Design Standards for New Aircraft

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Outline

- New Aircraft – Biggest Impact next 20 years
- Aircraft Characteristics Impacts
- Aircraft Pavement Loading Impacts
- Airside Geometry Impacts
- Aircraft Apron Servicing Impacts
- Ongoing Research
- Applied Geometry and Pavement Principles

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ICAO Annex 14 vs. TP 312

Aerodrome Reference Code				
Code element 1			Code element 2	
Code number	Aeroplane reference field length	Code letter	Wing span	Outer main gear wheel span@
1	Less than 800 m	A	Up to but not including 15 m	Up to but not including 4.5 m
2	800 m up to but not including 1200 m	B	15 m up to but not including 24 m	4.5 m up to but not including 6 m
3	1200 m up to but not including 1800 m	C	24 m up to but not including 36 m	6 m up to but not including 9 m
4	1800 m and over	D	36 m up to but not including 52 m	9 m up to but not including 14 m
		E	52 m up to but not including 65 m	9 m up to but not including 14 m
		F	65 m up to but not including 80 m	14 m up to but not including 16 m

@ distance between the outside edges of the main gear wheel

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How far we have come:

Wright Flyer – 1903

- 3 built
- MTOW 430 kg (950 lbs)
- Tire Pressure - N/A
- One Pilot
- No Pax
- No Cargo
- Design “Box” – 12.5m x 6.5m (A)

Airbus A380-800 – 2007

- 33 built (234 ordered (Aug/10))
- MTOW 561,000 kg (1.23 MM lbs)
- Tire Pressure – (218 psi)
- Two Pilots
- 525 to 850 Pax (3 class or 1)
- 6,200 cu. ft.
- Design “Box” – 80m x 72m (F)

New or Planned Aircraft to Consider

- Boeing B787 (2 models) - (2011) **E**
- Airbus A350 (3 models) - (2013) **E**
- Boeing B747-8 - (2011) **E**
- Bombardier CS100/300 - (2013) **C**
- Airbus A320 New/Upgrade - 2018? **C**
- Boeing B737 New/Upgrade - 2018? **C**
- Boeing B777 New/Upgrade - 2016? **E**
- Airbus A380 (2 models) – (2007) **F**

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Aircraft Characteristics and Impacts

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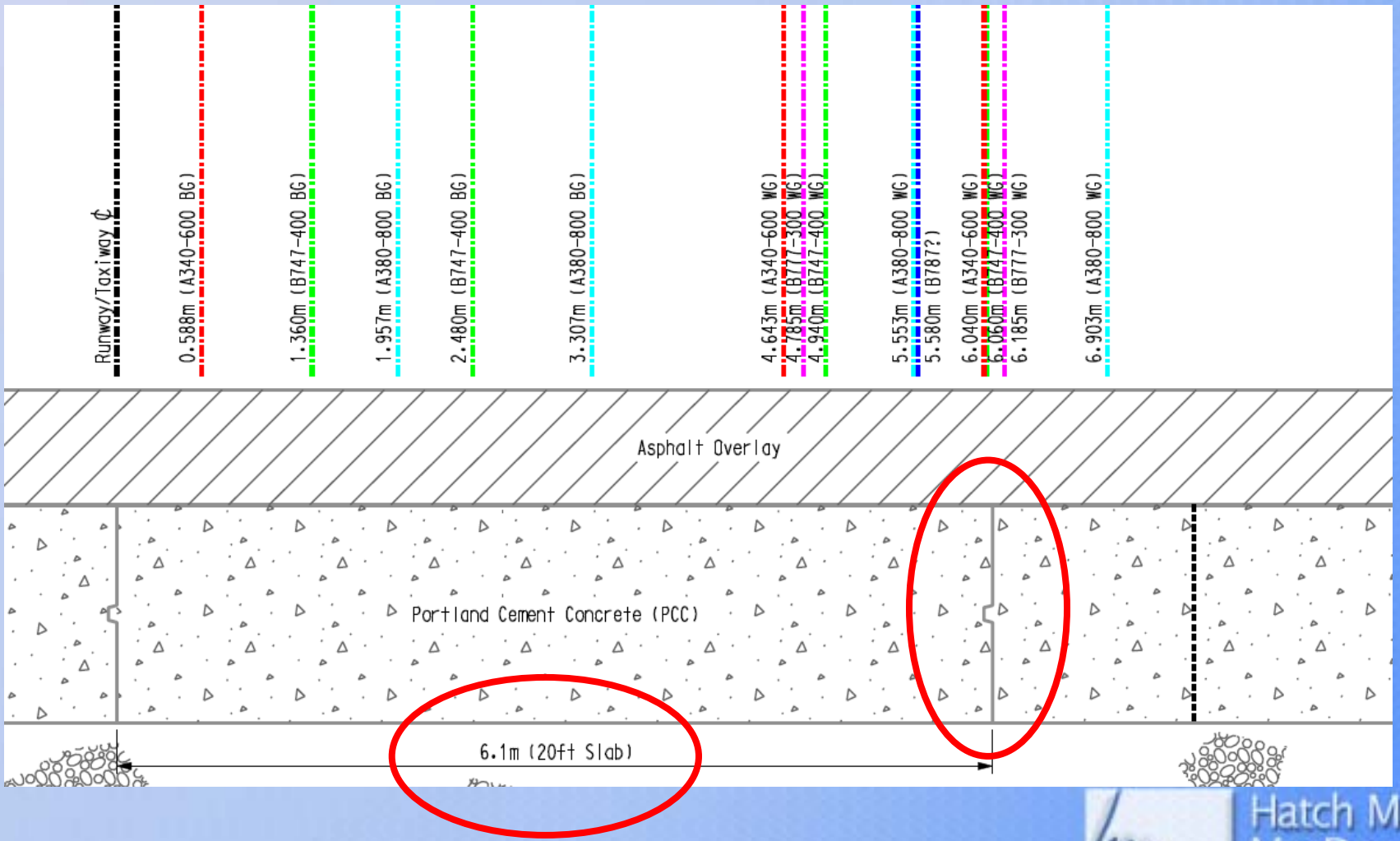
New Aircraft Tracks and Composite Pavements – Why Old "Keys" Deteriorate



