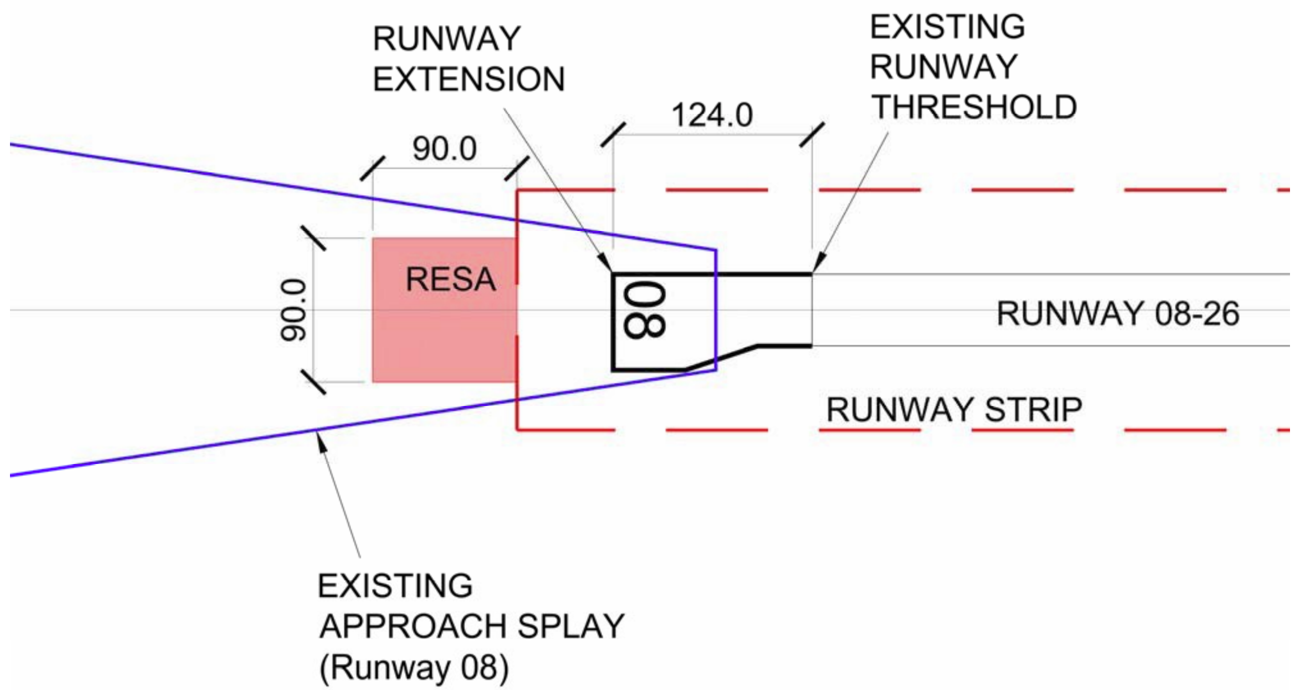

Figure 6.1 RESA Layout – Runway 08

Following the overrun of an Airbus A340 at Toronto-Pearson International Airport on 2 August 2005, the Transportation Safety Board (TSB) issued the following recommendation to Transport Canada in December 2007: “the Department of Transport require all Code 4 runways to have a 300 m runway end safety area (RESA) or a means of stopping aircraft that provides an equivalent level of safety.” The TSB subsequently added the issue of landing accidents and runway overruns to its inaugural watchlist of the transportation safety issues posing the greatest threat to Canadians with RESA identified as a key mitigating measure.

In 2010, Transport Canada tabled NPA 2010-012 with the objective to harmonize Canadian Standards (TP312) in regards to RESA with international standards (ICAO Annex 14) hence making the 90m RESA mandatory. Section 302.551 of the NPA states of that "A runway end safety area shall be provided where the runway length is 1 200 m or greater". Furthermore, section 302.552 states that "a runway end safety area may not be provided prior to the declared LDA where one of the following is operational on the runway in use:

(a) Precision Approach Path Indicator (PAPI);

(b) Abbreviated Precision Approach Path Indicator (APAPI); or

(c) Instrument Landing System glide slope."

Considering that BBTCA's Runway 08-26 is over 1,200m long, Runway-end safety areas may have become a requirement upon application of this rule. This would require the Toronto Port Authority to either reduce the declared Take-Off Runway Available on Runway 08-26 inducing range and payload restrictions on existing operations, or to undertake a RESA development project involving an extension of the airfield into the harbour similar to what is currently proposed simply to maintain existing operational requirements or by using an Engineered Material Arrester system (EMAS) which is proposed as an alternative to full length RESAs. Considering that BBTCA currently operates under a Code 2 category, there may also be an opportunity to obtain an exemption on the need for RESAs subject to review by Transport Canada.

