TURKISH AVIATION ACADEMY

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Introduction to Airports and Their Characteristics

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Module 3

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Airport Characteristics

- **Objectives:**
  - **Provide background and an overview on the diversity of airport characteristics**
  - **Discussion of geometric layouts of major airports**
  - **Useful background and terminology**
  - **Critical regional differences**
  - **Some major trends**

Reference: Chapter 9 [esp. 9.1-9.4], de Neufville+Odoni (2nd Edition, 2013)

Most of the pictures in this presentation were obtained from airport websites or through Google Maps

Outline

- General introduction and the changing notion of “what is a major airport”
- Some standard configurations, nomenclature, background
- A few non-standard configurations
- Regional characteristics

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What *Was* a (Major) Airport…

- Infrastructure facility ("terminal + runway") serving originating + terminating passengers and some freight (… up to mid-1970s); few commercial or other services
- Practically all airports had one or two runways (… up to 1970s)
- Government-owned (national, regional or local) facilities, managed by either government organizations or by special-purpose Airport Authorities (… up to 1986)
- Often heavily subsidized by national governments, especially w.r.t. to capital investments (… up to 1980s)
- Security was not an issue (… up to late 1960s) and not a dominant concern (… up to 1990s)
- Environmental concerns (beginning in 1960s) centered on airport noise

…and What *Is* a (Major) Airport

- "The Airport City"
  - Very large complex of diverse facilities
  - Big volumes of O-D and connecting passengers and high-value freight
  - Level-of-service varies widely (airline type, market)
  - Extensive commercial, logistic and supporting services
  - Increasingly an inter-modal node
- Often privatized or semi-privatized, operating largely along private sector lines
- Self-sufficient economically and typically profitable
- Security is paramount
- Emissions and climate impacts are critical environmental concerns, in addition to noise

Growth of Traffic Worldwide

- Number of passengers worldwide has tripled in 30 years
  - ~ 3+ billion enplanements in 2014 (~6+ billion airport pax)
- Despite two global "shocks", 30% growth since 2000
  - Uneven distribution of growth
    - Mostly Asia (esp., China + India + Middle East)
    - Across airports, largely driven by airlines
- Prospect: Continued significant growth worldwide (~4%) driven by fast growth in Asia and South America (~6%); slower growth in North America and Europe
- Top 30 airports ~30% of passengers; top 100 ~67%
- Major job generators: "1000 employees per million pax"
- Busy airports are "perpetual construction sites"

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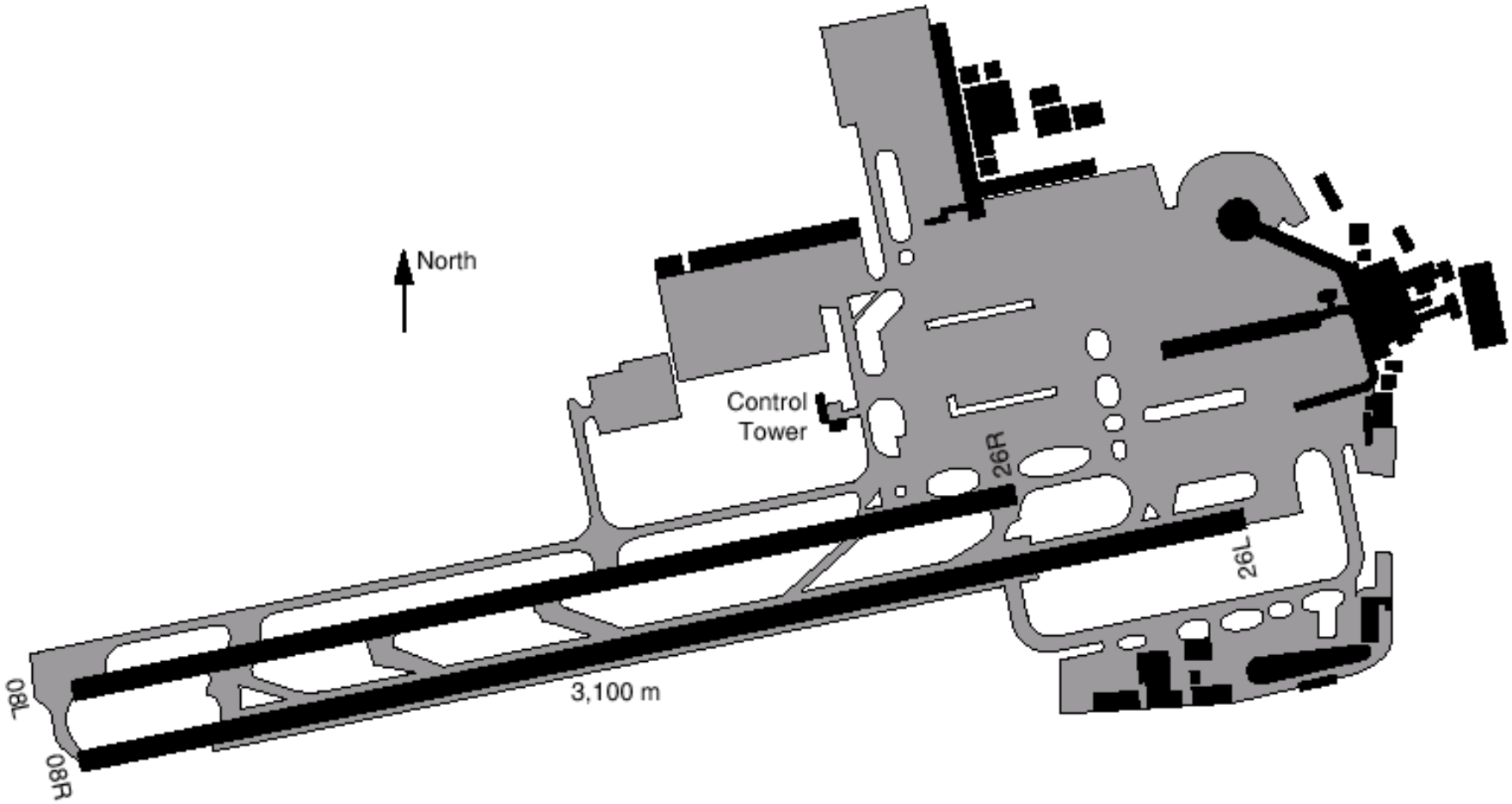
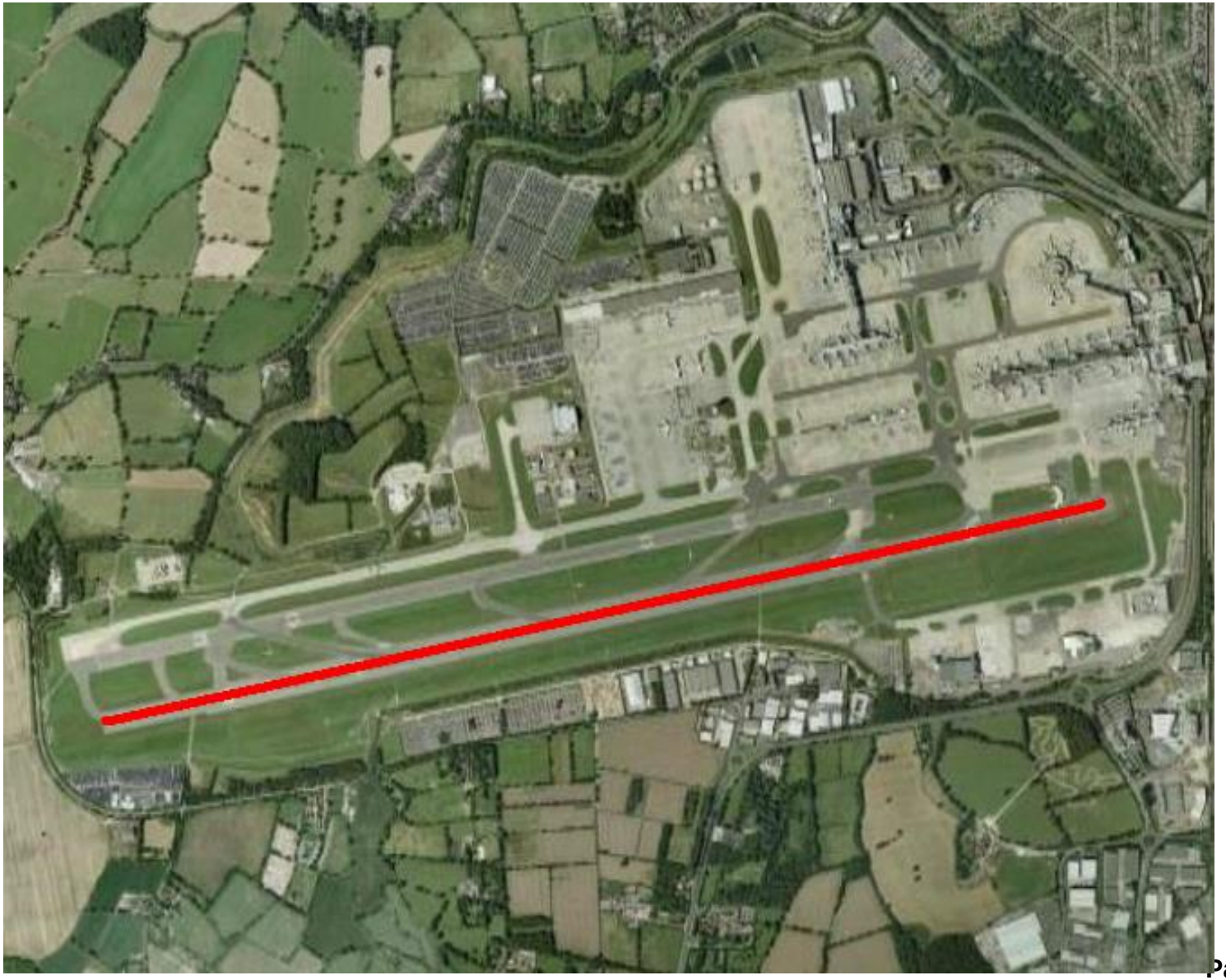
Airport Physical Layouts

