

Airside Productivity of selected European Airports

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Motivation and Previous Obstacles

Limitations of Airport Productivity

Airport Airside Capacity

Airport Demand and Capacity Utilization

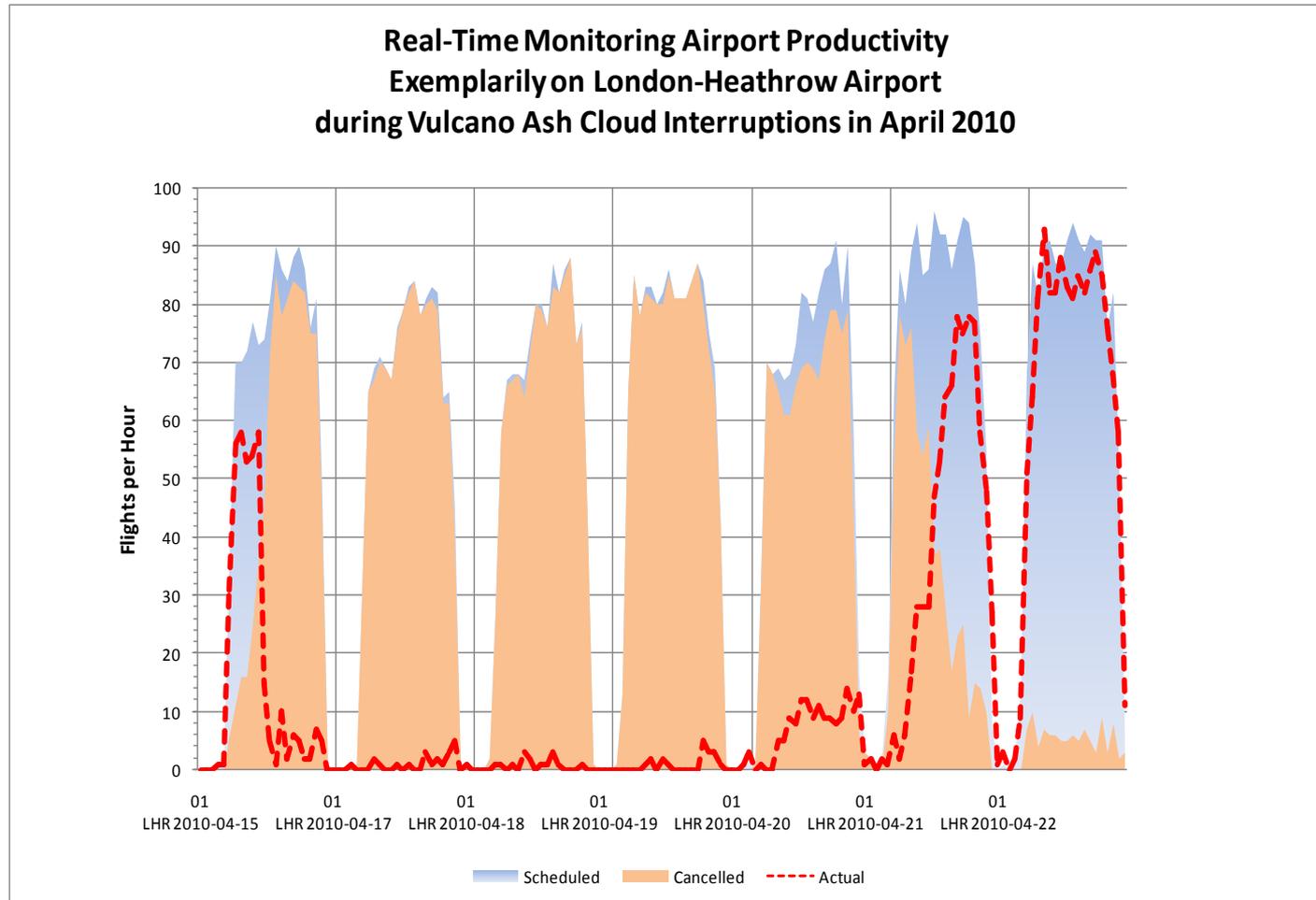
Conclusions and Outlook

Motivation

- Benchmarking airport productivity requires simple methodology
- Airport Peer groups must be found to compare “apples with apples”
- Earlier productivity analyses use various measures of airside capacity, e.g. Gillen and Lall (2001):
 - Movement Efficiency Analysis
 - Outputs: Air carrier movements, ~~commuter movements~~
 - Inputs: Airport area, number of runways, runway area and number of employees
 - Terminal Efficiency Analysis:
 - Outputs: Number of passengers, Pounds of cargo
 - Inputs: Number of gates, terminal area, number of employees, number of baggage collection belts and number of public parking spots
- Airport Operators and Planners prefer time based flow and throughput measures, e.g. (Peak hour) Operations (Landings and Departures) or Passengers