The *Runway 08-26 Extension Study* recommends the use of a portion of the Runway-End Safety Area to provide additional length for take-off operations. A similar concept called Starter Extension in the United Kingdom and New Zealand[19] enables an aircraft to optimize the use of the RESA with reduced runway strip and runway width requirements. Based on communication with Transport Canada, "If the RESA is to be used for the start of take-off operations then it is now officially "runway" and subject to the runway strip standards". As such, the provision of a 45m graded runway strip area would appear to be required

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[19] UK CAA http://www.caa.co.uk/docs/33/CAP168.PDF

before the commencement of the take-off roll as well as the provision of a full runway-strip.

TAXIWAYS

The runway lengthening proposal will have some impacts on the taxiway system at the BBTCA. Currently operating as a Code 2 facility, the extension of the runway to 1,569m will bring this runway into a Code 3 category as confirmed by Transport Canada. This will in turn affect the width of the runway strip which, currently at 80 metres, will need to be widened to 150m. A runway strip is a defined area including the runway intended to reduce the risk of damage to aircraft running off the runway and to protect aircraft flying over it during take-off or landing operations.

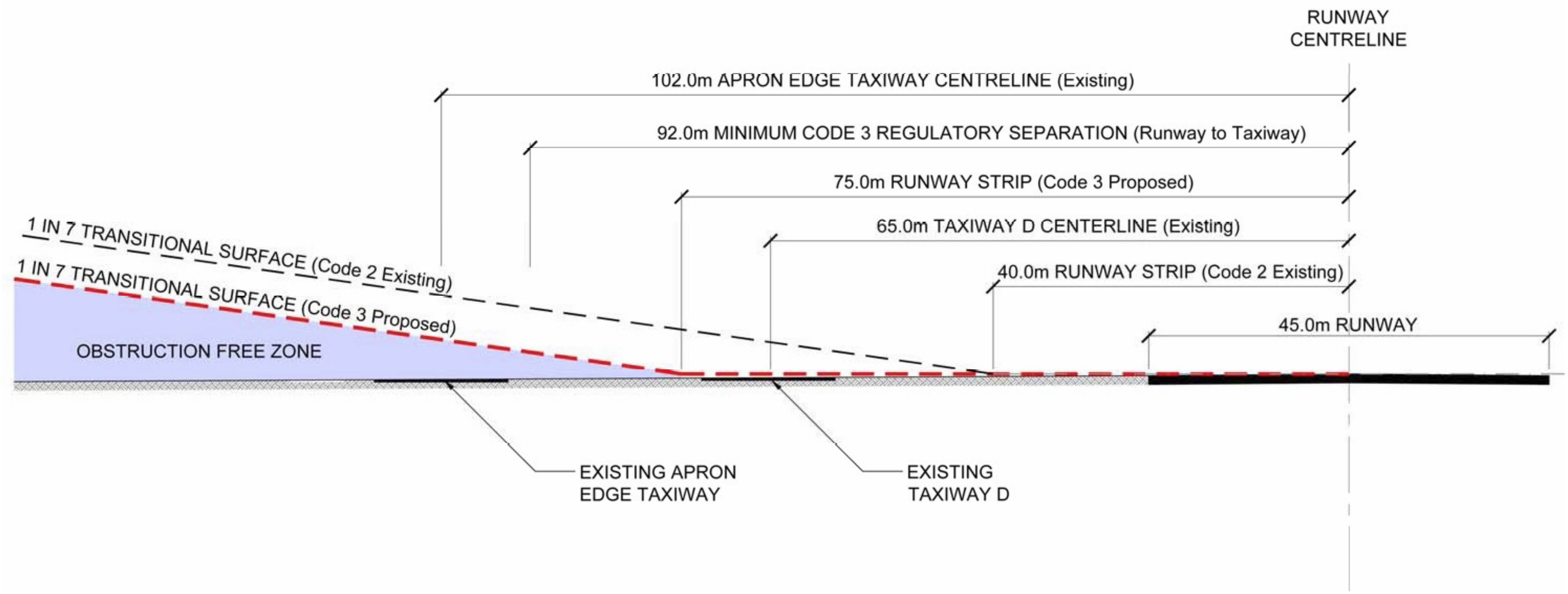

Fig 6.2 Code 2 and Code 3 Runway Strip Impacts

The widening of the runway strip in turns affects the minimum separation requirements between the runway and parallel taxiway. Previously at 57.8m from the runway centreline to taxiway centreline, the minimum requirement under a Code 3 runway requirement becomes 92.0m. At approximately 65m from Runway 08-26 centreline, Taxiway D would therefore breach the clearance requirements and would not be useable during Runway 08/26 operations.