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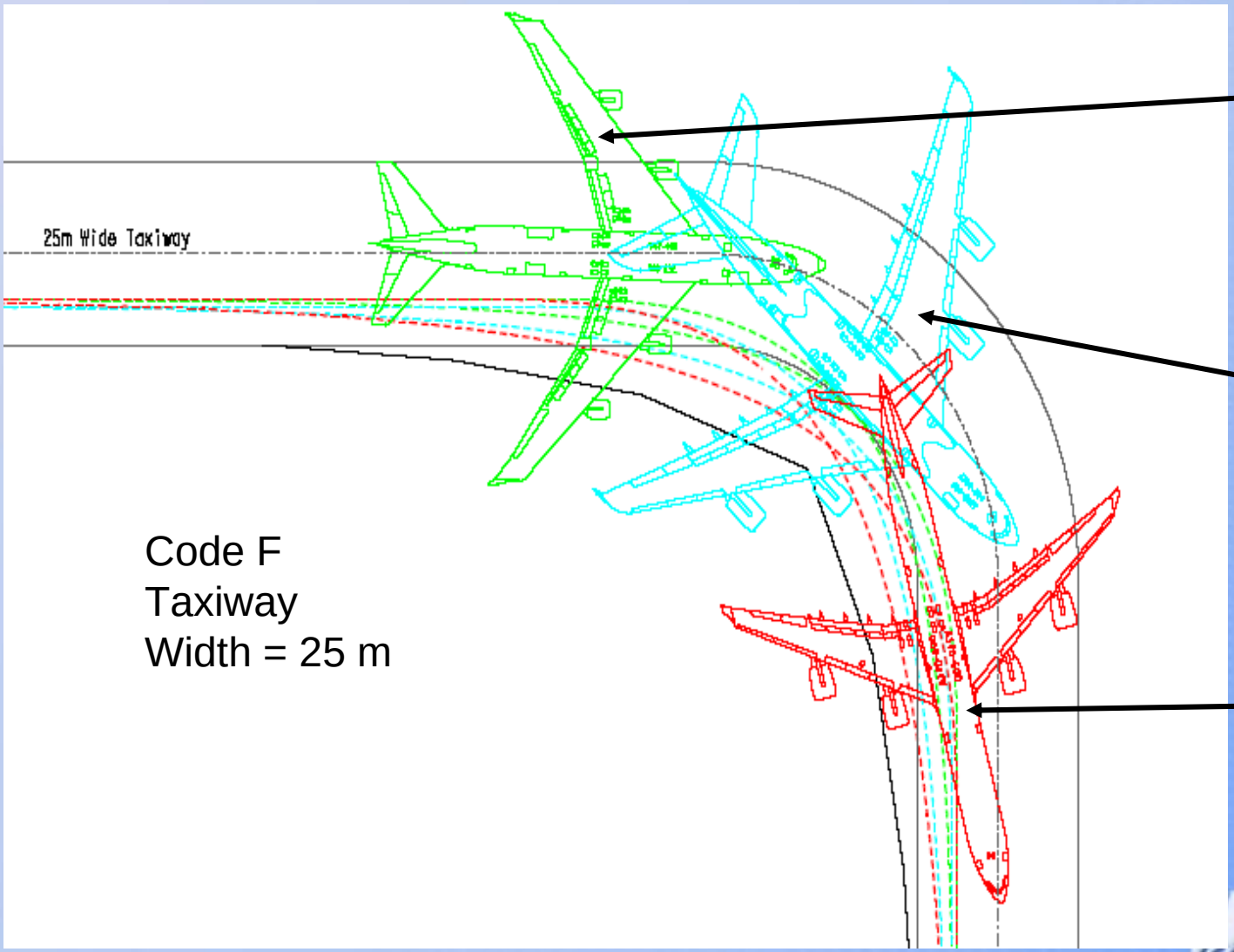
Aircraft Turning and Taxiway Fillets



B747-400

A380-800

A340-600

Code F
Taxiway
Width = 25 m

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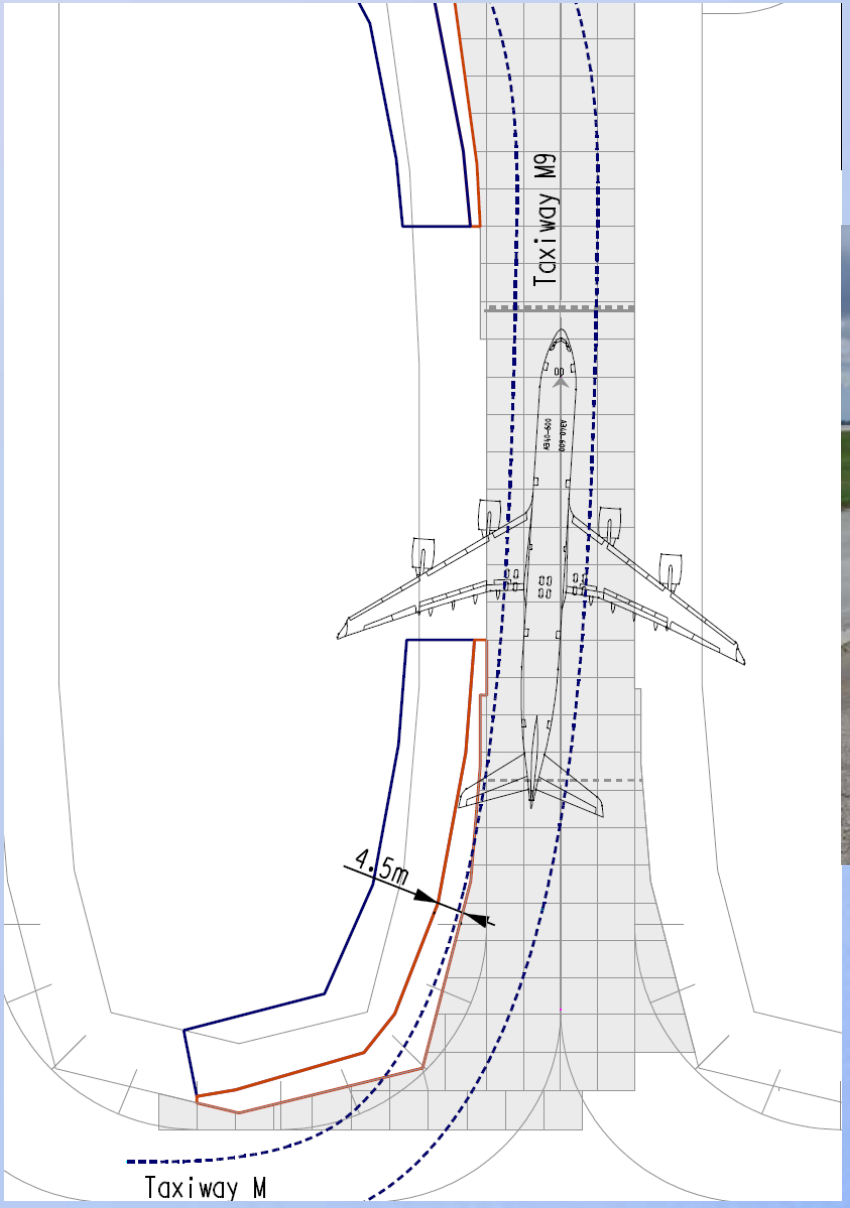
Taxiway Fillet Widening Retrofits



