PUBLIC VERSION

MOTT MACDONALD

Auckland Airport

Review of level of service, capacity and benchmarks contained in Air New Zealand PSE 4 submission dated August 2024

09 October 2024

Introduction

This paper reviews the aspects of the submission by Air New Zealand, that relate to the Level of Service Metrics, GFA benchmarks and pier arrangement benchmarks for the Domestic Processor Terminal.

Context of Air New Zealand's submission

Air New Zealand's submission proposes a number of value engineering actions, focused around three areas:

1. The Level of Service parameter values selected for the design;
2. Suitability of the GFA for the airport and type of traffic; and
3. Optimisation potential for the pier's width and internal configuration.

Limitations of Air New Zealand's submission

Noting the high-level nature of the report, the submission by Air New Zealand has a series of limitations that prevent a more exhaustive review and implementation in the final design. These include the following:

- Air New Zealand's Level of Service interpretation is not in line with IATA's description.
- Air New Zealand's proposed GFA does not include the area requirements associated with non-LoS items.

Background of the Mott MacDonald review

The baseline for the review conducted by Mott MacDonald includes:

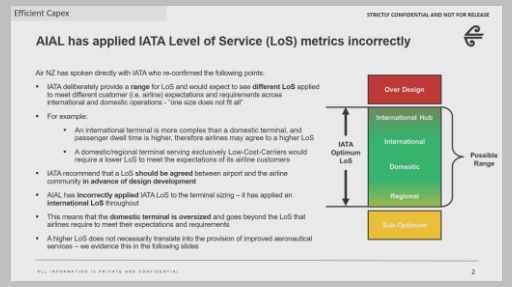
- IATA Level of Service definition and adequacy of parameters clarification, using inputs from Mott MacDonald employees' contributing to the IATA ADRM manual.
- Identification of terminal building areas not accounted for by Air New Zealand, including best practice for their dimensioning, and a GFA benchmark of airports of similar characteristics.
- Acknowledgement and clarification of Air New Zealand's optimisation opportunities for the pier width, including a pier width benchmark of airports of similar characteristics.
- Communications with Air New Zealand during previous design stages for the Domestic Processor. The communications demonstrate specific Air New Zealand requirements, which are at odds with the optimisation proposals included in Air New Zealand's report.

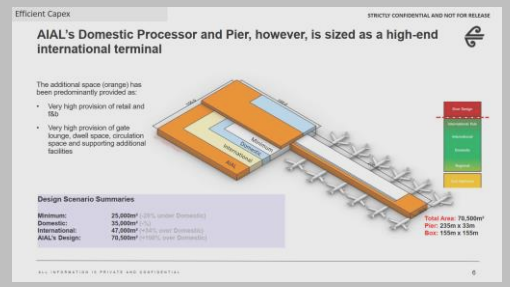
Review of Air New Zealand's submission

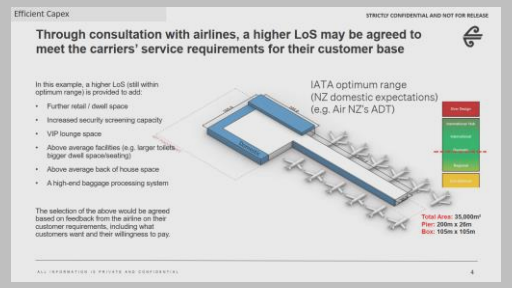
IATA Level of Service Clarifications

ITEMS SUBJECT TO IATA LoS
- Passenger processing facilities (check-in, security, border control, reclaim halls, customs)
- Passenger holding areas (departures hall, arrivals hall, gate lounges)

ITEMS EXCLUDED
- Back of house tenancies
- Circulation and amenities
- Commercial areas
- Plant, mechanical and building services







KEY POINTS RAISED BY Air NZ

- AIAL's application and interpretation of IATA LoS is incorrect.
- IATA provides LoS as a range for multiple scenarios to be applied to cater for traffic characteristics.
- INT / DOM / REG correspond to different ends of the IATA LoS Optimum range.
- AIAL has applied "INT LoS" leading to an overdesigned terminal building.

Definition and applicability of ranges

- As a contributor to the IATA ADRM manual, from which the Level of Service definition derives, Mott MacDonald is well placed to clarify some of the points raised by Air New Zealand.
- **IATA does not present an equivalence between the type of traffic and the values present within the optimum range of the LoS. – i.e. INT requiring a higher LoS than DOM.**
- As an example, INT Low Cost Carriers (e.g. Jetstar to Brisbane) often require a lower LoS than DOM Full Service Carriers (e.g. Air NZ to Wellington).
- The LoS Concept is an aggregated framework to express the **capacity** of a given airport. **Processes are considered at capacity** when the **waiting time** experienced by passengers is **above** the values defined as **optimum**, **or** when the **area per passenger** at a given location is **below** the values defined as optimum.
- **IATA provides the optimum range to reflect the global aviation market and standardise the airport design practice.**
- Standard practice is to target for a mid-point value, 5 years after opening day.

Allowing further degradation for lower-end values 7 years after opening day.

- To this effect, Auckland Airport has designed the Domestic Processor for the **mid-point value** of the optimum range, for a passenger demand **4 years after opening day.**
- By providing mid-point values 4-5 years after opening day, it is likely the LoS will remain within optimum values until expansion works are carried out.
- A 4-5 year mid-point target also enables that in case of construction/improvement delays – typically 2-3 years – LoS remains within optimum values by reaching the optimum lower end.
- IATA does recommend to cater for **Local Conditions.** This can either increase the LoS – e.g. airports at capital cities or economic hubs, main ports of entry, country demographic expectations – or decrease it – e.g. predominantly low-cost traffic, remote locations with low traffic demand, low passenger income.
- **Neither Auckland Airport nor Air New Zealand seem to qualify for Local Conditions that justify LoS degradations.**

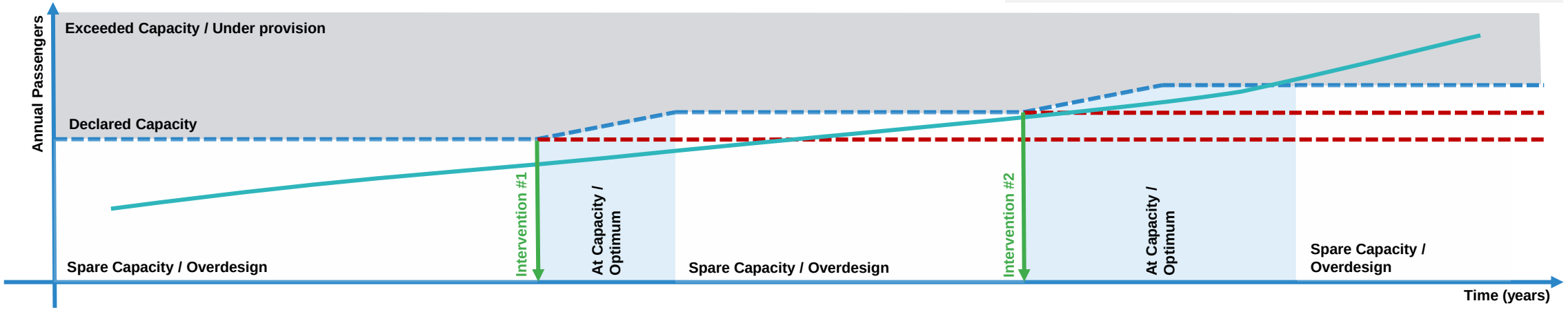
Review of Air New Zealand's submission

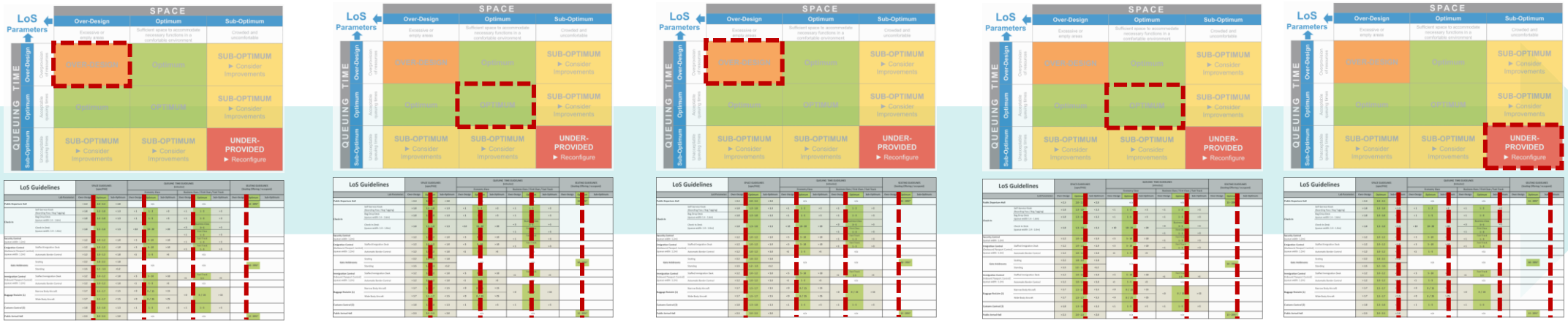
IATA Level of Service Clarifications

LoS DEFINITIONS

- **Under provision:** Poor level of service. Not recommended by IATA as a suitable level to plan for.
- **Optimal:** Balanced level of service that offers an acceptable experience for passengers whilst not resulting in overly large requirements for facilities or space. IATA recommendation for planning purposes.
- **Overdesign:** Excellent level of service resulting in high levels of capex. Not recommended by IATA as a suitable level to plan for.