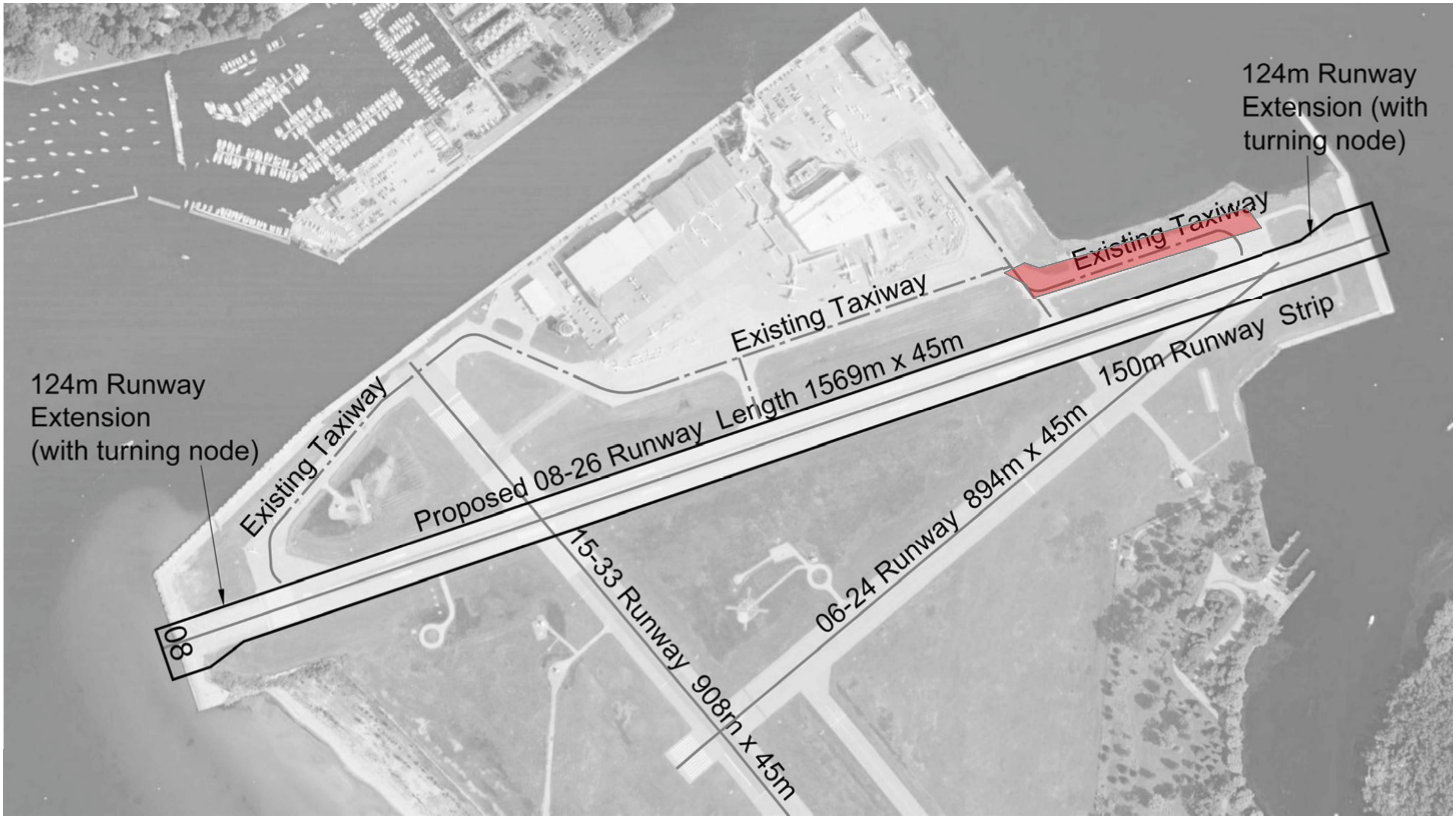

Fig 6.3 Taxiway Delta Location

Using the full length of the runway for take-off would therefore require backtracking by the aircraft, especially the CS100 since the Dash8-Q400 may still be able to operate from the intersection. This could however lead to an overall reduction in the capacity of runway 26.

The apron-edge taxiway centreline (running parallel to runway 08-26) is approximately at 102 metres from the runway centreline and therefore meets the minimum requirement of 92m.

APRON

The apron used for aircraft parking will be affected by the present proposal. As previously explained, a change of the runway code from 2 to 3 will lead to a wider runway strip requirement (up from 80m to 150m). The OLS transitional surface stems from the edge of the runway strip and therefore the OLS transitional surface will shift 35m towards the apron which will in turn trigger greater height restrictions over this area.

Although Dash8-Q400 aircraft will still be able to park at the gates on the southern face of the passenger terminal building (subject to a formal site survey confirming obstacle clearances), the CS100's length and height will prevent it from being parked at these gates. The opportunity to park the CS100 aircraft is therefore limited to the western and eastern faces of the existing terminal.

As existing Q400 aircraft parking positions are designed with minimum wingtip clearances, per Transport Canada regulations, the wider CS100 will need a realignment of the gates to allow for appropriate wingtip clearance at the western and eastern gates of the terminal.