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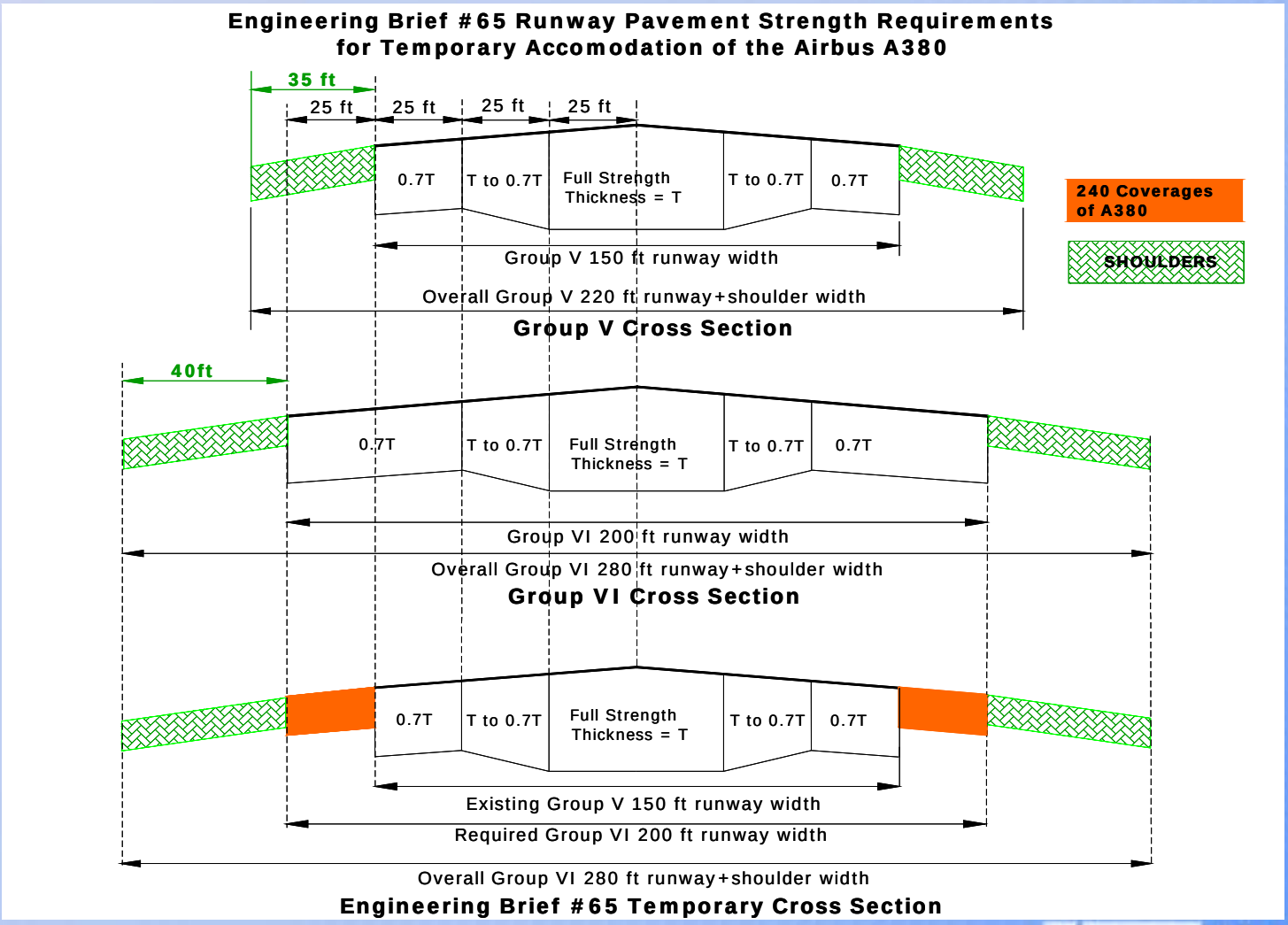
Dealing with Code F Runways – Not in Canada Eh!



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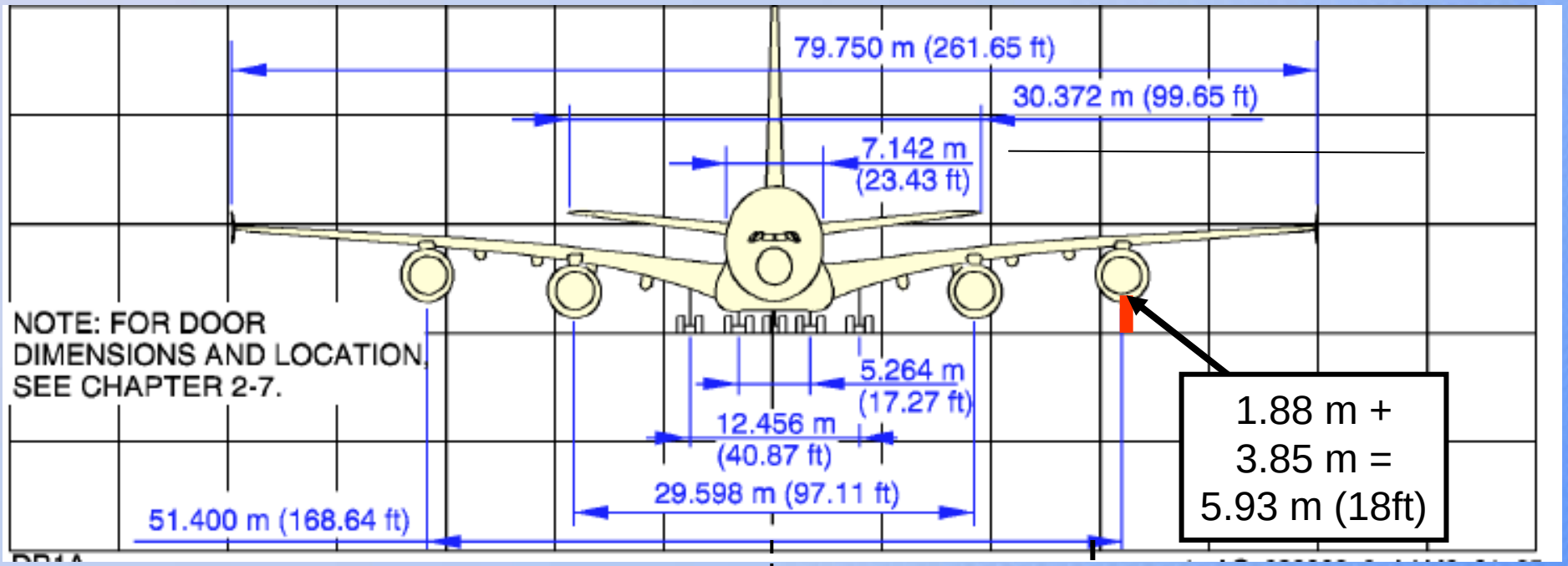
A380 – Twy Code F Shoulders