Motivation

- Why it is important to look at Productivity on an hourly and daily basis:

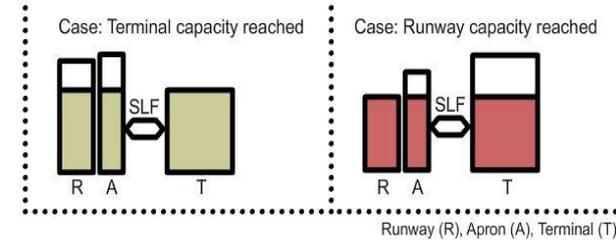


Source: BUBALO 2010

Understanding the Airport System: Flows and Limits

Limiting Factors for Capacity and Interdependencies at Airports

Capacity limit dictated by:



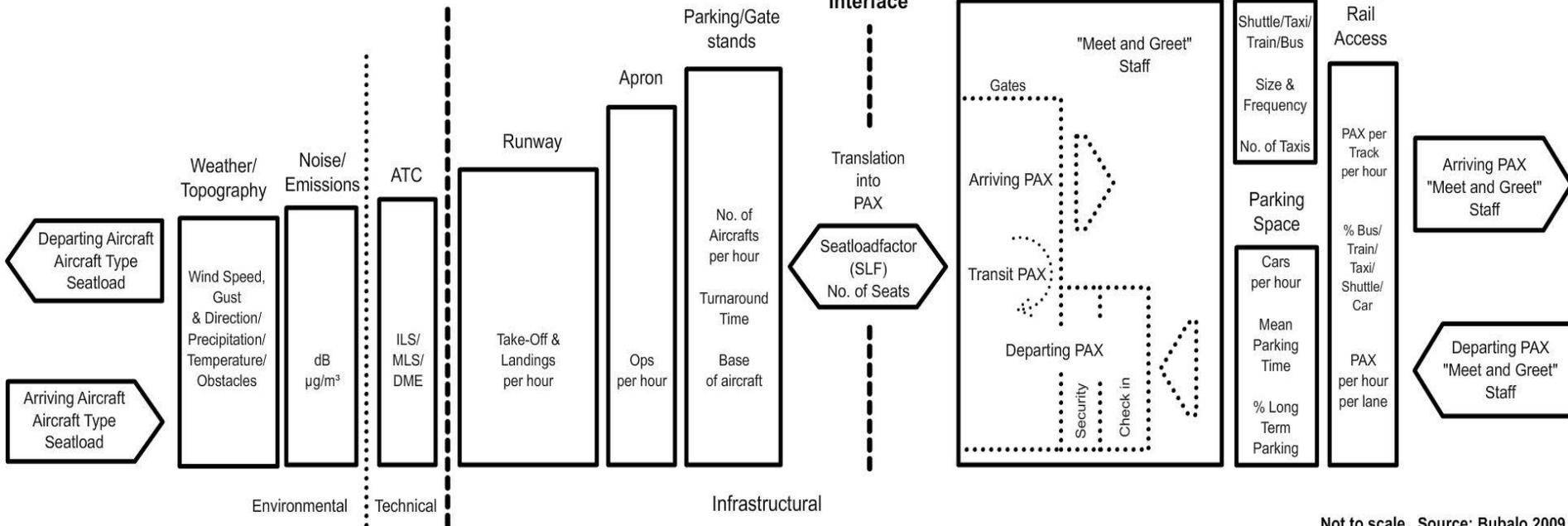
Airport Interface

Airside / Landside Interface