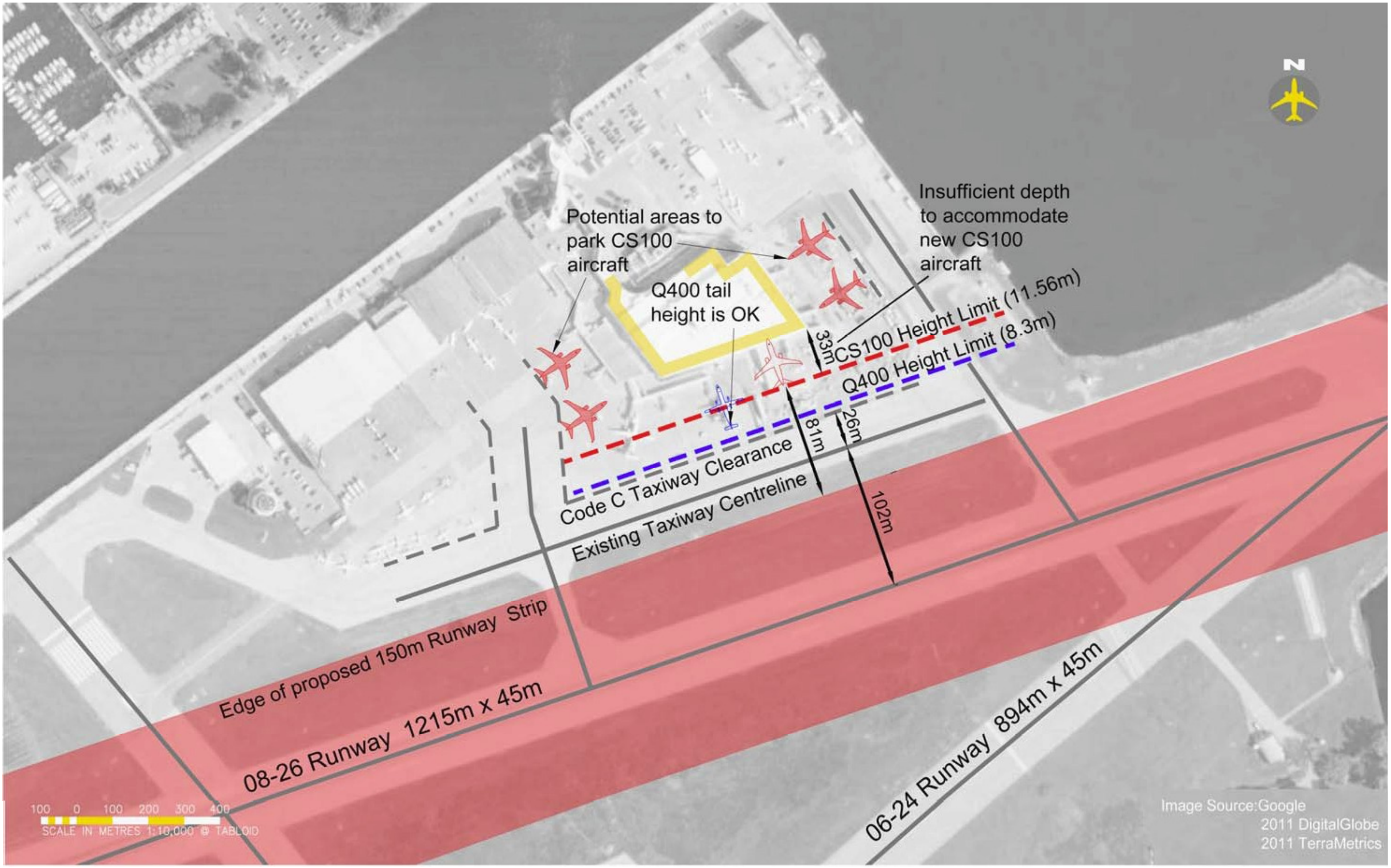

Fig 6.4 Code 3 Runway and Concept Apron Parking Plan with associated clearances

PAVEMENT STRENGTH

The Transport Canada Engineering Reference Document "Canadian Airport Pavement Bearing Strengths TP2162" as well as the BBTCA Airport Operations Manual defines the pavement strength of Runway 08/26 as follows:

Specification	Value
Pavement Load Rating (PLR)	6
Tire Pressure Limit	1.0 MPa
Pavement Classification Number (PCN)	11/Flexible/Medium Strength/Technical Evaluation

Table 6.1 Existing Runway 08/26 Pavement Rating

A specific authorization must be obtained from the Airport Operator for operation of aircraft with load ratings or tire pressures exceeding values shown above. An aircraft like the Bombardier CS100 and comparable aircraft will have ALR (Aircraft Load Rating) and ACN (Aircraft Classification Number) in excess of what is currently provided at BBTCA. The ALR is a number developed by Transport Canada expressing the relative structural loading effect of an aircraft on a pavement based on 12 groups according to their pavement strength requirements. The ACN is an ICAO number expressing the relative structural loading effect of an aircraft on a pavement for a specified pavement type and a specified standard subgrade category.

A more detailed study on the required pavement upgrades is recommended for the existing runway, taxiway and aprons. The appropriate ALR and ACN need to be confirmed and a scope of work defined to confirm the extent of work and associated costs related to the pavement ratings at BBTCA.

The cost estimates within this preliminary report do not make provisions for pavement upgrades to existing facilities as this is within the purview of the Toronto Port Authority.