Code F 25 m Pavement

Code E Pavmt + Shld

Full Code F

44 m

60 m

Limit of Sign Location
21 m

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Aircraft Pavement Loadings Effects

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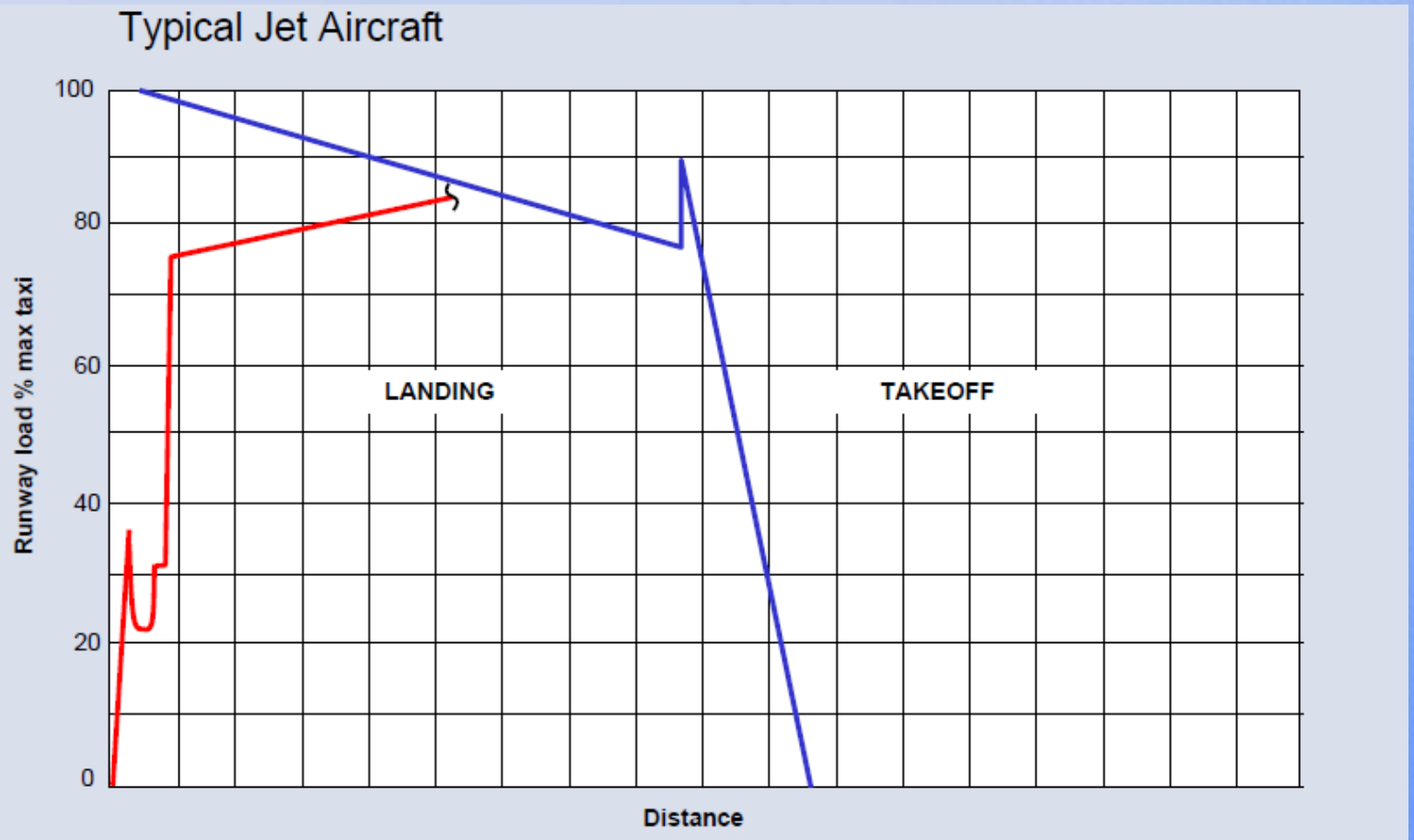
Reminder – Takeoff vs. Landing Loads



Runway pavements are designed for static load.

The impact of landing is only about 38% of the takeoff static load.