Figure 1. Definition and applicability of ranges





Infrastructure will show high-end or overdesign LoS at opening day. Demand below design capacity.

LoS will reach mid-point values when demand approaches design figures. Interventions should be applied at this stage

Once interventions are applied, LoS will match the high-end/overdesign values until demand grows to the new declared capacity

If no interventions are applied, LoS will deteriorate to low-end values once the design traffic is reached

Further traffic increases without improvement works will lead to under provision LoS. Operation is compromised at this point

Review of Air New Zealand's submission

IATA Level of Service Clarifications

Implications on the peak hour

- Additionally, the design process provides **capacity for a peak-hour passenger demand below the expected absolute maximum peak** of the design year. In the case of Auckland Airport this corresponds to the **30th busiest hour of the year**.
- Designing for the absolute peak will lead to the infrastructure being underutilised for most of the year, until the absolute maximum peak materialises. This is already a **value engineering exercise applied by design**.
- However, if no buffer is provided in the LoS, **designing for the lower-end** of the optimum LoS range with a traffic demand below the absolute maximum, **will lead to below optimum LoS** when the absolute peak materialises.
- On top of providing an additional buffer for potential delays in construction, mid-point LoS values also provide resiliency for the busiest days of the year.
- Applying **mid-point LoS values** also **provides resiliency** in case the forecasted **traffic materialises ahead of the design year**. It also allows for **unexpected surges in traffic** – e.g. sport events, international summits, etc. – to be served within the optimum LoS range.
- This approach provides additional contingency for unexpected facility outages leading to periods of reduced capacity.

Equipment and queueing areas

- As an additional resiliency measure, it is not uncommon for the number of facilities to be planned for optimum range LoS values, while planning queueing space for sub-optimal levels.
- This provides for contingency in the queue arrangement for occasions when queue times exceed optimal values and would spill into adjacent areas.

Figure 2. Equipment and queueing areas

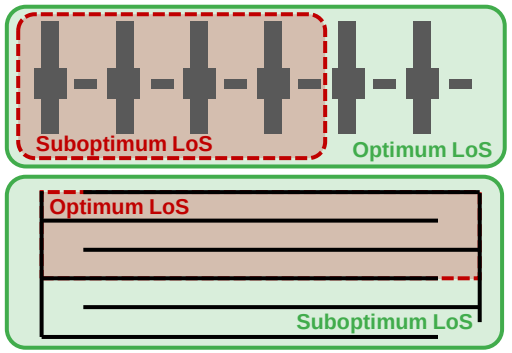
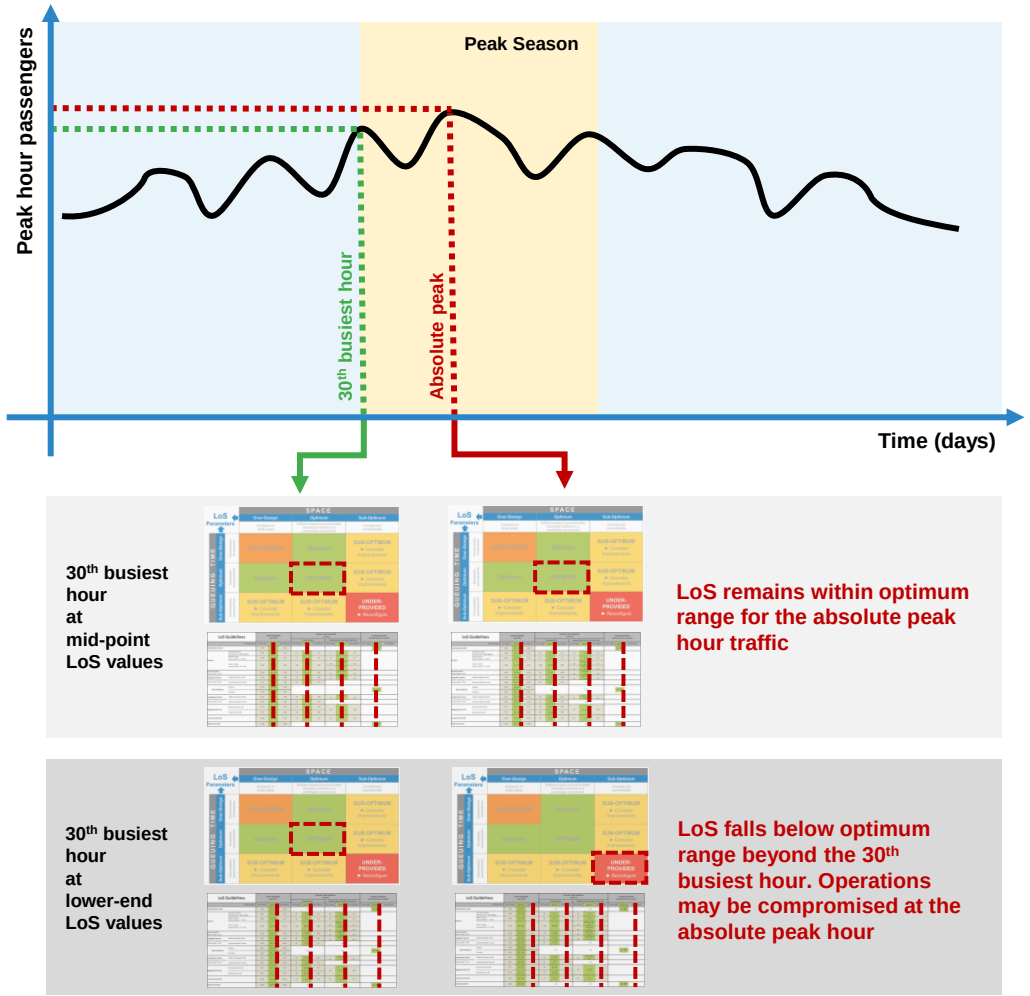


Figure 3. Implications on the peak hour



Review of Air New Zealand's submission

IATA Level of Service Clarifications

Auckland Airport Parameters

- All passenger facilities included in the Domestic Processor building have been designed to mid-point optimum LoS both in terms of maximum queue times and space per passenger.
- Contact gate lounges have been designed to mid-point optimum values in terms of seating provision, and low-end optimum in terms of space per passenger.
- Remote gate lounges are the only facilities designed to low-end optimum values, both for seating provision and space per passenger.
- Low-end values have been used for the gate lounge design as independent seating areas have been provided along the pier for additional space.
- It is also assumed part of the circulation area along the pier can be used by departing passengers under high turnout circumstances.
- Bussing lounges have a lower seat provision percentage, due to the lower utilisation of these gates and lower LoS to be expected from a remote operation.

Air New Zealand Interpretation

- Air New Zealand presents an equivalence between traffic markets and LoS that is not supported by IATA.
- Air New Zealand proposes a LoS degradation not suitable for the type of airport Auckland Airport is.
- Air New Zealand does not consider the capacity and resiliency implications of the LoS.

Conclusion

- AIAL has applied LoS values in line with international best practices for the most cost-effective outcome.