PASSENGER TERMINAL

As described in the previous section, the passenger terminal currently has a capacity of approximately

720 passengers (origin/destination) per hour, each way.[20] Although the Porter Airlines proposal is targeted at the runway extension project, the ability of the airport to cater for the Bombardier CS100 (or equivalent) jet aircraft will require expansion works at the passenger terminal to allow passengers to board this aircraft and to process the additional passenger demand that may result from the operation of larger aircraft during the busy hours. Cost estimates within this preliminary report do not make provisions for gate and passenger terminal upgrades that cater for the new aircraft and the additional passenger demand as this is within the purview of Porter Airlines.

GROUNDSIDE

Groundside includes the interface with the ground transportation systems such as taxis, buses, private cars and pedestrians. Our review is limited to the provision of passenger volumes that are anticipated to interface between the passenger terminal and the various ground transportation options. The BBTCA and Eireann Quay Strategic Transportation Study will take these passenger counts and conduct their own studies and present findings to the City of Toronto. The anticipated passenger volumes that are expected under the auspices of the Porter Airline proposal are:

- 3.2 Million origin and destination (O/D) passengers/annum
- 910 O/D passengers/hour

The main process currently affecting the flow of passengers between groundside and the passenger terminals is the ferry link. This ferry link will soon be complemented by an underground pedestrian tunnel which will have the effect of removing the sporadic peaks currently experienced on groundside whenever a ferry was docking, 4 times an hour. The anticipated combined peak hour capacity of the ferry and the tunnel is:

- Ferry, 800 Passengers/hour each way
- Tunnel, 1,066 passengers/hour each way
- Maximum combined capacity, 1,866 passengers/hour each way

This review confirms that the pedestrian tunnel has enough capacity in both directions to process the projected busy hour demand associated with the introduction of the CS100 at BBTCA.

[20] Airbiz, Peer Review – 2010 Capacity Study

SUMMMARY

The following chart highlights the key findings from our review of infrastructure requirements.

Item	Description
1	Review of declared distances should be undertaken with Transport Canada based on obstacles on take-off.
2	Runway-End Safety Areas are to be provided at both end and used to provide additional runway length on take-off. No jet blast issue were identified subject to a more comprehensive review when the CS100 is certified.
3	Approach surface is assumed to remain at the same location but runway thresholds will be displaced subject to Transport Canada review.
4	Runway will become Code 3C resulting in the runway strip being widen to 150m and displacing the Transitional Surfaces.
5	Insufficient minimum separation between Taxiway Delta and Runway 08-26.