- To cope with traffic growth older airports have expanded "as best they could"; layouts are greatly influenced by local constraints
- Layouts exhibit enormous variability (general arrangement of facilities, no. of runways, geometric configuration of runways, length of runways, location and configuration of terminal facilities)
- Range from very simple to complex geometries
- Area occupied only mildly correlated with traffic volumes
- Some common configurations:
  - 1 runway
  - 2 intermediate parallels
  - 2 close + 1 independent
  - 2 intersecting runways
  - 2 close parallels
  - 2 independent parallels
  - 2 independent close pairs
  - Many others (local factors)

London Gatwick (LGW)



London Gatwick (LGW): single runway



Designation of Runways

- Runways are identified by a two-digit number, which indicates the magnetic azimuth of the runway in the direction of operations to the nearest 10º
- When parallel runways are involved the indication R (“right”), L (“left”) and, with three runways, C (“center”) is also used (e.g., Runway 22R)
- Note that 22R is 04L in the opposite direction
- With 4-6 runways, one pair is marked to the nearest 10º and the other to the next nearest 10º

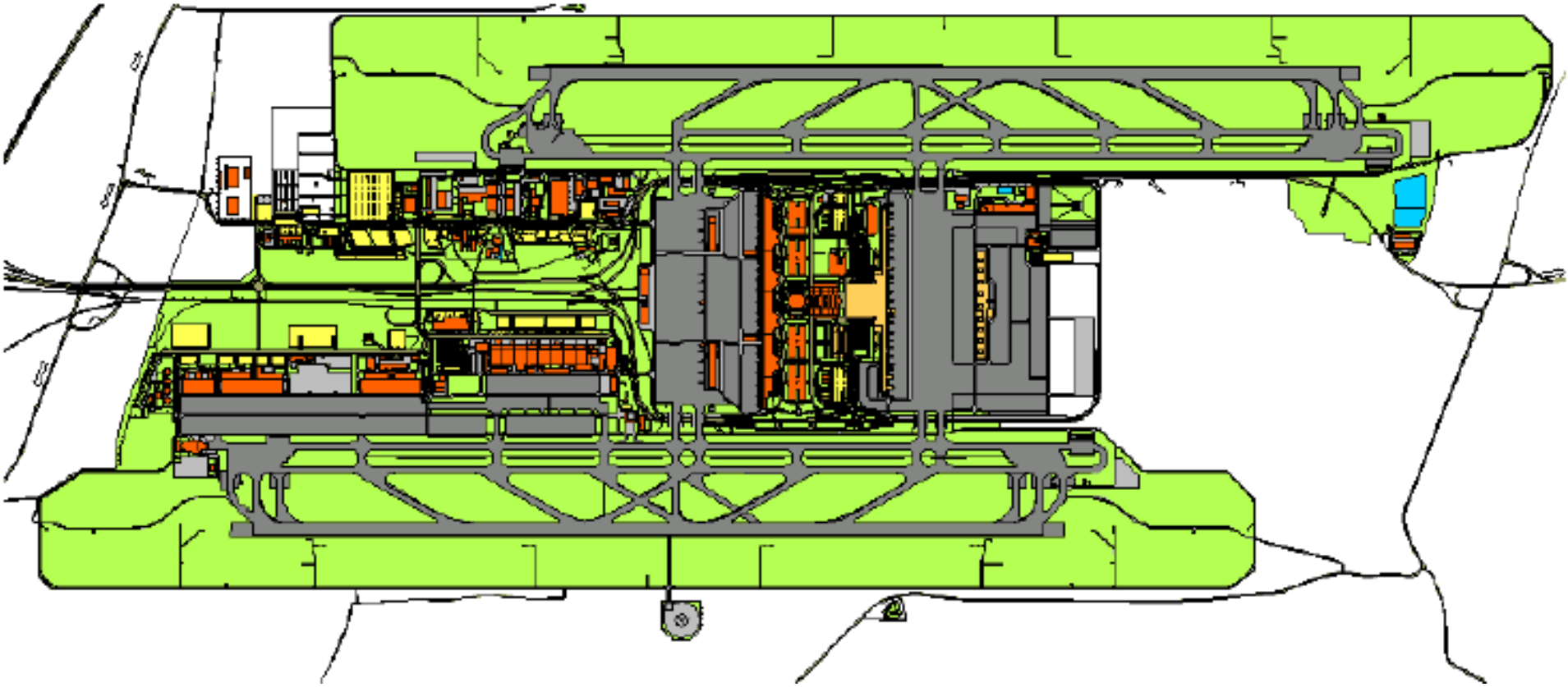
Dusseldorf International Airport (close parallels)

1620 ft (494 m) between runways

Milan Malpensa: medium-spaced parallels

2640 ft (805 m) between runways

Munich: independent parallels



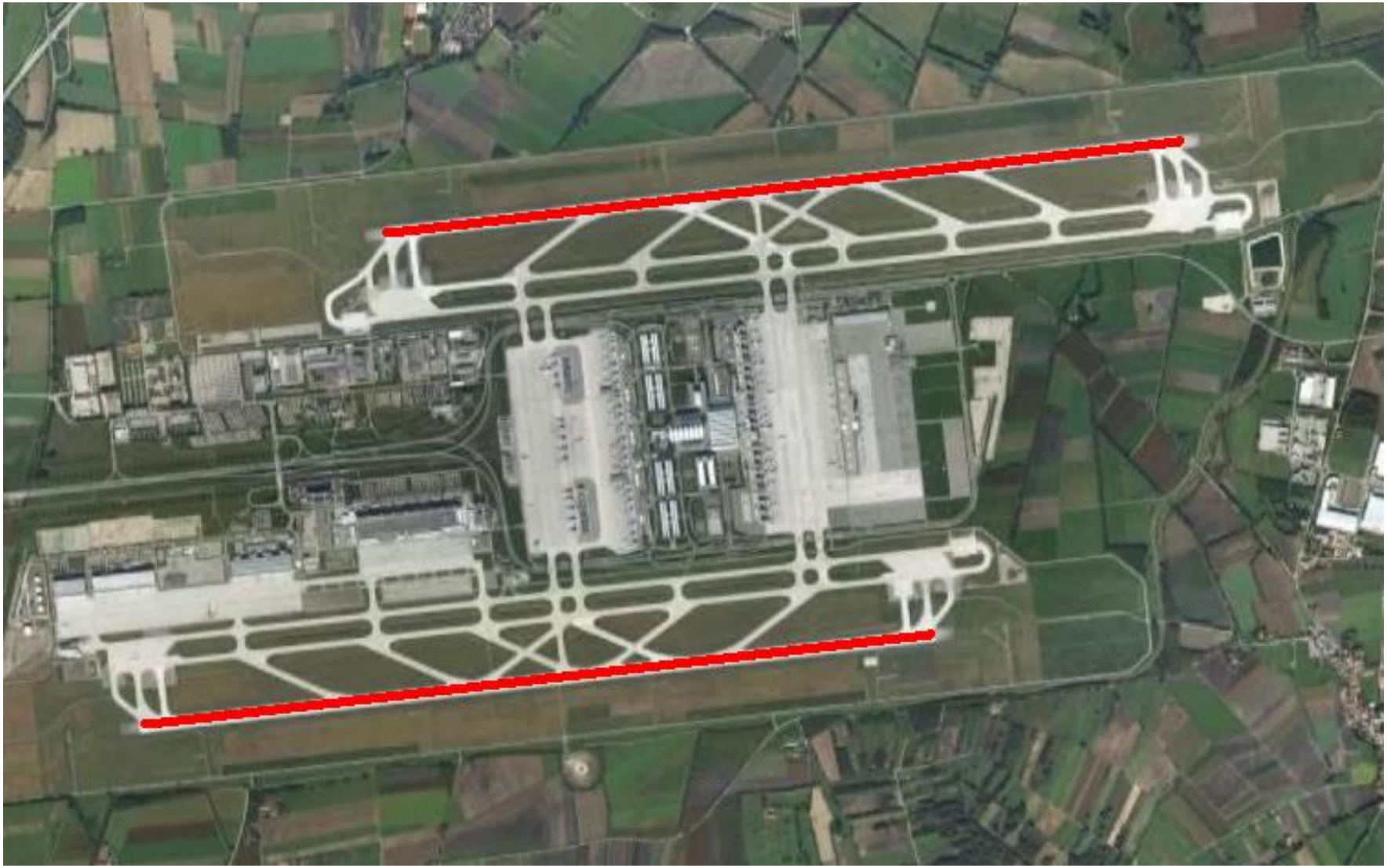
7530 ft (2296 m) between runways

Parallel Runways (IFR)