Process			Maximum Queue Time LoS	IATA LoS	Space per passenger LoS	IATA LoS	Passenger Percentage	IATA LoS
Boarding Pass Control	INT		1min	N/A	1.1m2/pax	N/A	N/A	N/A
	DOM		1min	N/A	1.1m2/pax	N/A	N/A	N/A
	D-I Transfers		1min	N/A	1.1m2/pax	N/A	N/A	N/A
Security Control	INT		7.5min	Mid-point Optimum	1.1m2/pax	Mid-point Optimum	N/A	N/A
	DOM		7.5min	Mid-point Optimum	1.1m2/pax	Mid-point Optimum	N/A	N/A
	D-I Transfers		7.5min	Mid-point Optimum	1.1m2/pax	Mid-point Optimum	N/A	N/A
Emigration Control	Counters		7.5min	Mid-point Optimum	1.1m2/pax	Mid-point Optimum	N/A	N/A
	eGates		3min	Mid-point Optimum	1.1m2/pax	Mid-point Optimum	N/A	N/A
Gate Lounges	Contact	Standing	N/A	N/A	1.2m2/pax	Low-end Optimum	40%	Mid-point Optimum
		Seating			1.8m2/pax	Low-end Optimum	60%	Mid-point Optimum
	Remote	Standing	N/A	N/A	1.2m2/pax	Low-end Optimum	50%	Low-end Optimum
		Seating			1.8m2/pax seated	Low-end Optimum	50%	Low-end Optimum

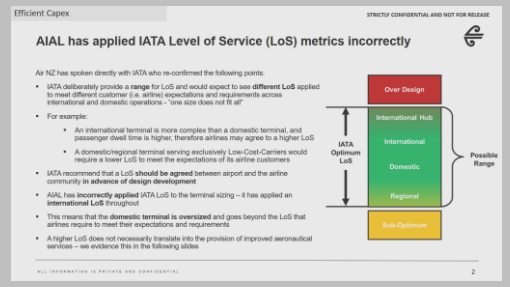
Figure 4. Equipment and queueing areas

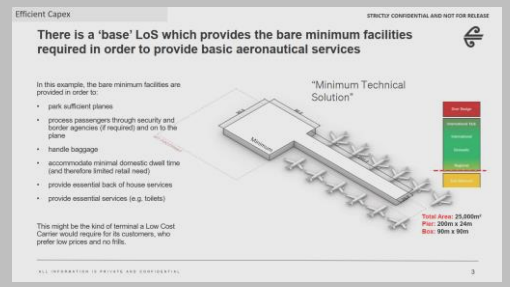
Review of Air New Zealand's submission

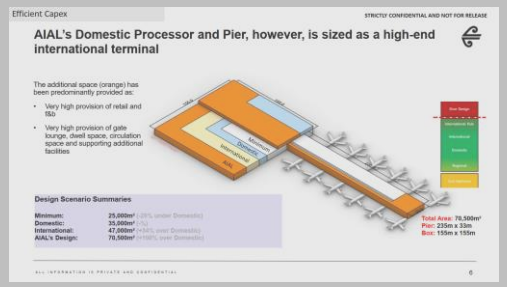
Non-Passenger Processing Areas

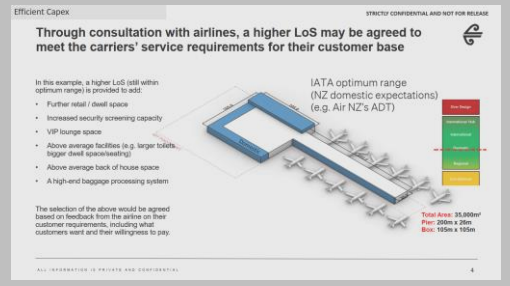
CONSULTATION PROCESS

- The elements not subject to LoS listed below have been sized following extensive internal and external stakeholder consultation in accordance with IATA's guidelines
- The consultation process included Air New Zealand, whose feedback has driven BoH area requirements and pier internal configuration









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Additional Areas Not Accounted For

- Air New Zealand proposes an **equivalence between the overall m2 of the terminal with the LoS**. This is **not supported by IATA**.
- **Air New Zealand's alternative** GFA submission also **excludes key elements** needed for an airport terminal. These include:
  - **Back-of-house tenancies** for the various airlines, agencies, retail outlets, airport operator, and baggage handling, typically ranging from an **additional 30% - 60%** of the functional area.
  - **Front of house circulation** being the main circulation routes between processes. Typically **ranging from 20% - 30%** of the functional area. 5m wide corridors are provided for unidirectional flows, 8m for bidirectional, and 10m for areas with high loads.
  - **Plant, MEP and building services** typically **ranging from 15%-20%** of the functional area. Depending on local conditions such as the level of local services and terminal volume.
  - **Commercial areas** including retail, F&B outlets and airline lounges. Sized according to the airlines' and airport's commercial strategy.
  - **Amenities,** being a critical component of the ASQ ratings and standardized across the terminal building.
- **IATA does not provide LoS requirements for any of the items listed**.
- The **sizing** of these facilities **follows an independent process**, being the result of **stakeholder consultation** (BoH tenancies), building services **engineering** (plant/MEP), **commercial studies** (retail and F&B), and the overall **terminal arrangement** (circulation).
- It must be noted that as a **brownfield site and terminal extension** – rather than a new standalone building – the Domestic Processor i**ncludes passenger processes not exclusive to DOM** traffic – i.e. Emigration, INT security, BHS, EBS, terminal logistics.
- Brownfield sites also need to navigate **legacy issues**, leading to **increased space requirements** as greenfield sites.
- Following pages include a GFA benchmark for similar DOM terminals.

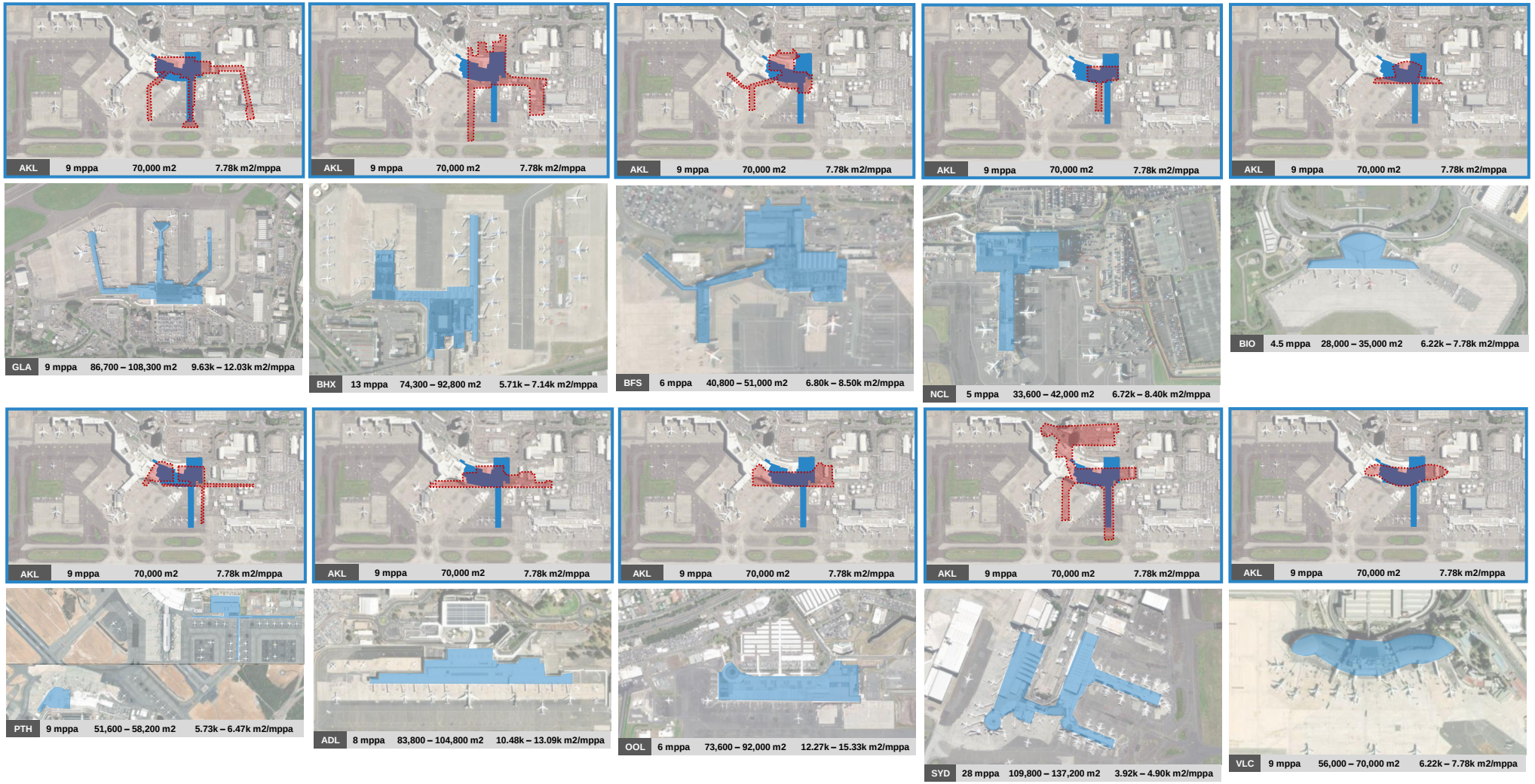
Review of Air New Zealand's proposal

GFA Benchmarks - Summary

CONCLUSION
- AIAL's GFA provision presents similar metrics to airports of comparable size
- ANZ's GFA proposal of 35,000m2 is akin to airports of 5mppa capacity

Figure 5. GFA Benchmarks - Summary

Note: Area metrics shown in this benchmark have been obtained using satellite imagery and publicly available floor plans. As such, values presented below must be considered as an approximation.