Table 6.2 Infrastructure Requirements – Summary of Findings

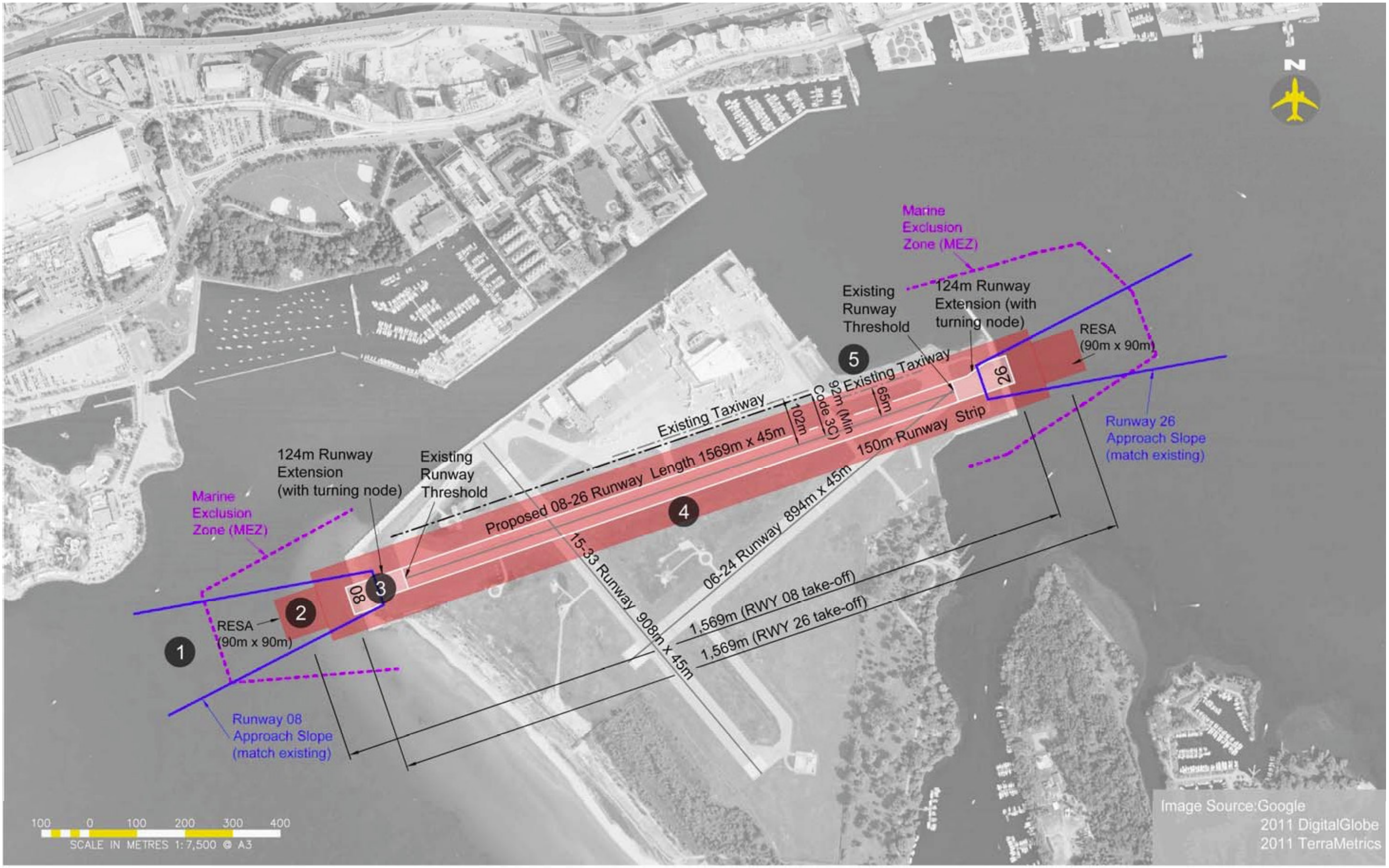

Fig 6.4 Infrastructure Requirements – Summary of Findings

07. NOISE CONSIDERATIONS

This section reviews the noise considerations associated to lifting the ban on jet aircraft operations at the Billy Bishop Toronto City Centre Airport and more specifically the considerations of the potential noise impacts associated to the Bombardier CS100.

DEFINITION OF AIRCRAFT NOISE

Aircraft noise is the sound emitted through the operation of aircraft during all phases of flight. Aircraft noise is induced primarily by the engines (or propellers) as well as the airframe of the aircraft including the landing gear, slats and flaps. Individuals do not experience a uniform response to sounds of the same intensity generated at different frequencies. Loudness based metrics such as the maximum sound level ($L_A$max) can be measured by an instrument but do not account for the duration and are possibly less representative of annoyance. The EPNdB(effective perceived noise in Decibels) metric is used in the certification of most jet and heavy turboprop aircraft. It assesses the true noisiness of a complete aircraft event such as the spectral characteristics, tonal content and persistence of the sound. It cannot be directly measured but is calculated using a standard defined by the International Civil Aviation Organisation (ICAO).

The Standard and Recommended Practices (SARPs) of the ICAO are contained in 18 annexes. SARPs relating to Noise Standards are defined in Part I of Annex 16 (Environmental Protection – Aircraft Noise).

Annex 16 defines the noise limits for the purpose of certification as well as references and their test procedures. A standardized methodology is used which involves measurements at three (3) specific points of an aircraft's journey:

- Lateral / Full-Power

A point on a line parallel to and 450 m from the runway centre line, where the noise level is a maximum during take-off.

- Approach

  A point on the ground, on the extended centre line of the runway 2km from the threshold. On level ground this corresponds to a position 120 m (394 ft) vertically below the 3° descent path originating from a point 300 m beyond the threshold.

- Flyover

A point on extended centre line of the runway and at a distance of 6.5 km from the start of roll.

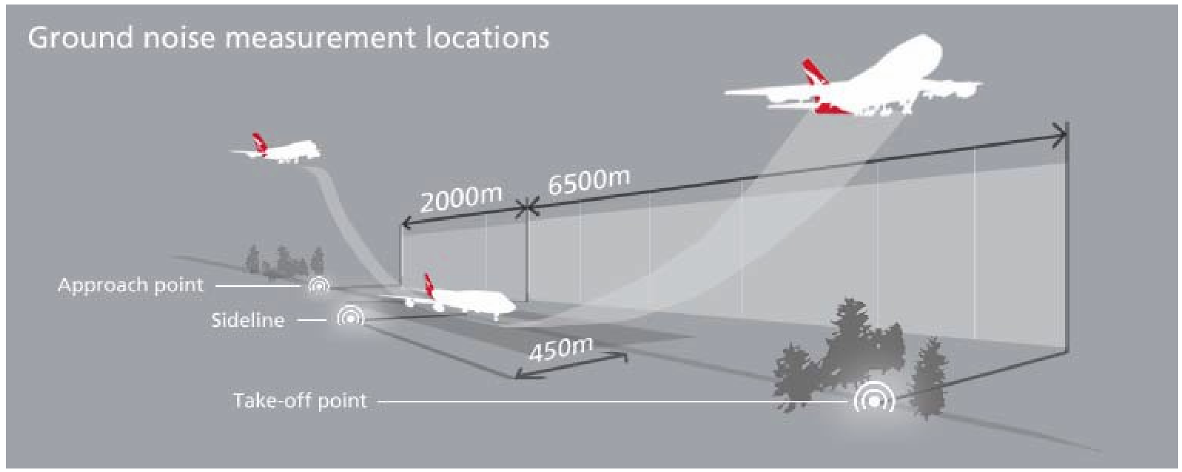

Fig 7.1 Ground Noise Measurement Locations (source: Qantas)

Maximum noise levels under Annex 16 have been applicable since 1972 under chapter 2 requirements and varies based on the Maximum Certified Take-Off Weight of a given aircraft. New quieter noise standards (Chapter 3) were introduced in 1977 for new aircraft models and in 1981 for derivatives of existing aircraft. The key features of this new standard included reduction of limits by 16 EPNdB for light aeroplanes and 10 EPNdB for heavy aeroplanes (Based on the sum of three (3) certification measures - lateral, approach, and flyover).