Source: Boeing

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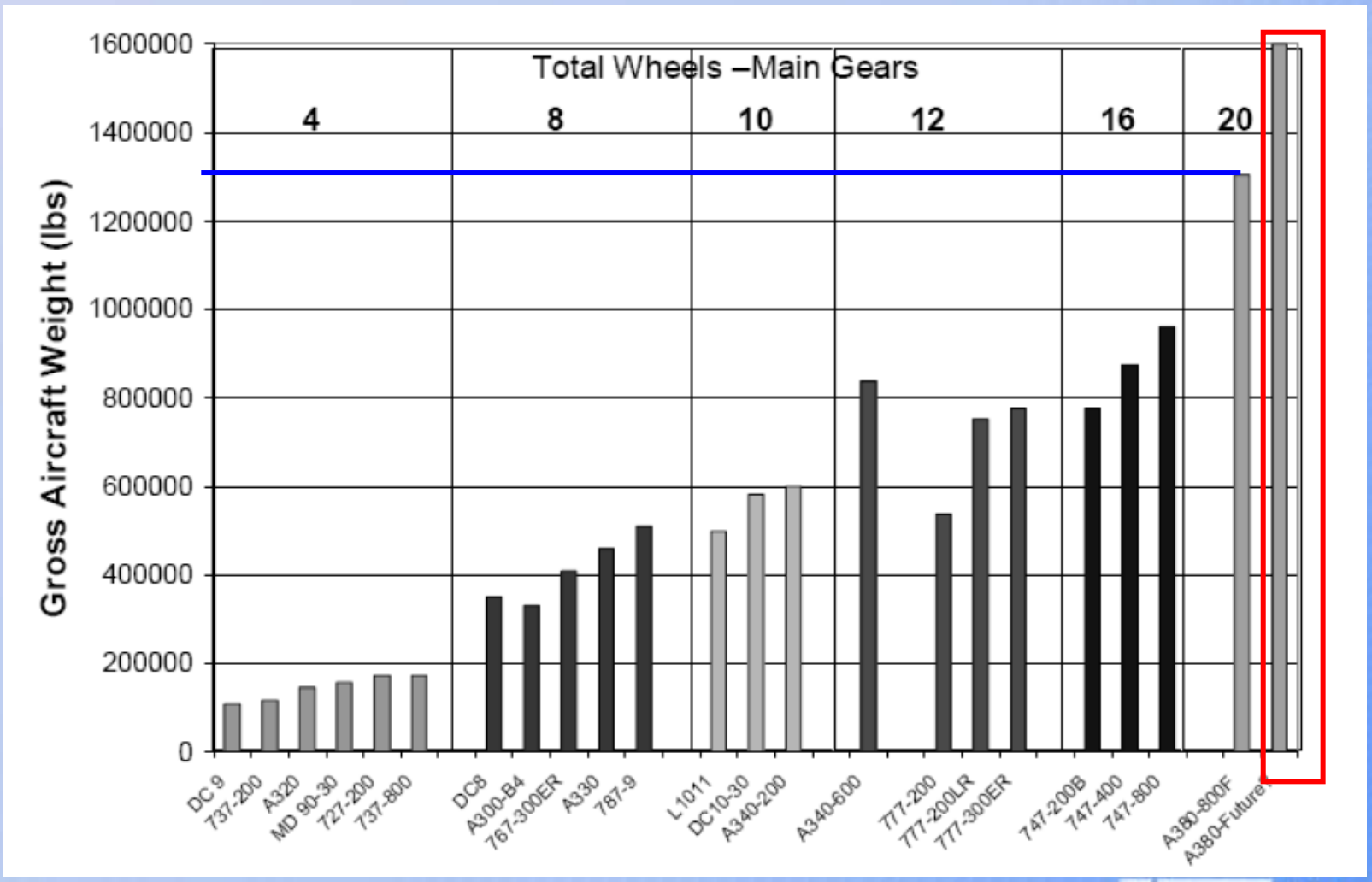
Growth in Aircraft Loading



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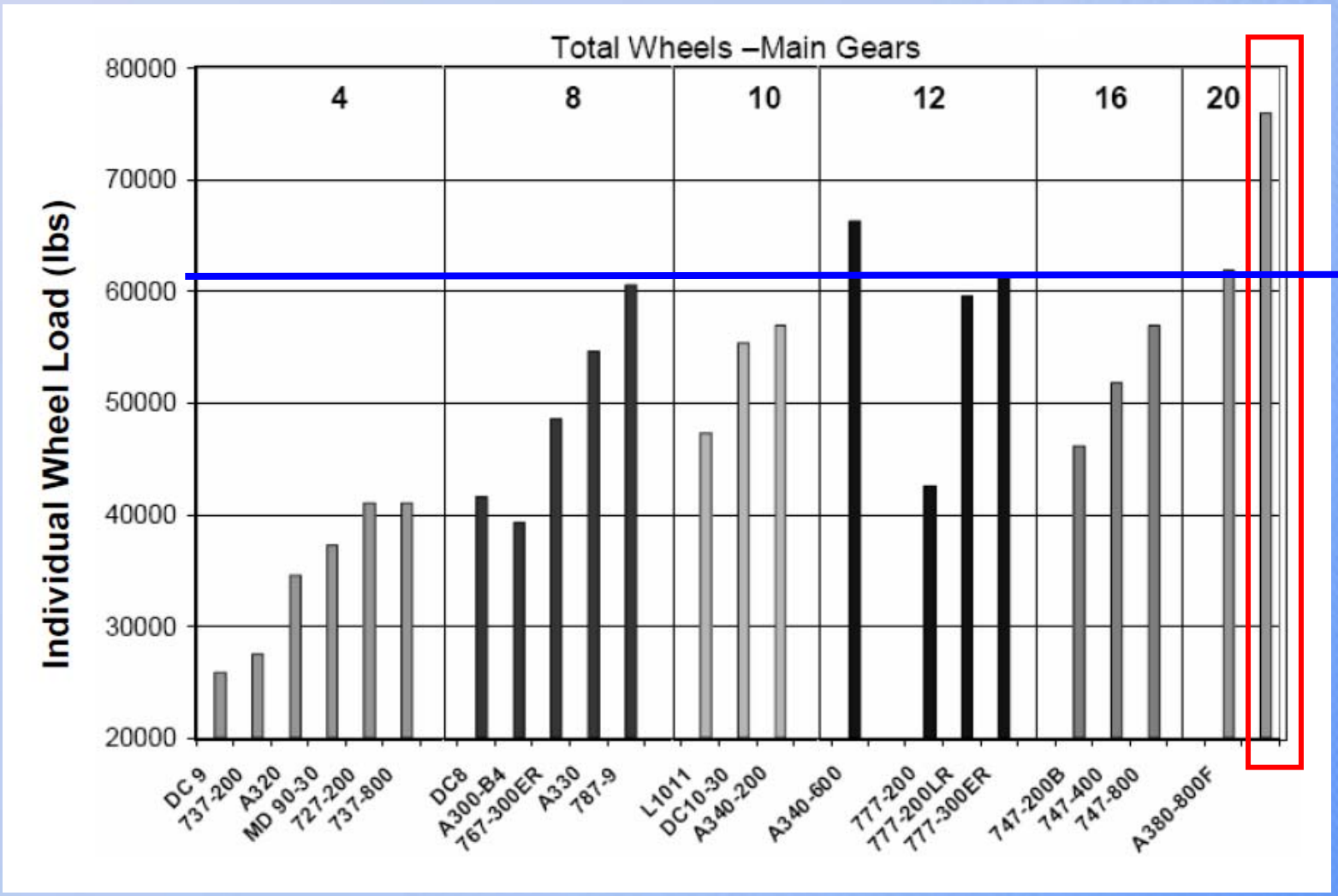
Aircraft Wheel Loads



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B-777- 300ER (1995)