Airport	Capacity (mppa)	GFA (m2)	x1000 m2/mppa
AKL	9	70,000	7.78
GLA	9	86,700	9.63
		108,300	12.03
BHX	13	74,300	5.71
		92,800	7.14
BFS	6	40,800	6.80
		51,000	8.50
NCL	5	33,600	6.72
		42,000	8.40
BIO	4.5	28,000	6.22
		35,000	7.78
PTH	9	51,600	5.73
		58,200	6.47
ADL	8	83,800	10.48
		104,800	13.09
OOL	6	73,600	12.27
		92,000	15.33
SYD	28	109,800	3.29
		137,200	4.90
VLC	9	56,000	6.22
		70,000	7.78

Review of Air New Zealand's submission

GFA Benchmarks – Comparable Traffic Volume

Figure 6. GFA Benchmarks – Comparable Traffic Volumes

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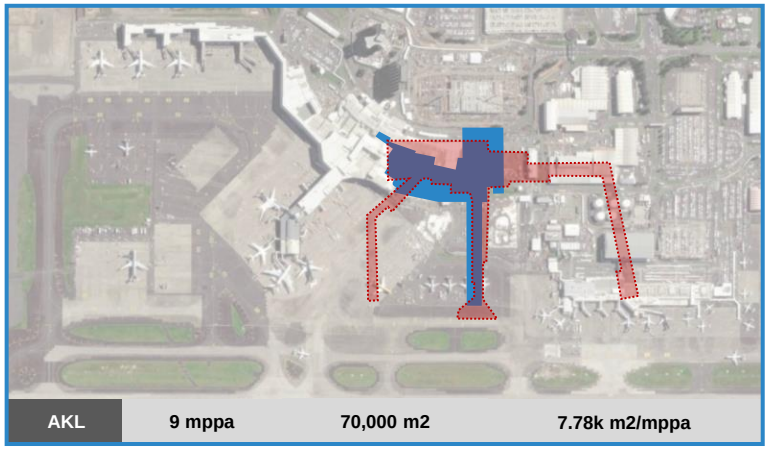
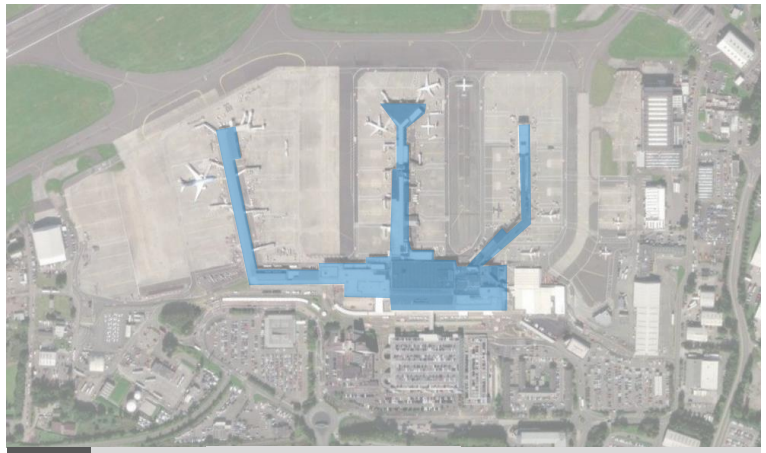


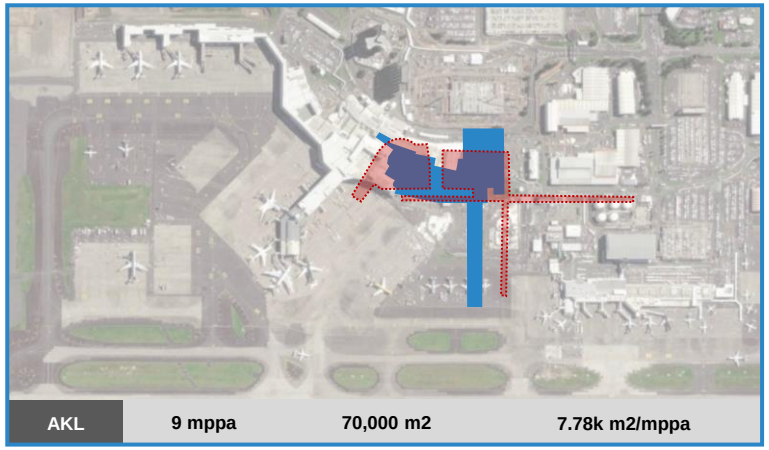
AKL	9 mppa	70,000 m2	7.78k m2/mppa

Glasgow International Airport (UK)

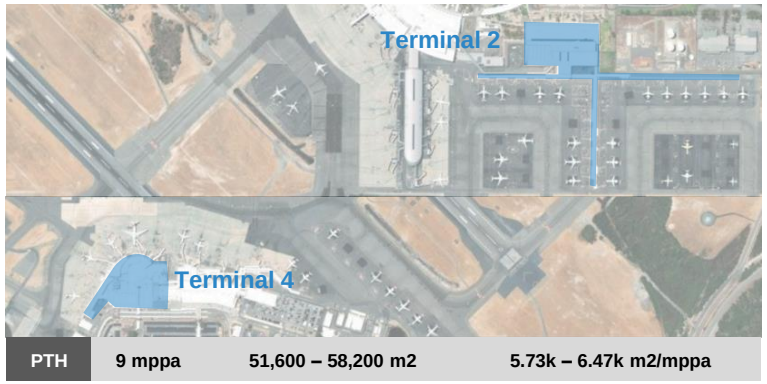
- Mix of domestic, international SH and international LH traffic
- Mix of Full Service and Low-Cost Carriers
- 3 levels across most of the footprint
- City population of c. 1.8 million inhabitants



GLA	9 mppa	86,700 – 108,300 m2	9.63k – 12.03k m2/mppa



AKL	9 mppa	70,000 m2	7.78k m2/mppa



PTH	9 mppa	51,600 – 58,200 m2	5.73k – 6.47k m2/mppa

Perth Airport – Terminal 2 & Terminal 4 (AU)

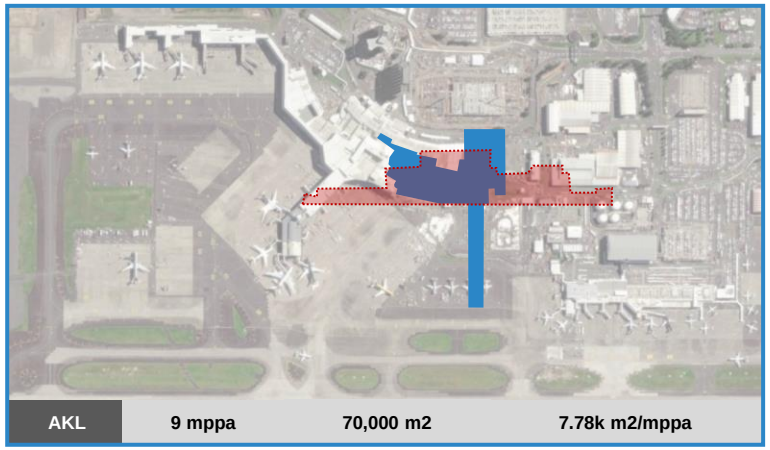
- Regional and domestic Low-Cost Carriers in Terminal 2
- Domestic Full Service Carriers in Terminal 4
- 1 level in Terminal 2. 2 levels in Terminal 4
- City population of c. 2.3 million inhabitants

Review of Air New Zealand's submission

GFA Benchmarks – Comparable Traffic Volume

Figure 7. GFA Benchmarks – Comparable Traffic Volumes

Note: Area metrics shown in this benchmark have been obtained using satellite imagery and publicly available floor plans. As such, values presented below must be considered as an approximation.