Chapter 4 standards for new jets were accepted in 2001 for application in 2006. These among other things required a cumulative (sum of margins at all three measurement locations) reduction of 10 EPNdB compared to Chapter 3.

In Canada, under Federal Legislation Chapter 2 aircraft were phased-out in 2002 (exceptions involve aircraft operating to parts of Northern Canada). Some of the most common Chapter 2 were the B737 classic and B727 which remain in operation at major airports in Canada due to the use of hush-kits installed on engine exhaust to reduce noise levels and ensure their compliance to Chapter 3 noise standards.

In February 2013, the International Civil Aviation Organization's (ICAO) Committee on Aviation Environmental Protection (CAEP) met for its ninth formal meeting (CAEP 9) in Montreal. An outcome of this meeting was a recommendation that ICAO adopt a new, more stringent aircraft noise certification for new aircraft designs.

The agreed new noise standard (Chapter 14) will be a cumulative 7EPNdB below ICAO's current Chapter 4 standards and will be applicable to new-design aircraft entering into service from 2017 for aircraft greater than 55 tonnes and from 2020 for aircraft under 55 tonnes.

TRIPARTITE AGREEMENT

Under clause 14 (1)e of the Tripartite Agreement, the lessee (Toronto Port Authority) shall not permit aircraft generating excessive noise to operate to and from the Toronto City Centre Airport, with the exception of medical evacuations, other emergency use required, and during the period of the annual Canadian National Exhibition airshow.

Clause 14 (2) provides the definition of an aircraft generating excessive noise based on the type and weight of the aircraft. Commercial airliners such as the Dash8-Q400 (Propeller-driven over 5,700kg) will be deemed to generate excessive noise if they generate a noise level in excess of 84.0 EPNdB on takeoff (flyover), or in excess of 83.5 EPNdB on sideline at takeoff (lateral to the flight path) or in excess of 92.0 EPNdB on approach. However, trade-offs are allowed where one or two measurements exceed the limit as long as the sum of excesses is not greater than 3 EPNdB, any excess at any single point is not greater than 2 EPNDB and that any excesses are offset by corresponding reductions at the other point or points.

The following chart presents the evolution of international noise certification standards in comparison to the rules set in the 1983 Tripartite Agreement. The chart addresses a range of existing turboprop and narrowbody jet aircraft, as well as the advised cumulative noise level for the CS100.