Max. ALR = 12.8

MTOW 353,000 kg (777,000 lbs) – Tire Pres. 221 psi

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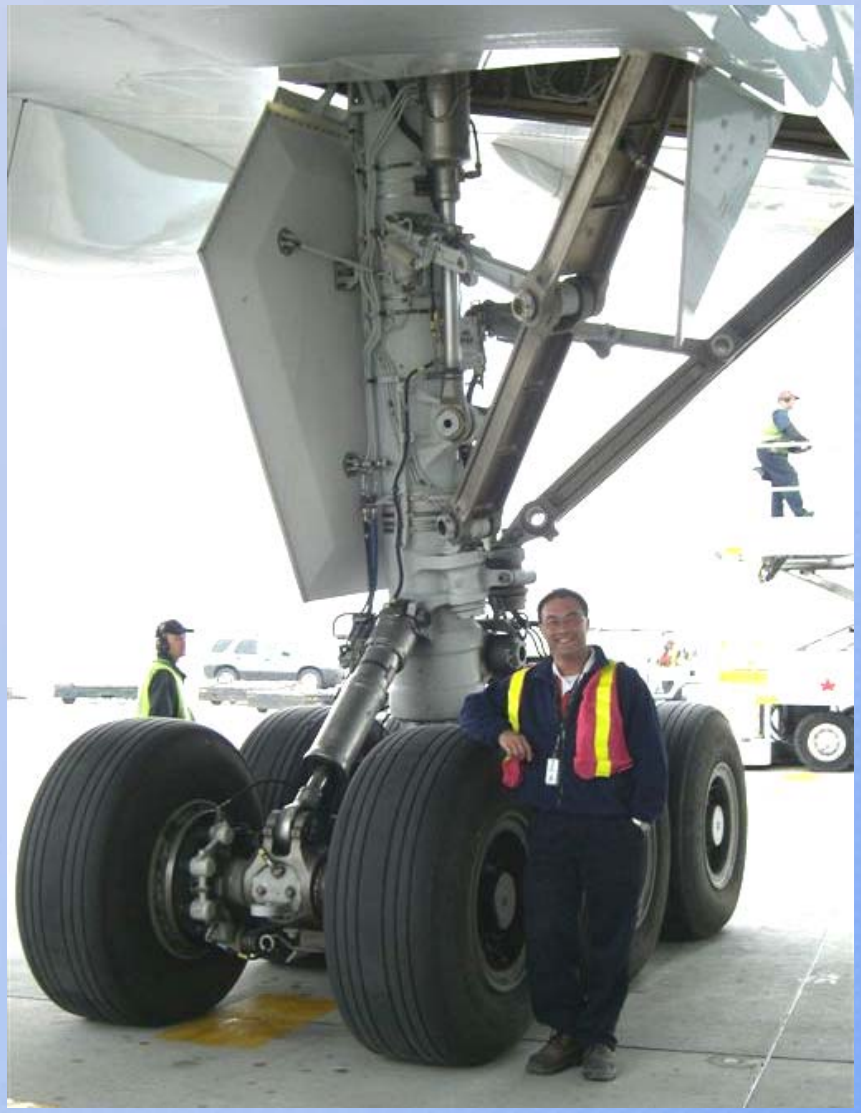
B777-200LR/300ER Gear



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B777-200LR/300ER Gear Load

6 x 60,000 lbs GVW = one B777-200LR/300ER Gear

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Test Vehicle Validation

National Airport Pavement Test Facility (NAPTF)
Atlantic City, New Jersey, USA

Airbus Load Test, Toulouse, France

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Aircraft Tire Pressure Trends- More Rutting on Horizon?

A340-500/600, B747-400ER, A380-800F, B777-300ER B787, A350, B747-8 – all exceed current "X" upper limit of 1.50 MPa (217 psi)

Tire Pressure Category	Current ICAO Limits Psi (MPa)	Proposed New ICAO Limits Psi (MPa)
W	**Unlimited**	**Unlimited**
X	**217 (1.50)**	**240 (1.65)**
Y	**145 (1.0)**	**181 (1.25)**
Z	**72 (.50)**	**72 (.50)**

Major Runways Worldwide 60% "X" and 40% "W"

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Aircraft Apron
and
GSE Impacts

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Multiple Aircraft Ramp System (MARS)

- IATA recommended aircraft stand configuration suited to mixes of Code E/C or Code F/C aircraft.
- Gaining usage at many new airports and airport upgrades and fits in with future Code E and C aircraft planned by major manufacturers

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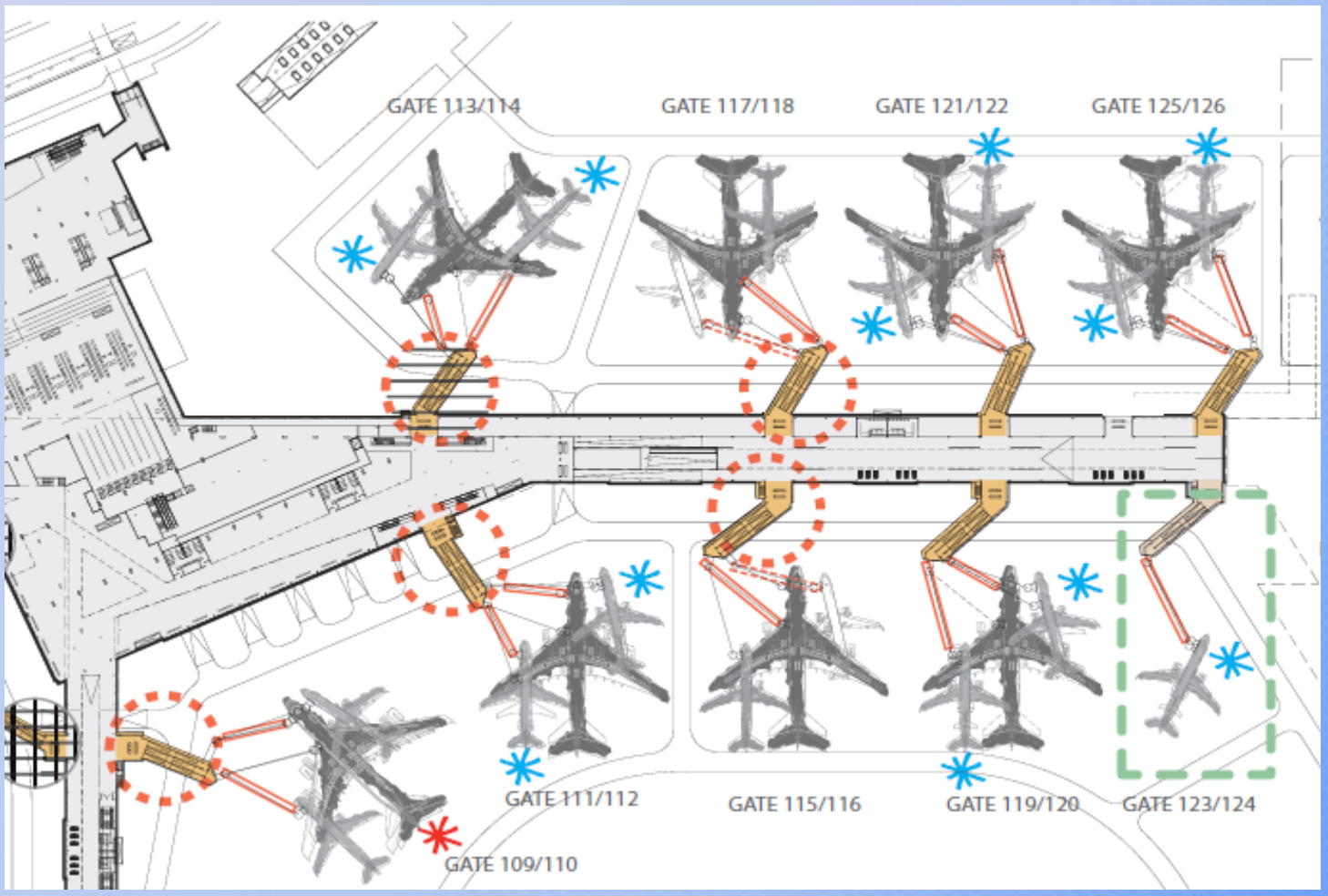
MARS Apron Applied to YYC IFP