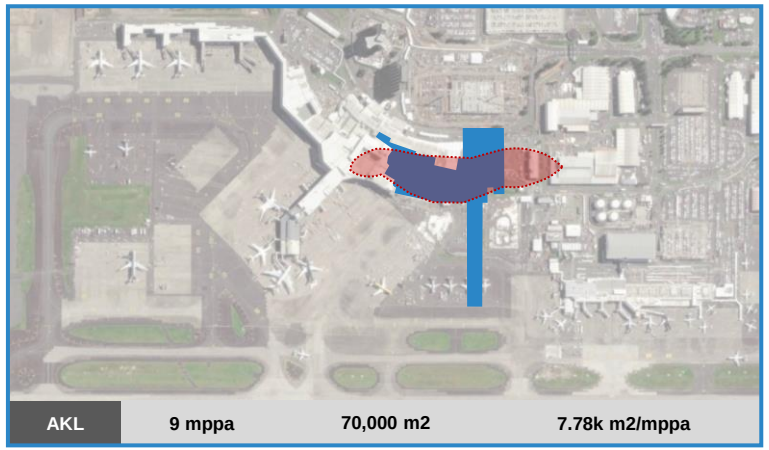


AKL	9 mppa	70,000 m2	7.78k m2/mppa

Adelaide Airport (AU)

- Mix of domestic, international SH and international LH
- Mix of Full Service and Low-Cost Carriers
- 2.5 levels across most of the footprint
- City population of c. 1.4 million inhabitants

ADL	8 mppa	83,800 – 104,800 m2	10.48k – 13.09k m2/mppa



AKL	9 mppa	70,000 m2	7.78k m2/mppa

Valencia Airport (SP)

- Mix of domestic and international SH
- Mix of Full Service and Low-Cost Carriers
- 2.5 levels across most of the footprint
- City population of c. 2.5 million inhabitants

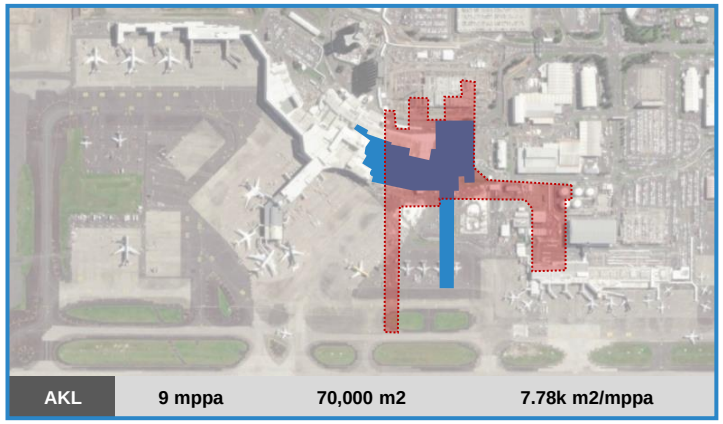
VLC	9 mppa	56,000 – 70,000 m2	6.22k – 7.78k m2/mppa

Review of Air New Zealand's submission

GFA Benchmarks – Bigger Traffic Volume

Figure 8. GFA Benchmarks – Bigger Traffic Volume

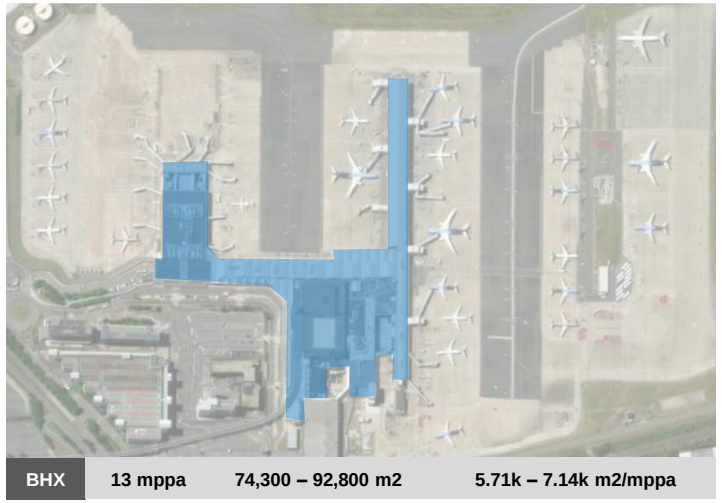
Note: Area metrics shown in this benchmark have been obtained using satellite imagery and publicly available floor plans. As such, values presented below must be considered as an approximation.



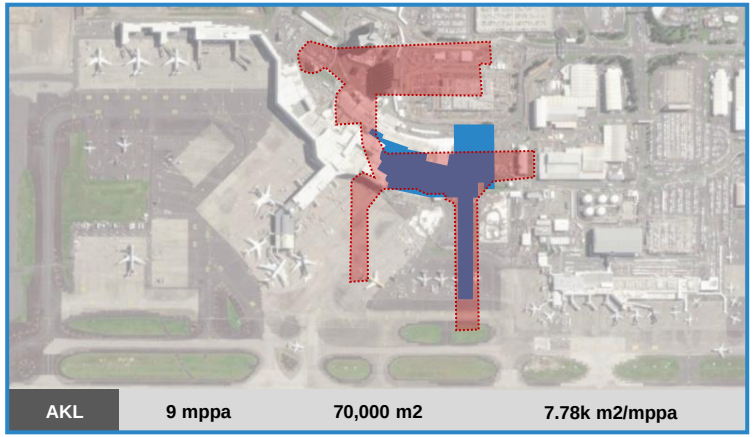
AKL	9 mppa	70,000 m2	7.78k m2/mppa

Birmingham Airport (UK)

- Mix of domestic, international SH and international LH traffic
- Mix of Full Service and Low-Cost Carriers
- 3 levels across most of the footprint
- City population of c. 1.8 million inhabitants



BHX	13 mppa	74,300 – 92,800 m2	5.71k – 7.14k m2/mppa



AKL	9 mppa	70,000 m2	7.78k m2/mppa

SYD	28 mppa	109,800 – 137,200 m2	3.92k – 4.90k m2/mppa

Sydney Airport – Terminals 2 & 3

- Domestic and regional terminals
- Mix of Full Service and Low-Cost Carriers
- 2 levels across most of the footprint
- City population of c. 5.4 million inhabitants

Review of Air New Zealand's submission

GFA Benchmarks – Lower Traffic Volume

Figure 9. GFA Benchmarks – Lower Traffic Volume

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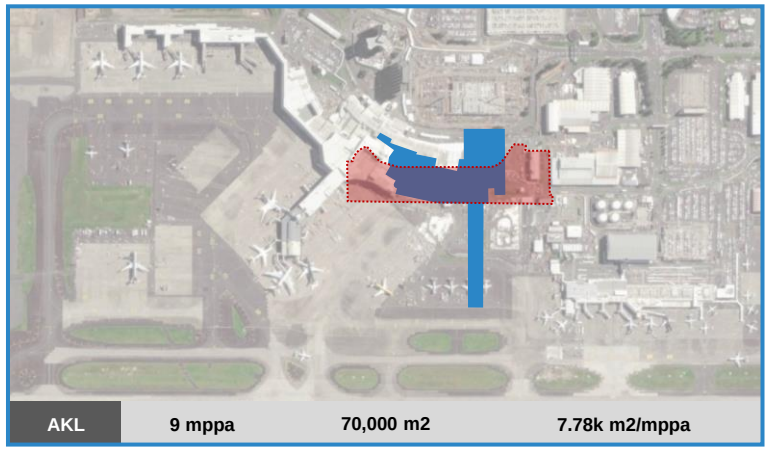
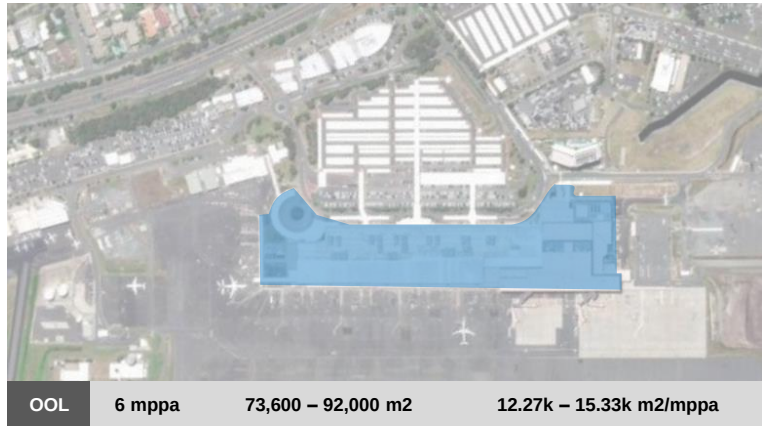


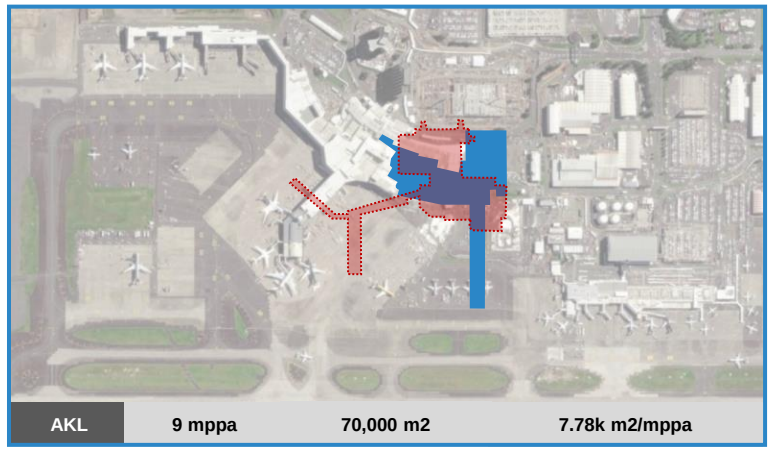
AKL	9 mppa	70,000 m2	7.78k m2/mppa

Gold Coast Airport (AU)