Separation between runway centerlines	Arrival/ arrival	Departure/ departure	Arrival/ departure	Departure/ arrival
Closely-spaced 1200 – 2500 ft (366 – 762 m)	As in single runway	As in single runway	Arrival touches down	Departure is clear of runway
Medium-spaced 2500 – 5000* ft (762 – 1525* m)	1.5 nmi (diagonal)	Indep't	Indep't	Indep't
Independent > 5000* ft (> 1525* m)	Indep't	Indep't	Indep't	Indep't

* 3400 ft (1035 m; ICAO) or 4300 ft (1310 m) are alternative limits

Munich: independent parallels



7530 ft (2296 m) between runways

London Heathrow Airport (LHR)

4560 ft (1390 m) between runways

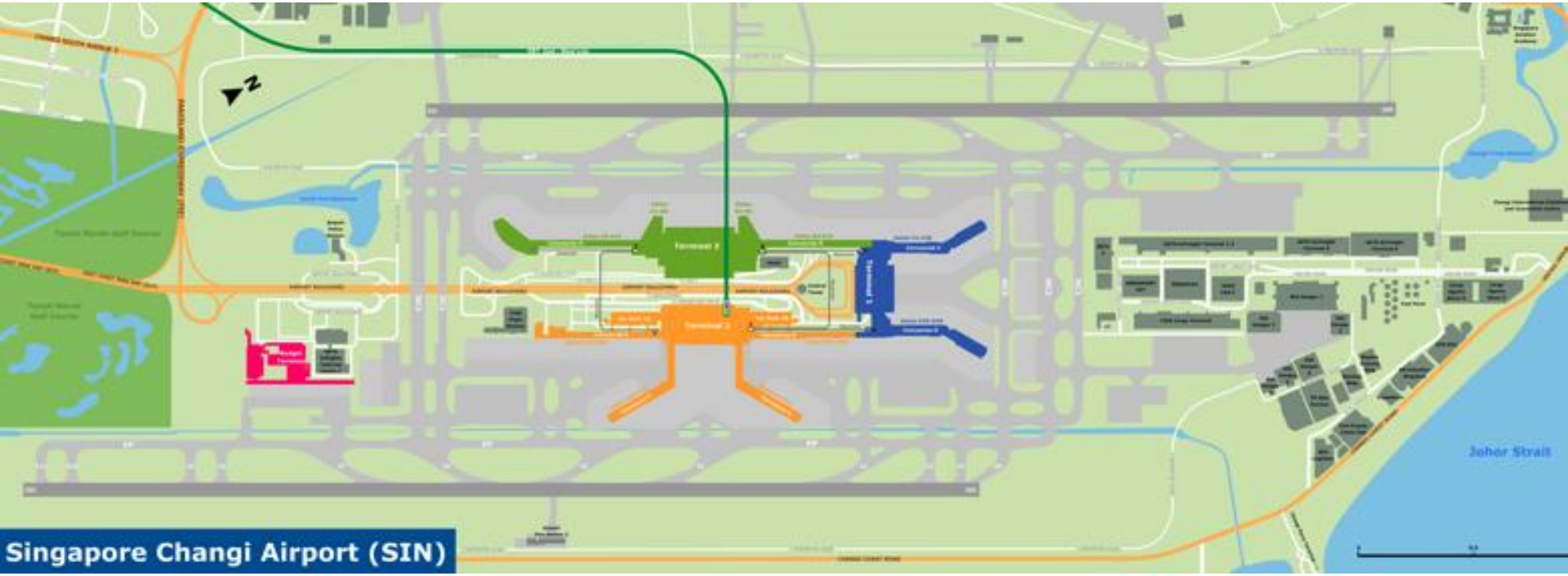
Osaka Kansai International Airport (KIX)

2014: 142,000 movements, 19.4 mio pax

Source: Wikipedia (2015)

Osaka Kansai International Airport (KIX)