Terminal

Modality

Road/ Rail Access

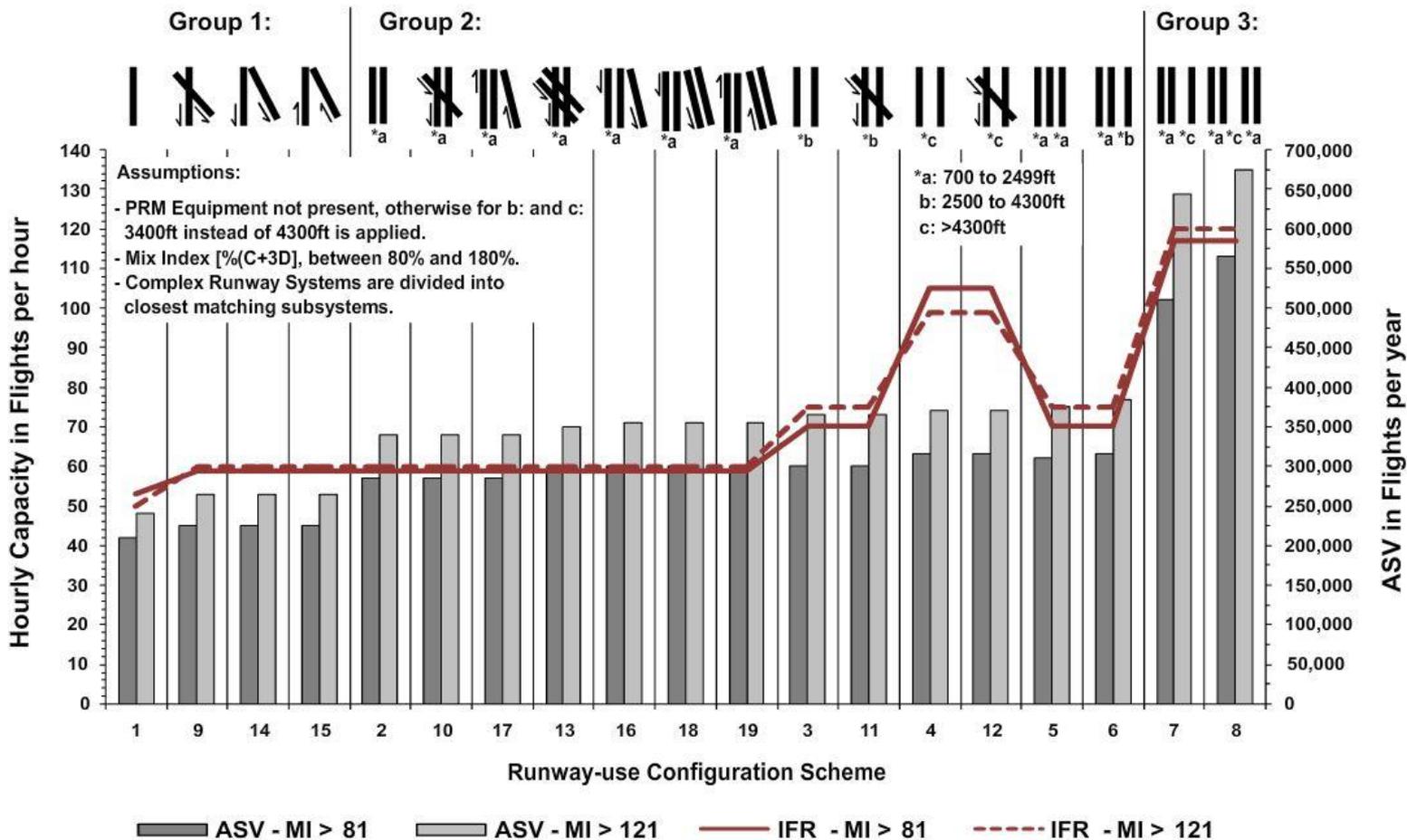


Not to scale. Source: Bubalo 2009

Source: BUBALO 2009

Estimating Capacity among Peers by Preferential Runway(s) Schemes

Annual Service Volume and Design Hour IFR Capacity
by Runway-use Configuration for Traffic Mix Indices (MI) > 81%
(based on FAA AC 150 5060-5, ranked by ASV)