- Mix of domestic, international SH and international LH traffic
- Mix of Full Service and Low-Cost Carriers
- 1 level across most footprint. Up to 3 levels in some areas
- City population of c. 0.6 million inhabitants



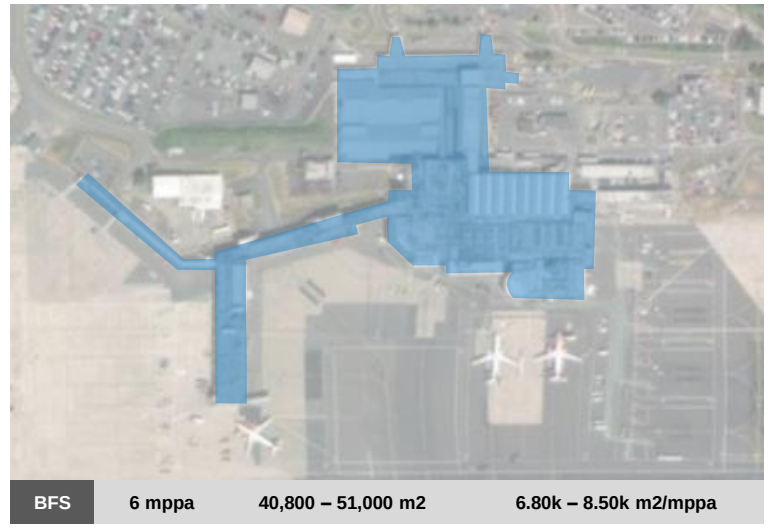
OOL	6 mppa	73,600 – 92,000 m2	12.27k – 15.33k m2/mppa



AKL	9 mppa	70,000 m2	7.78k m2/mppa

Belfast Airport (UK)

- Mix domestic and international SH traffic
- Low-Cost Carriers and Charter
- 2 levels across most footprint
- City population of c. 0.3 million inhabitants



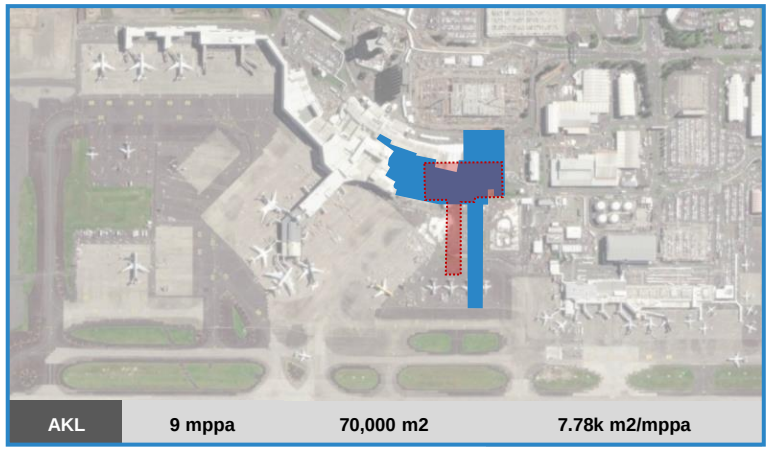
BFS	6 mppa	40,800 – 51,000 m2	6.80k – 8.50k m2/mppa

Review of Air New Zealand's submission

GFA Benchmarks – Lower Traffic Volume

Figure 10. GFA Benchmarks – Lower Traffic Volume

Note: Area metrics shown in this benchmark have been obtained using satellite imagery and publicly available floor plans. As such, values presented below must be considered as an approximation.

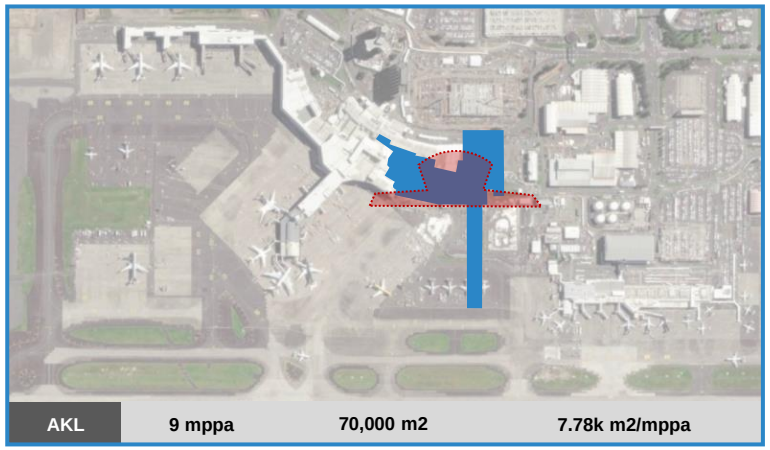


AKL	9 mppa	70,000 m2	7.78k m2/mppa

Newcastle Airport (UK)

- Mix domestic and international SH traffic
- Mix of Full Service and Low-Cost Carriers
- 2 levels across most of the footprint
- City population of c. 0.3 million inhabitants

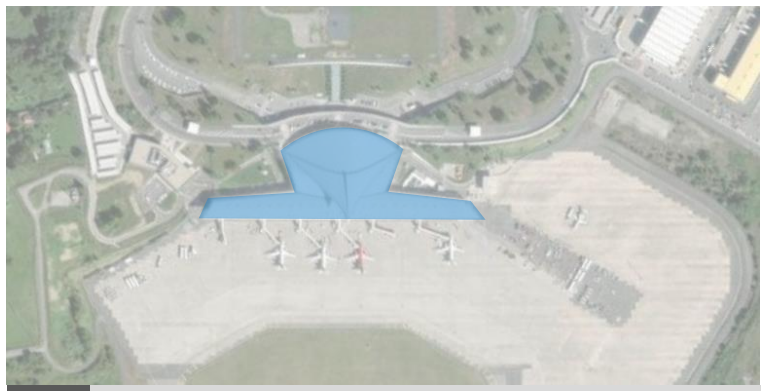
NCL	5 mppa	33,600 – 42,000 m2	6.72k – 8.40k m2/mppa



AKL	9 mppa	70,000 m2	7.78k m2/mppa

Bilbao Airport (SP)

- Mix of domestic and international SH
- Mix of Full Service and Low-Cost Carriers
- 2 levels across most of the footprint
- City population of c. 0.3 million inhabitants



BIO	4.5 mppa	28,000 – 35,000 m2	6.22k – 7.78k m2/mppa

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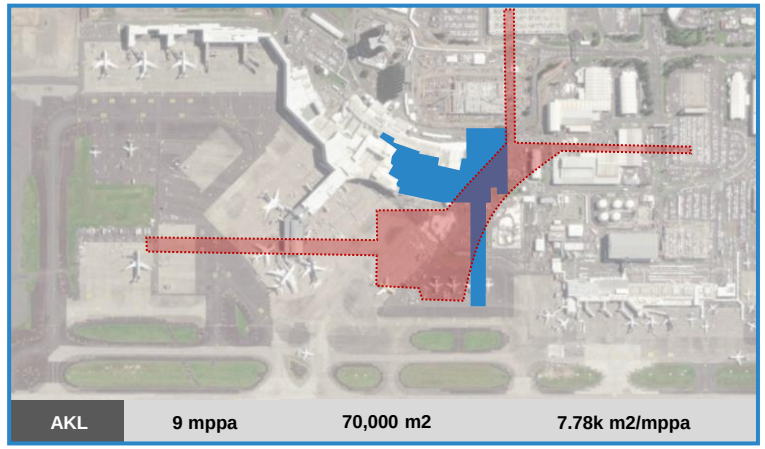
GFA Benchmarks – Additional Comparison

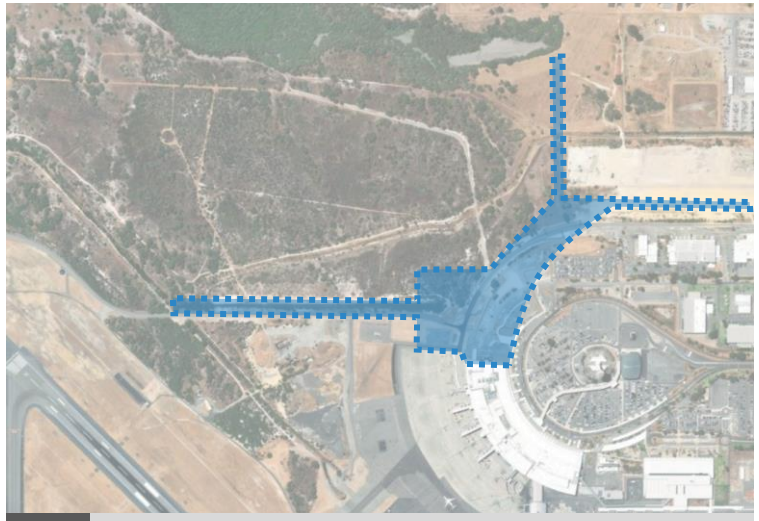
Figure 11. GFA Benchmarks – Additional Comparison



AKL	9 mppa	70,000 m2	7.78k m2/mppa

Perth Airport – New Terminal (AU)

- All international traffic
- Quantas group domestic
- Internal configuration to be defined. Minimum of 2 levels
- City population of c. 2.3 million inhabitants



PER	17 mppa	120,000 – 125,000 m2	7.06k – 7.35k m2/mppa

NOTE:

- New terminal building under planning process
- Comparable m2 to passenger ratios as AKL Domestic Processor
- Area provision expected to grow as BoH and Plant areas are added
- Agreed in principle by Qantas Group

Note: Area metrics shown in this benchmark have been obtained using satellite imagery and publicly available floor plans. As such, values presented below must be considered as an approximation.