SIN – 2-runway configuration

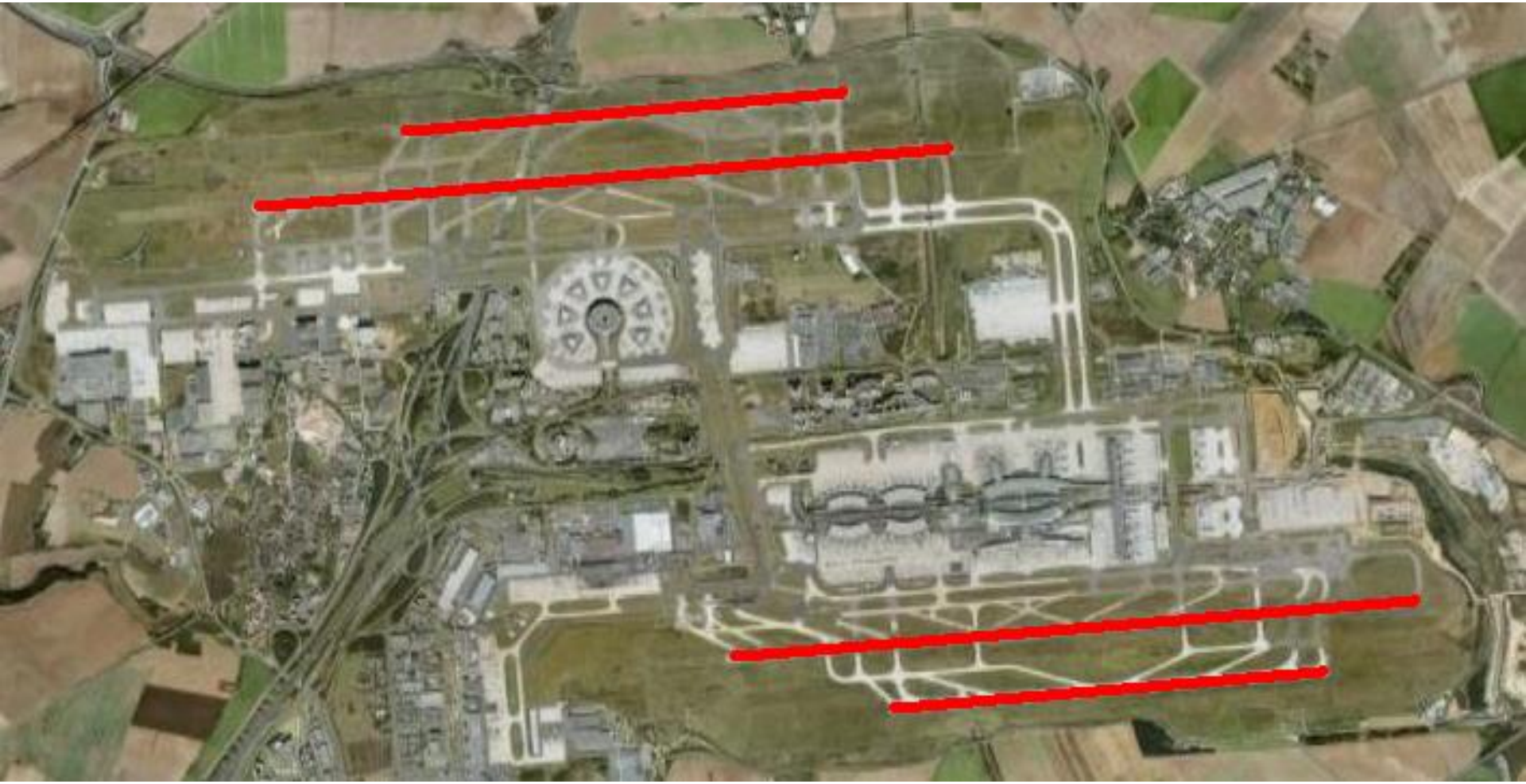


5750 ft (1750 m) between runway centerlines
2014: 54.1 mio pax, 341K mvts

Guangzhou International Airport (CAN)

Seoul Incheon (close pair + 1)