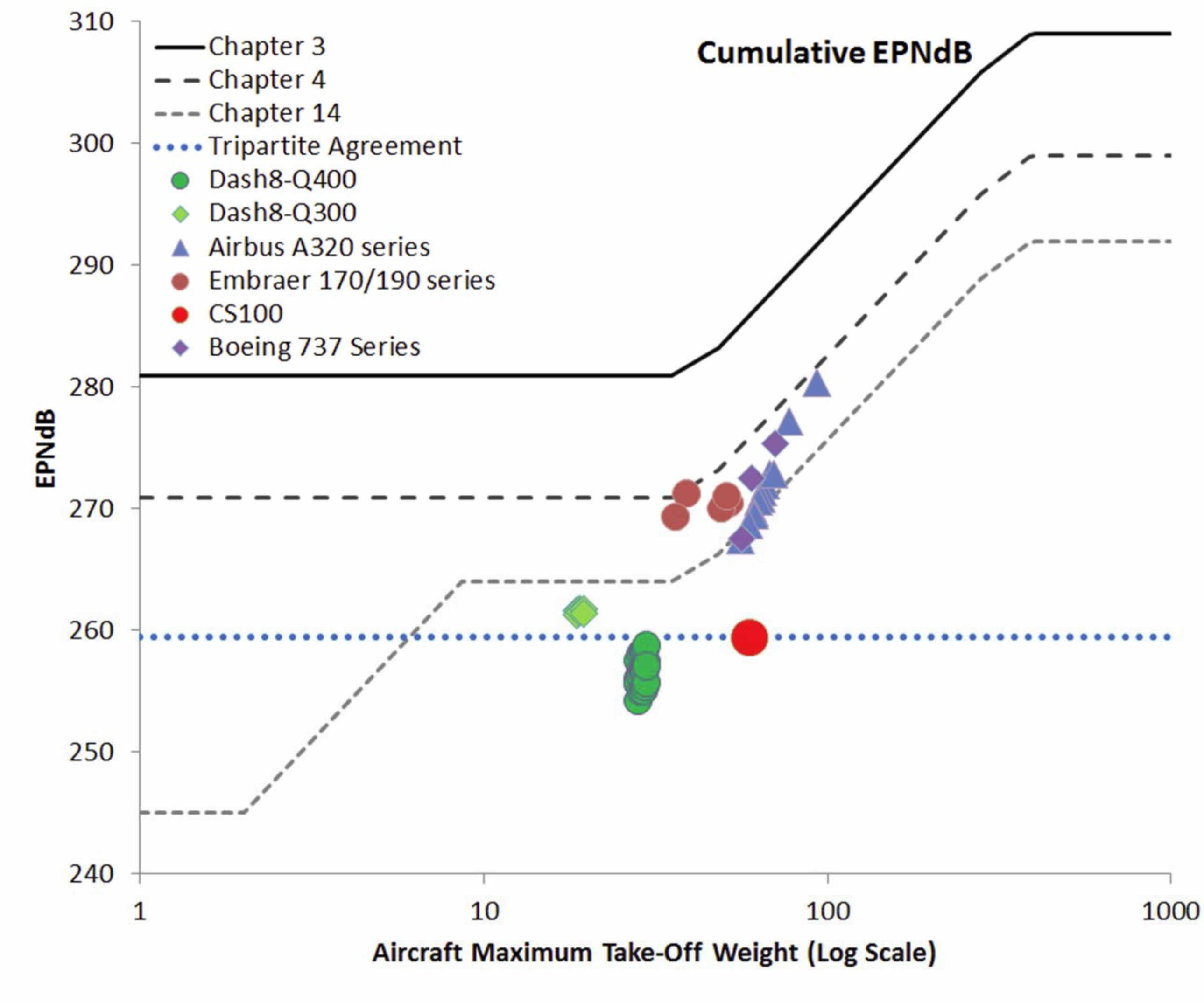

Fig 7.2 Cumulative EPNdB / Noise Certification Standards and Aircraft Compliance

The cumulative noise level requirements described in the Tripartite Agreement (259.5 EPNdB) are within restrictions set in the ICAO's Annex 16 Chapter 14 standards. For a 2-engine aircraft of the weight of the Dash8-Q400 this will require a cumulative noise level of 264 EPNdB once formally adopted by ICAO. However, the noise level requirements contained in the Tripartite Agreement are less stringent than the requirements found in the forthcoming Chapter 14 standards for light jet aircraft (under 8.6 tonnes) that will enter service by 2020. Based on very light jets (VLJ) currently operating in the market such as the Embraer Phenom 100, the Eclipse 500 and the Cessna Mustang 510, this new standard merely matches what is already being achieved by these quiet aircraft.

Formal confirmation of the CS100 compliance to the Tripartite Agreement also requires the certification of the noise levels at each measurement points (Approach, Lateral and Flyover) which will not be completed until May 2014 (based on advice received from Porter Airlines). ICAO Annex 16 states that in the event that the maximum noise levels are exceeded at one or two measurement points:

a) the sum of excesses shall not be greater than 3 EPNdB;

b) any excess at any single point shall not be greater than 2 EPNdB; and

c) any excesses shall be offset by corresponding reductions at the other point or points.

The data available allows confirming that from the conditions set in section 3.5.1, the CS100 meets the criteria set under clause c) through the guarantee of meeting the cumulative levels. However, data is not yet available to confirm compliance to clauses a) and b). Preliminary tests are scheduled to occur around September 2013 with formal certification occurring in May 2014.

NOISE EXPOSURE

Noise exposure is the accumulation of aircraft operations and their associated sound energy levels. Metrics such as the NEF (Noise Exposure Forecasts) used in Canada represent noise exposure with a single number rating of overall aircraft noise. These are then correlated to land use zoning criteria (noise-dose-response curves which are correlated to societal, as opposed to individual response to aircraft noise). There are a number of metrics used by various countries, but all include a weighting for operations at night or in the evening, in recognition of increase sensitivity for sleep disturbance at this time) The software NEF-CALC (Version 2.0.6.1 being the most recent) is used for modelling noise exposure contours in Canada.

The Tripartite Agreement states that the lessee (Toronto Port Authority) must regulate the overall frequency of aircraft movements in order to contain the actual 28 NEF Contour within the boundary of the official 25 NEF Contour for 1990 illustrated below except in a westerly direction beyond the official 25 NEF Contour at any point between the two points marked " X and "Y" on the official 25 NEF Contour in the image below. The cap of 202 movements on commercial operations is imposed by the Toronto Port Authority as a mean to ensure that this condition set in the Tripartite Agreement is not breached.

Fig 7.3 Tripartite Agreement – Noise Exposure Forecasts (1990)

The Tripartite Agreement requires Transport Canada to produce NEF contours for every year to confirm compliance to the 1990 noise contours.

Recent noise studies have confirmed compliance to the NEF noise exposure forecasts contained in the Tripartite Agreement. The following table and charts provide key outputs from the analysis for 2008 and 2010