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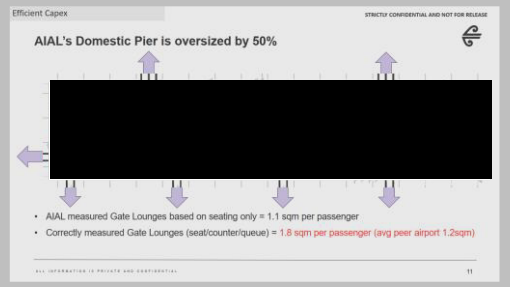
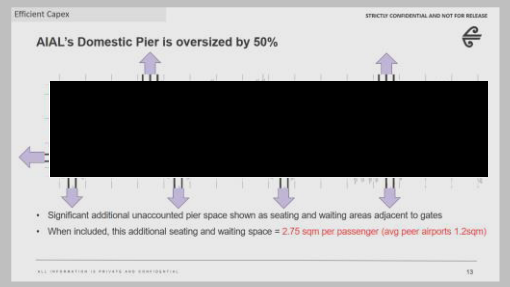
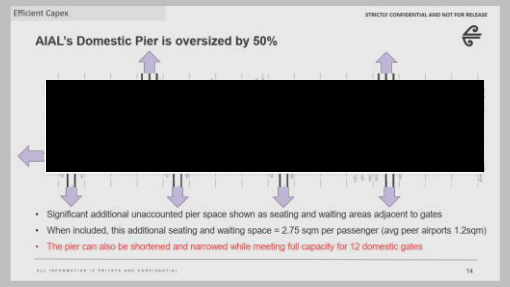
Pier Optimisation Clarifications







KEY POINTS RAISED BY Air NZ

- AIAL's pier is oversized by 50% in terms of m2/pax when compared to average peer airports.
- Gate lounge areas have been measured incorrectly, excluding counter and queueing space.
- Additional unaccounted pier space used for retail and seating space.
- There is potential to reduce pier width and pier length while still serving 12 gates.

Clarifications

- **Pier width and length is in line with international benchmarks** summarised in following pages.
- **Pier length** is **aligned with the apron** layout, **fixed link locations**, plant room requirements, bus lounges and airline tenancies **requirements** (including Air New Zealand's) **on the ground floor**.
- Air New Zealand's **pier length reduction** submission in the feasibility study report, leaves two gates being served by a single link bridge. This configuration **will block one gate while the adjacent is in use**. This approach will hinder **internal gate lounge configurations** at the pier end.
- **Pier width** is the result of a 10m circulation corridor that allows for **bidirectional flows on a double-loaded concourse**. This provision is **in line with international guidance** (ACRP R25).
- The **remaining** components of the **pier width** are derived from the **gate lounge width**, including boarding queue areas.
- The **standard toilet blocks** distributed along the pier provide a **fixed width** constraint on each side of the pier.
- **Any width reductions will be carried out at the expense of circulation areas, against international best practices.**
- **Gate Lounge area requirements have been obtained** using the expected passenger occupancy per gate based on the design aircraft. Applying **IATA LoS** values of seated passengers and m2/pax as described in previous sections.
- **Other items identified by Air New Zealand** correspond to retail requirements (Pier F&B outlets), customer experience items (interactive zone) and circulation elements (VT lobby), all of which **are required for the operation and in line with international best practice**.
- The **area identified by Air New Zealand at the front of each gate** cannot be considered part of the gate lounge, as it **must remain unblocked to allow for disembarking passengers**.
- **Air New Zealand's approach** of an overall m2/pax for the pier **does not align with international best practice**. Items must be sized independently.

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Oversize Clarifications

Clarifications

- Area per passenger metrics indicated by Air NZ are not in line with IATA LoS calculations.
- At a 50/50 split between seated and standing passengers, 1.8m2/seat, and 1.2m2/standing, leads to an **overall ratio of 1.5m2/pax.** This is the ratio required to meet IATA LoS Optimum lower end.
- This is the minimum area per passenger to be provided at gate lounges to comply with IATA LoS Optimum range. **Peer airport's metric of 1.2m2/pax is not aligned with this figure**.
- AIAL has used values below the IATA LoS Optimum range for seating areas, at 1.6m2/seat.
- While **IATA** does mention that sufficient area for **queueing and boarding** must be provided, it **does not include this** process **in the LoS calculation**.
- **ACRP Rpt 25** mentions a **clear area of 7m from the wall** to include boarding desks and their queueing area. It also mentions **a 1.8m wide circulation** corridor from the boarding bridge to the main circulation area.
- Informal seating areas have been provided to compensate for low-end optimum range area/pax metrics.

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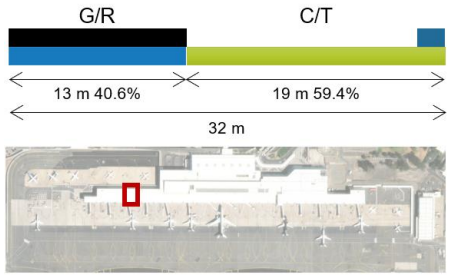
Pier Width Benchmarks – Summary

CONCLUSION
- Pier widths and its internal configuration vary significantly between airports.
- Common arrangements show similar configurations to AIAL's

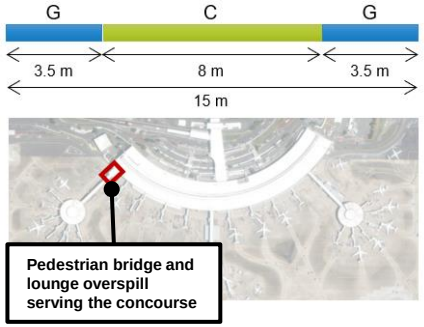
Figure 12. Pier Width Benchmarks - Summary

G : Gate Lounge **C : Circulation** **R : Retail** **T : Travellator(s)**

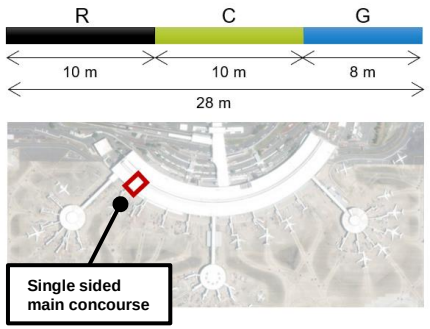
Adelaide Terminal 2B



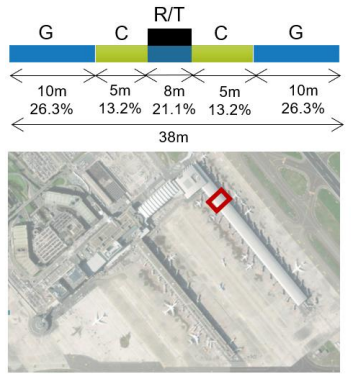
Brisbane – Domestic Terminal (Head of Pier)



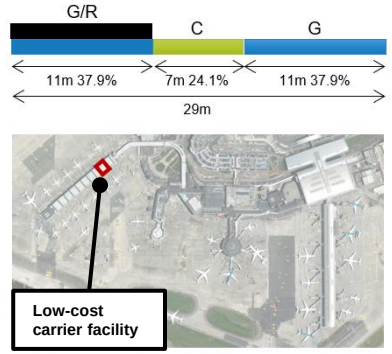
Brisbane – Domestic Terminal (Main Lounge)



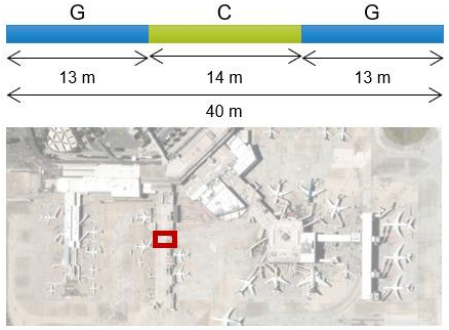
Brussels Airport Pier A (Schengen)