Paris CDG: 2 independent close pairs

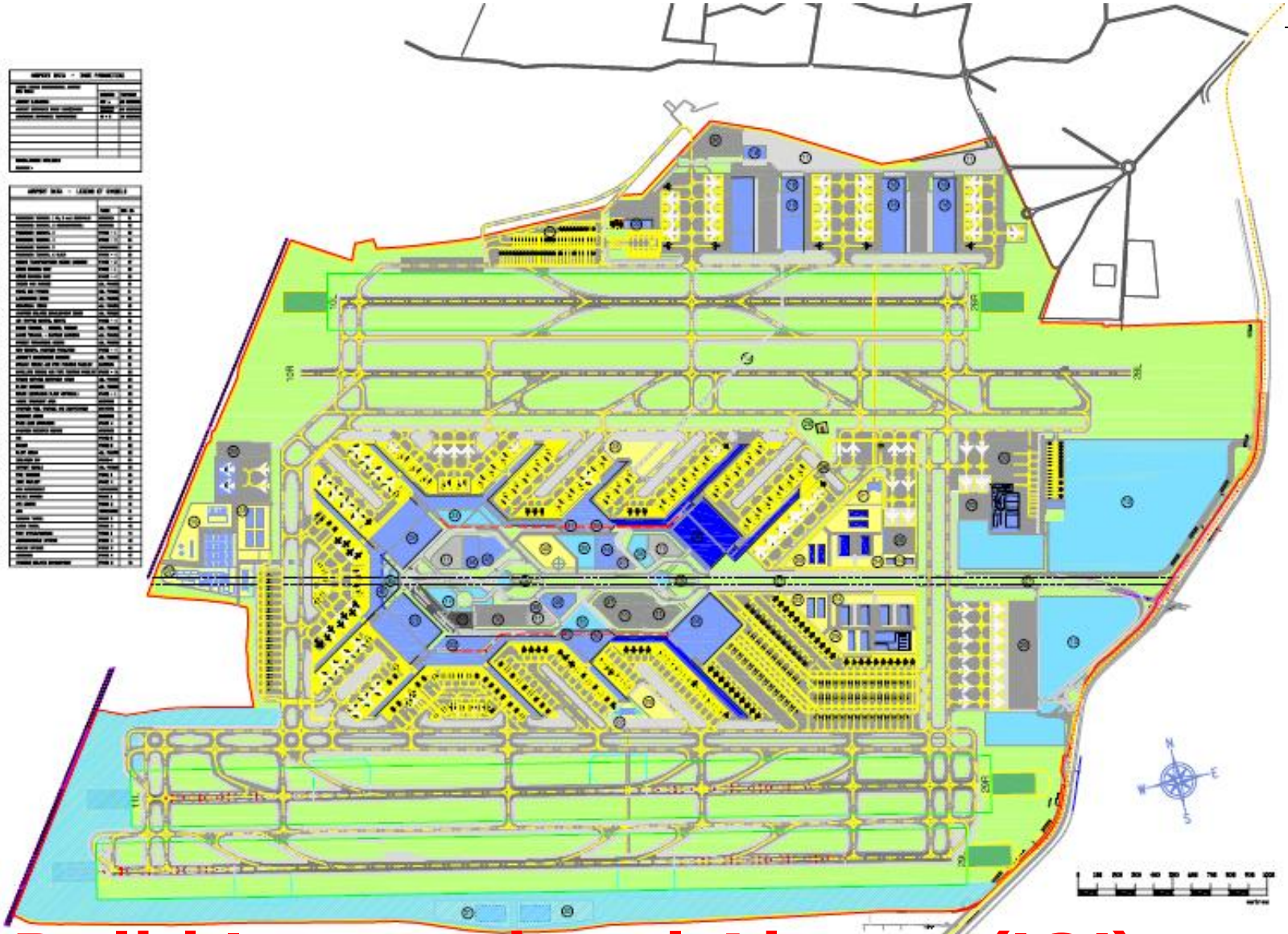


1260 ft between close parallel runways

Los Angeles International: 2 independent pairs