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MARS – “More Aircraft Restricted Space”
What about GSE Areas?

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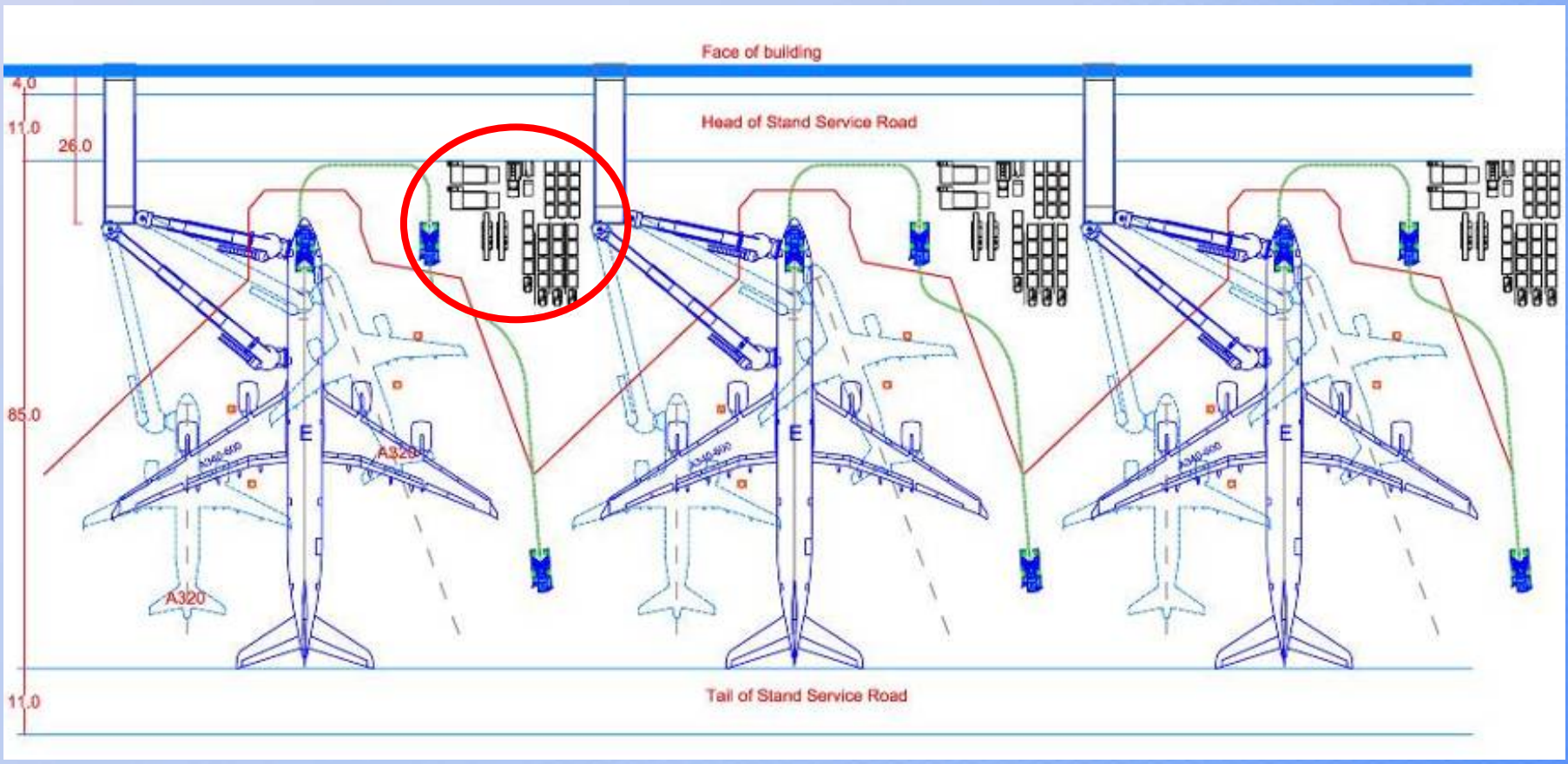
Generic MARS Gate Layout