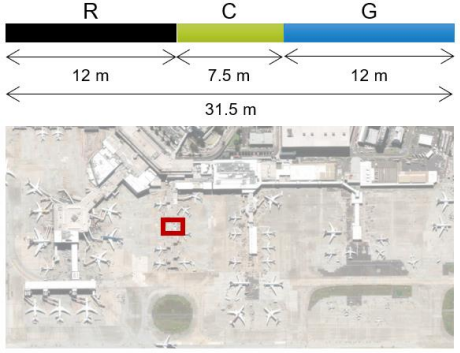
Dublin Terminal 1 – Pier D



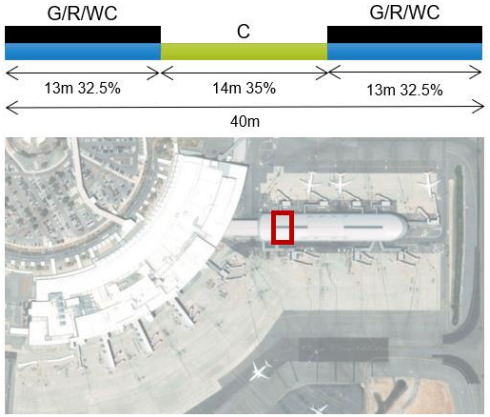
Melbourne T1 – Qantas Domestic



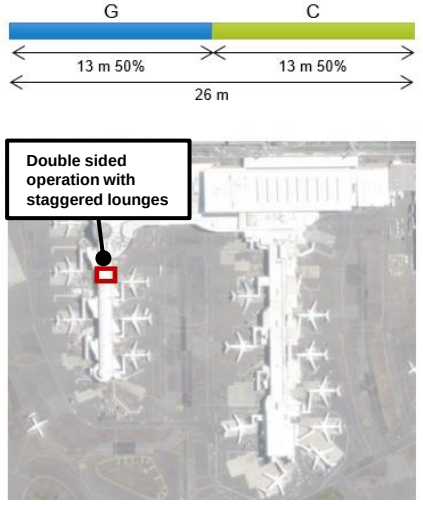
Melbourne T3 – Virgin



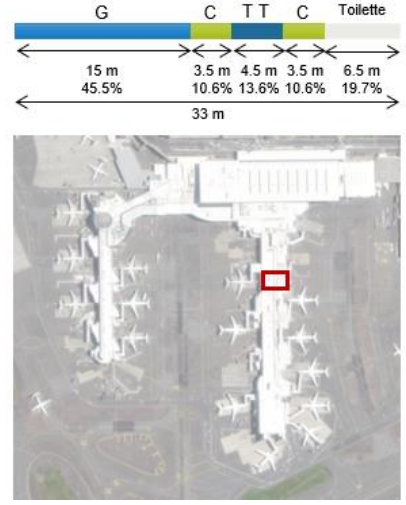
Perth - Terminal 1 (Domestic Pier)



Sydney T2 – Domestic Terminal (Pier 1)



Sydney T2 – Domestic Terminal (Pier 2)



	ADL	BNE - Pier	BNE - Lounge	BRU	DUB	MEL – T1	MEL – T3	PTH – T1	SYD – T2 P1	SYD – T2 P2
Pier Width (m)	32	15	28	38	29	40	31.5	40	26	33
Circulation Width (m)	19	8	10	10	7	14	7.5	14	13	7

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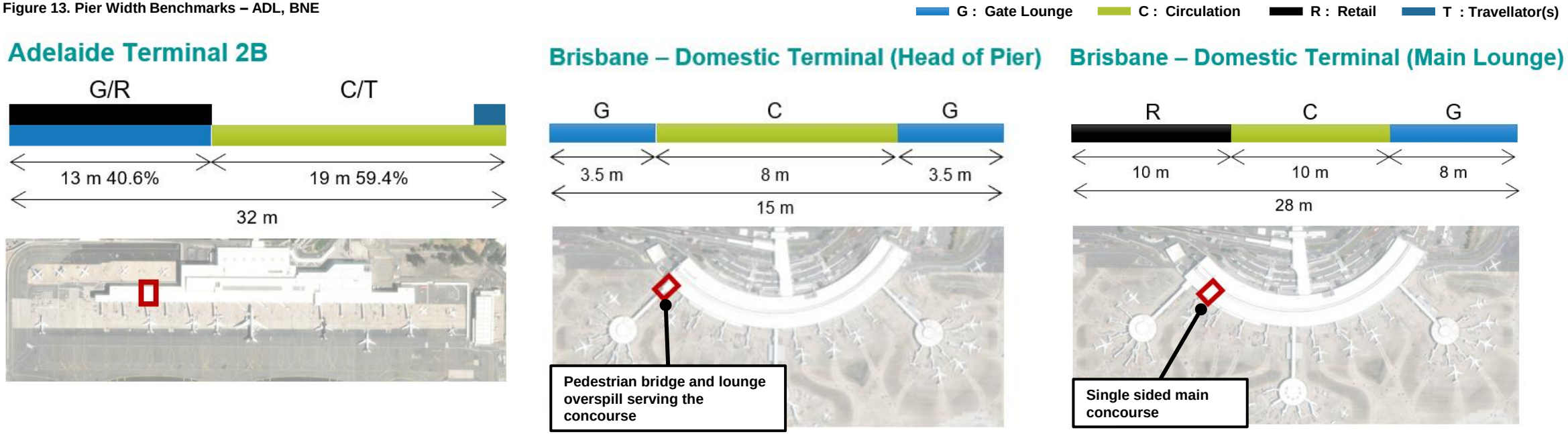
Pier Width Benchmarks – ADL, BNE

Figure 13. Pier Width Benchmarks – ADL, BNE



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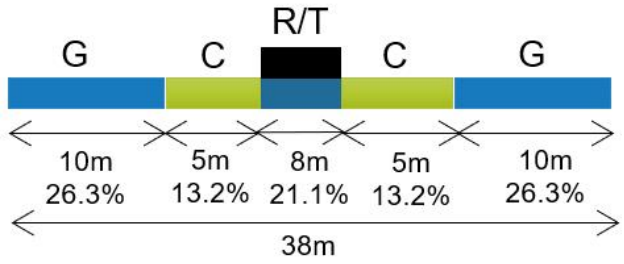
Pier Width Benchmarks – BRU, DUB, MEL

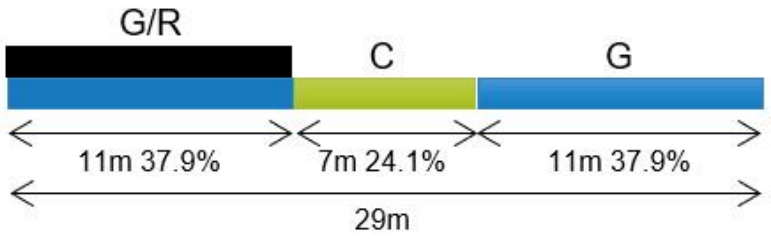
Figure 14. Pier Width Benchmarks – BRU, DUB, MEL

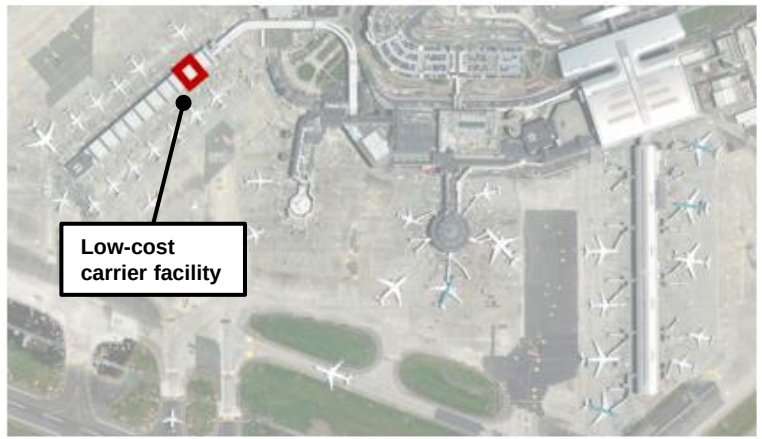
G : Gate Lounge C : Circulation R : Retail T : Travellator(s)

Brussels Airport Pier A (Schengen)

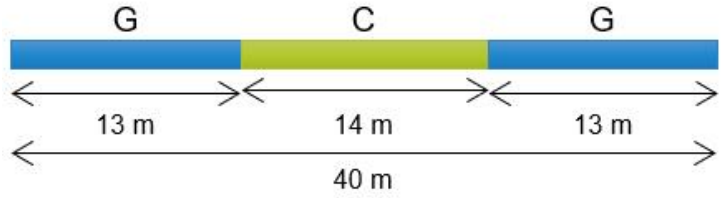


Dublin Terminal 1 – Pier D





Melbourne T1 – Qantas Domestic



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Pier Width Benchmarks – MEL, PTH, SYD

Figure 15. Pier Width Benchmarks – MEL, PTH, SYD