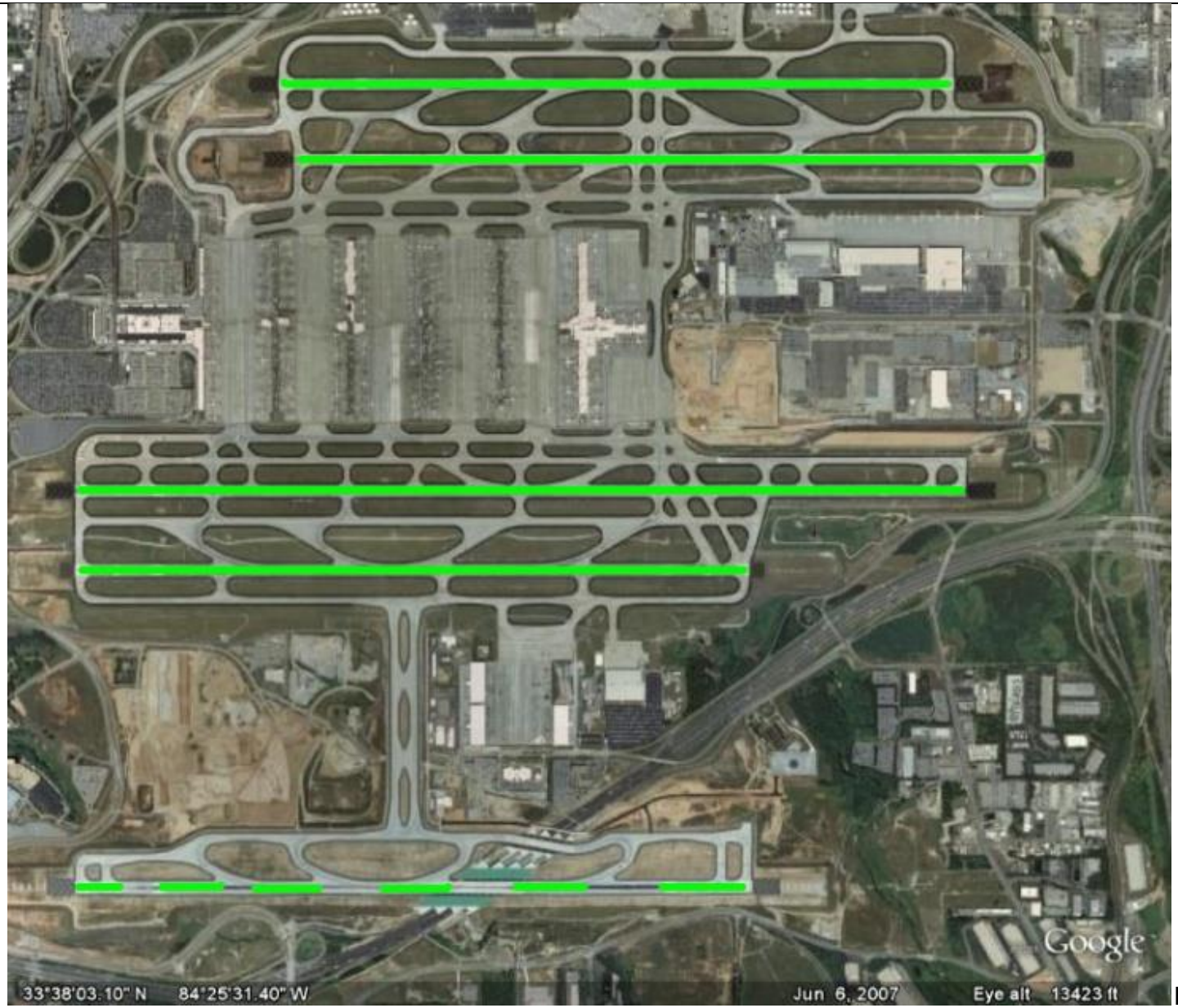
700 and 800 ft between runways

SATURATION PHASE DEVELOPMENT PLAN

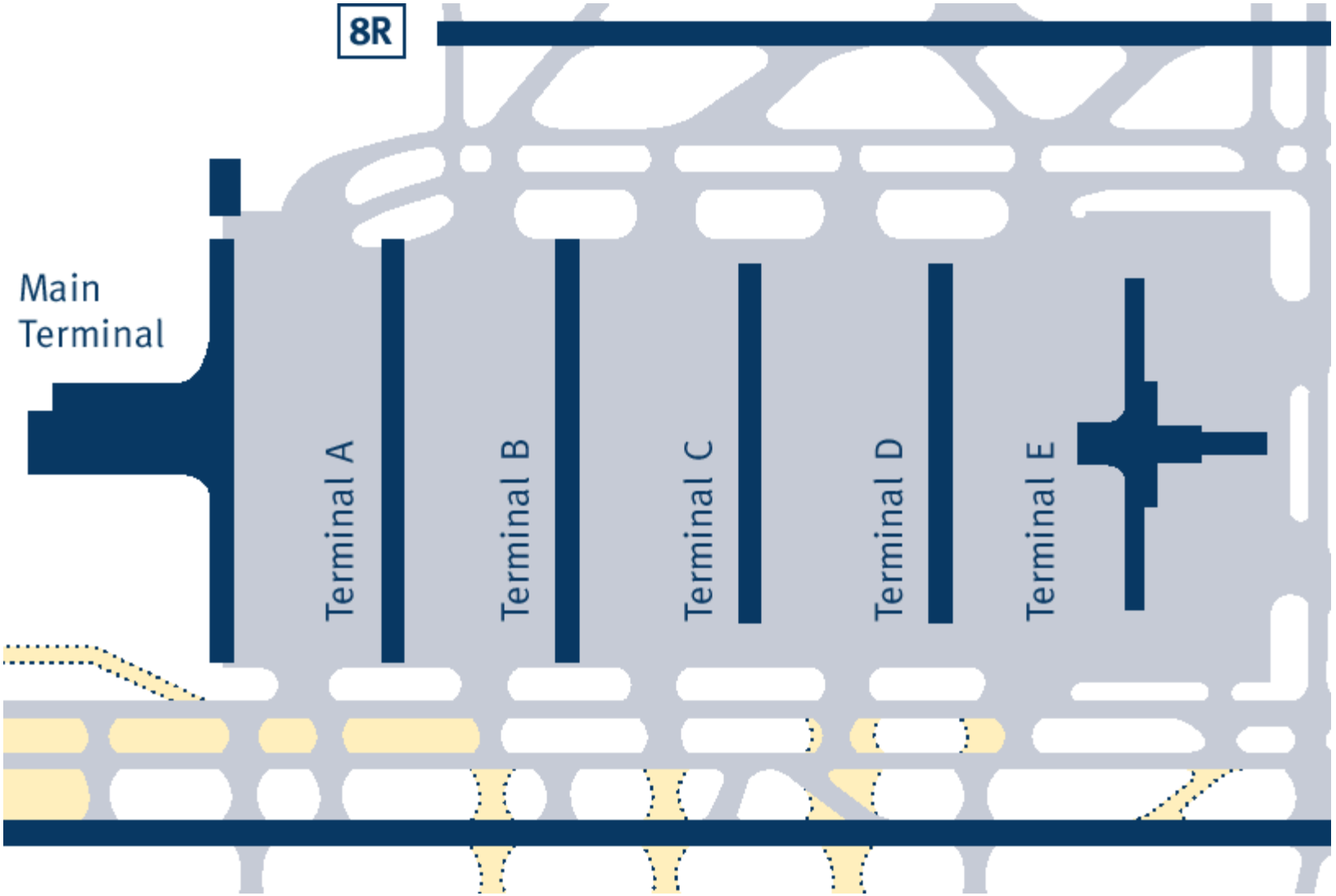


Delhi International Airport (IGI)