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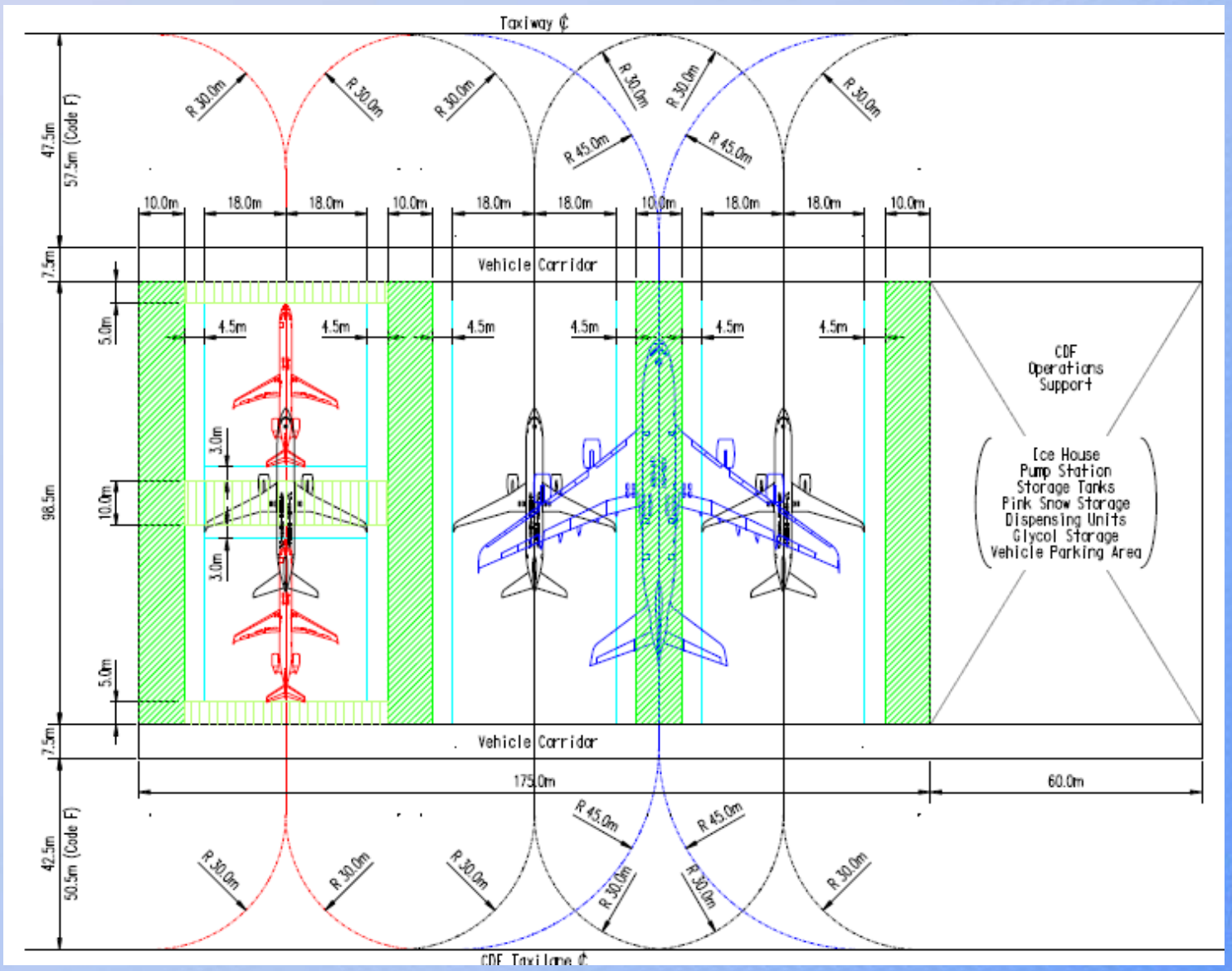
Planning for Deicing Facilities



"MARS" Approach to Deicing

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Ongoing Research

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Airport Support - Firefighting

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NAPTF - FAA

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NAPTF – Research (18 months/section)

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Applied Geometry
and
Pavement Principles

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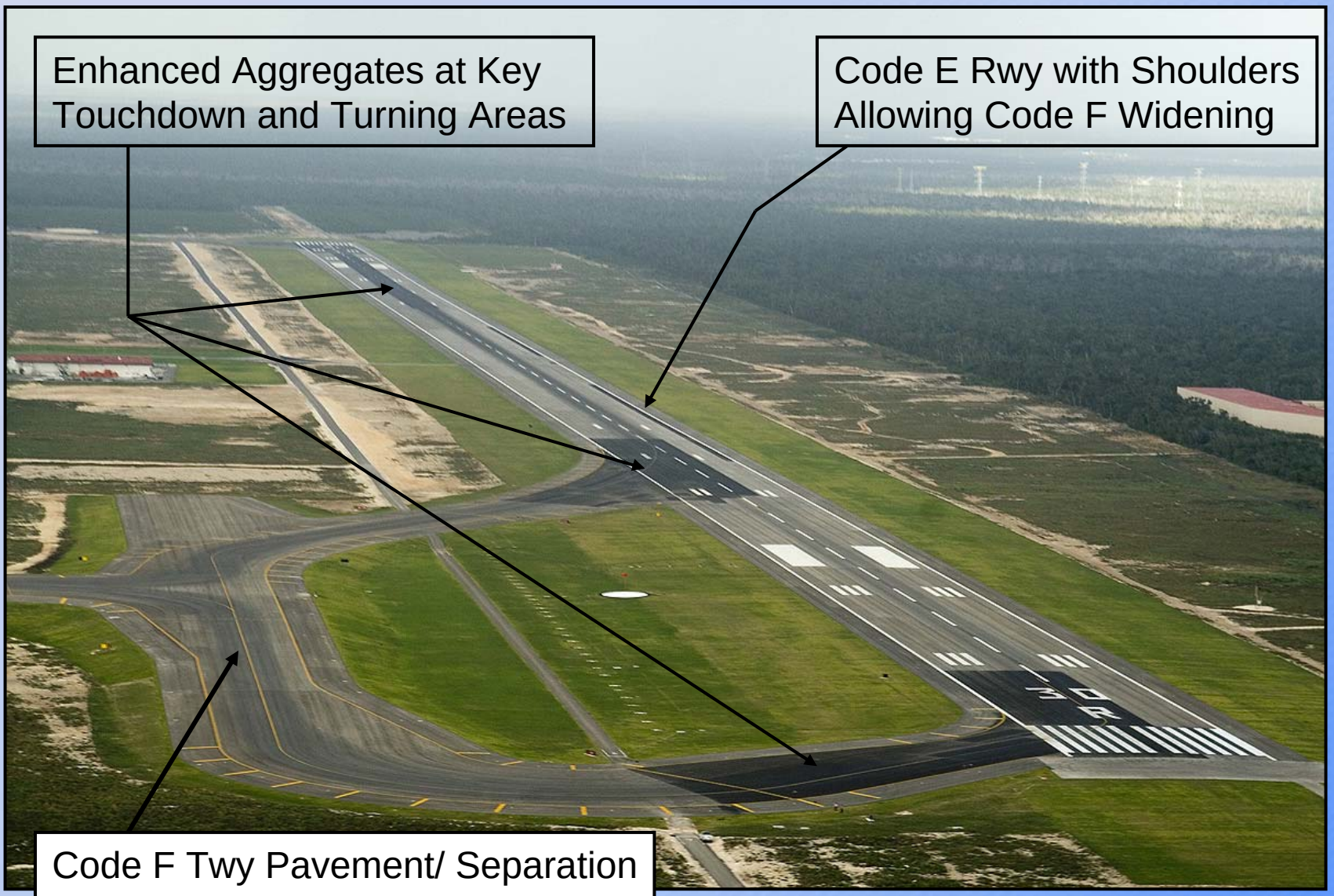

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THANK YOU ! Questions ?

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