Atlanta Hartsfield International (ATL)



Midfield linear satellites: Atlanta (ATL)



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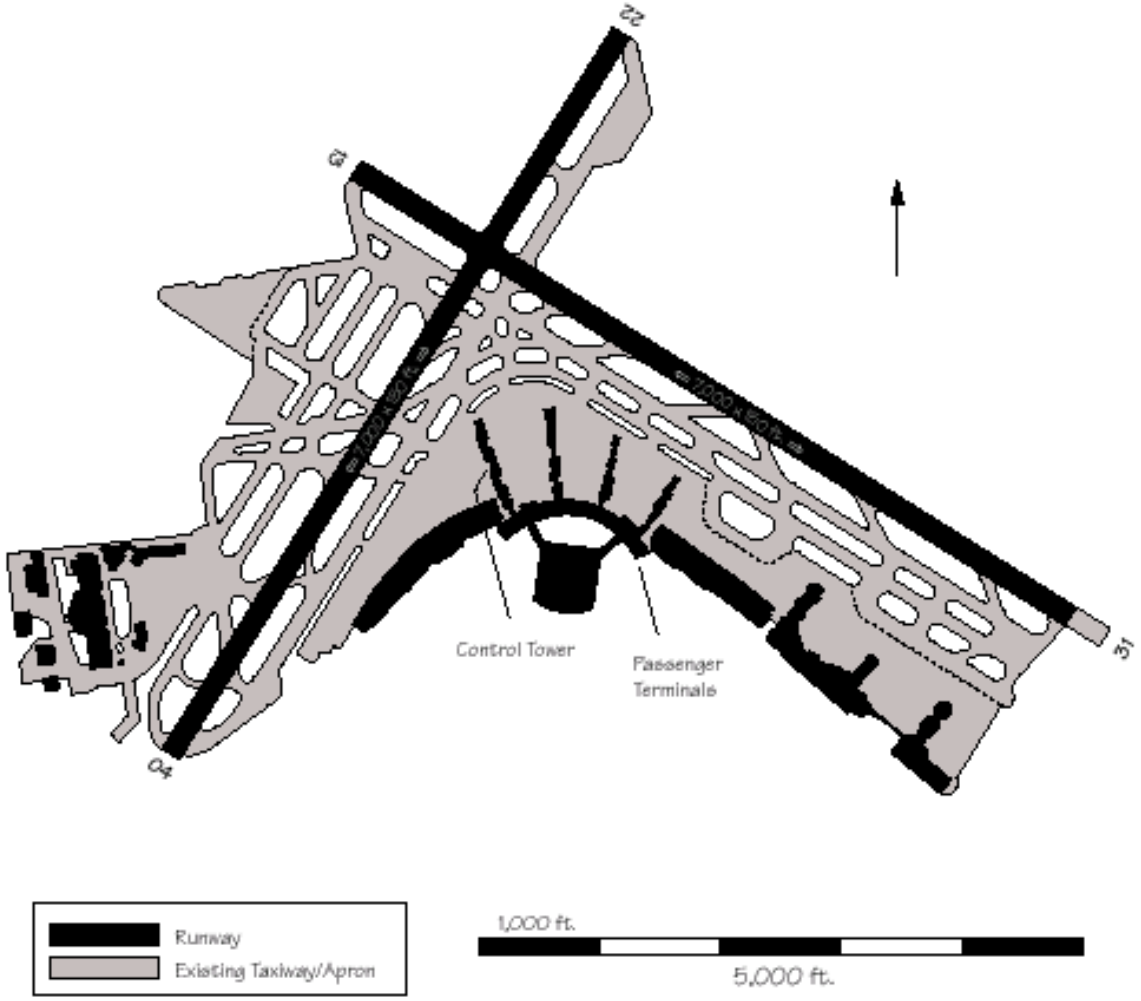
New York LaGuardia (LGA)



JFK International Airport, New York

Rio de Janeiro/Galeão–Antonio Carlos Jobim (GIG)

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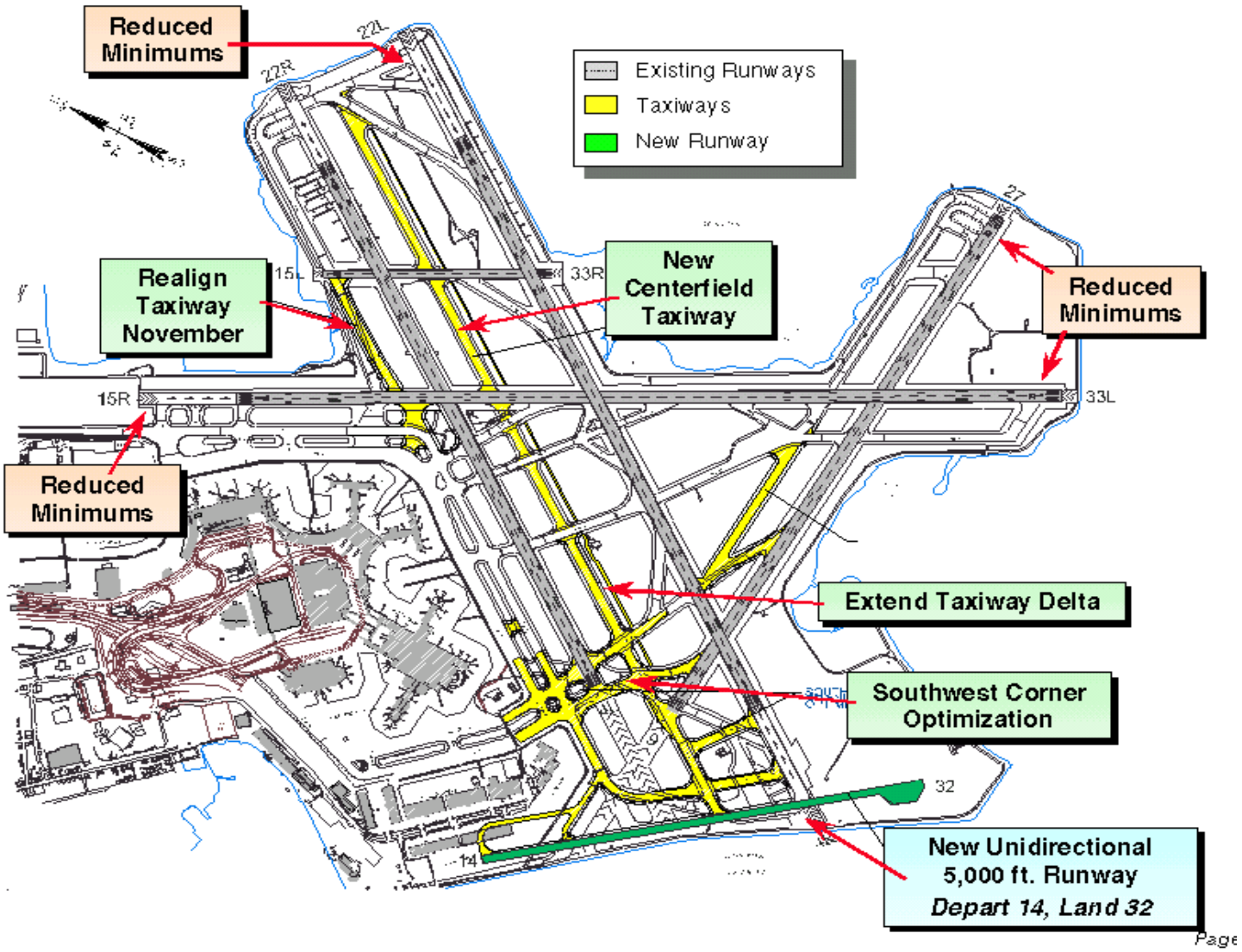
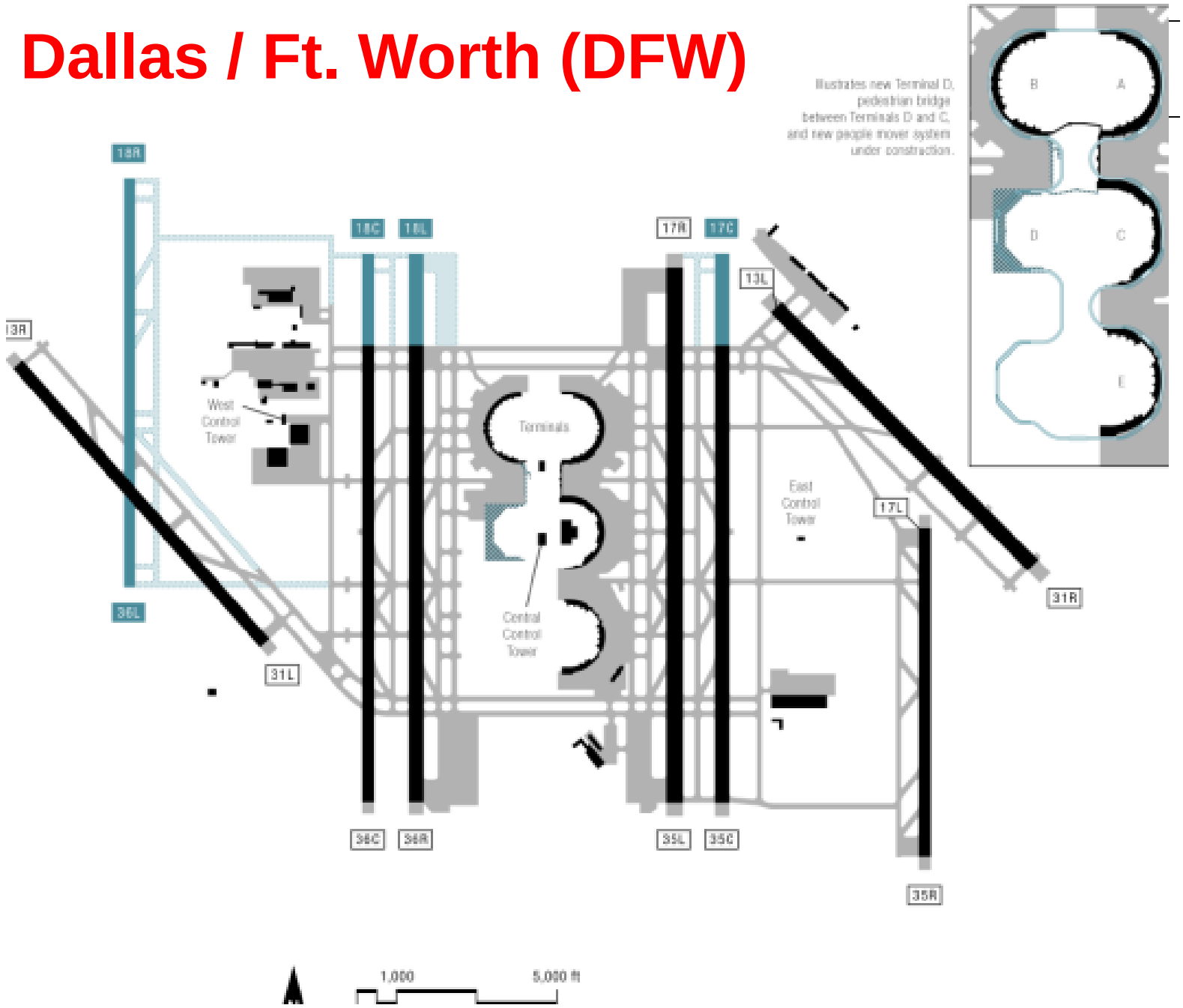
Boston/Logan: Proposed Airside Changes (2008)



Boston Logan International Airport (BOS)

Dallas / Ft. Worth (DFW)




DFW
Airport

Zurich International (ZRH)

Sydney Kingsford-Smith Airport

Singapore Changi Airport with Third Runway

Source: Wikipedia (2011)

Factors Affecting Airport Area Requirements

- Principal factors affecting airfield size are:
  - Airside capacity requirements: number and configuration of runways and apron stands
  - Weather: no. and configuration of runways
  - Unused area: noise "buffer" or for future expansion
  - Types of aircraft and operations: runway, taxiway, apron dimensions and separations
  - Location of passenger terminals and landside facilities relative to runways
- Terminal facilities and related landside space typically take up only 5-20% of an airport's total area