Source: FAA 1995, Bubalo 2009

Traffic Mix at selected European Airports

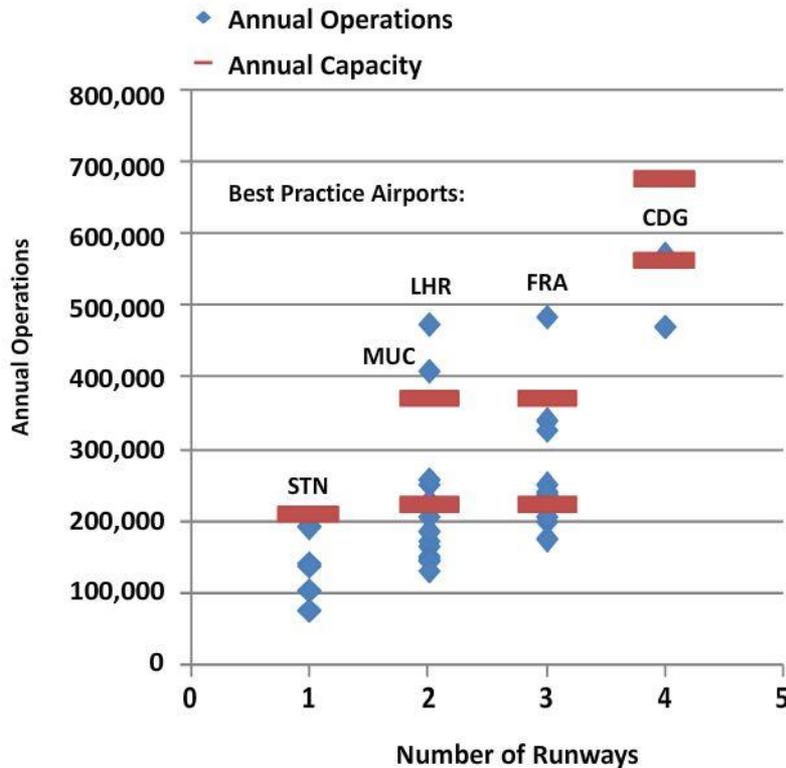
Traffic Mix expressed in Weight and Turbulence Class Shares and Mix Index per selected European Airport March 2008					
Airport	Airport Code	Small	Large	Heavy	Mix Index
Amsterdam	AMS	0%	83%	17%	135%
Athens	ATH	0%	95%	5%	110%
Birmingham	BHX	0%	98%	2%	103%
Brussels	BRU	0%	90%	10%	121%
Cologne	CGN	0%	98%	2%	103%
Copenhagen	CPH	0%	96%	4%	107%
Dusseldorf	DUS	0%	97%	3%	106%
Frankfurt	FRA	0%	76%	24%	147%
Hannover	HAJ	0%	100%	0%	100%
London-City	LCY	0%	100%	0%	100%
London-Gatwick	LGW	0%	91%	9%	118%
London-Heathrow	LHR	0%	66%	34%	168%
London-Luton	LTN	0%	99%	1%	102%
Munich	MUC	0%	94%	6%	111%
Nice	NCE	46%	54%	1%	56%
Oslo	OSL	0%	100%	0%	100%
Palma de Mallorca	PMO	0%	100%	0%	100%
London-Stansted	STN	0%	99%	1%	102%
Stuttgart	STR	0%	99%	1%	101%
Vienna	VIE	0%	96%	4%	108%
Zurich	ZRH	0%	90%	10%	120%

Source: OAG

Difficulties with using Input “Number of Runways”

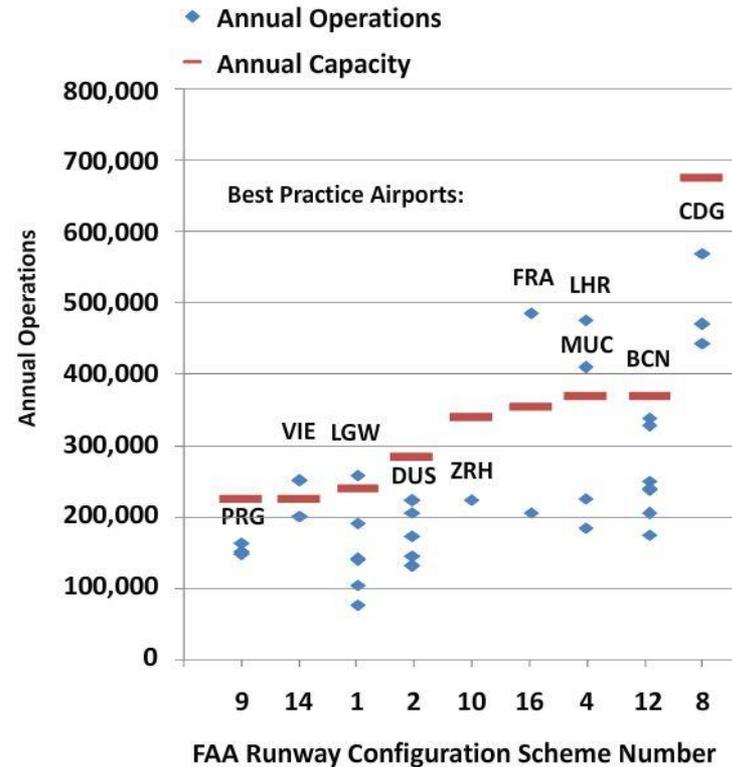
Current Approach:

Annual Capacities and Demand of 33 European Airports in 2007 by Number of Runways



“Optimized” Approach:

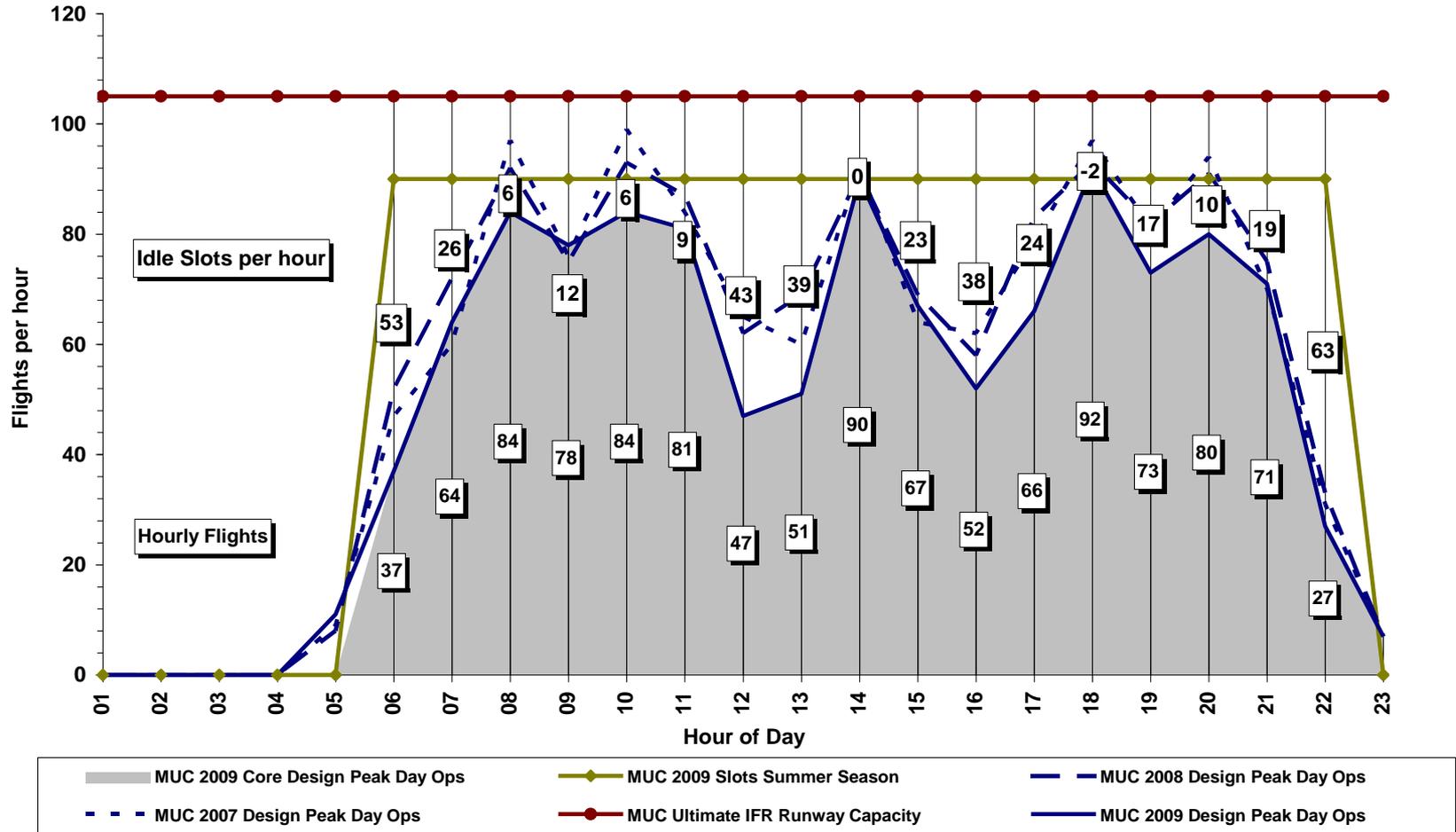
Annual Capacities and Demand of 33 European Airports in 2007 by Runway Configuration Scheme



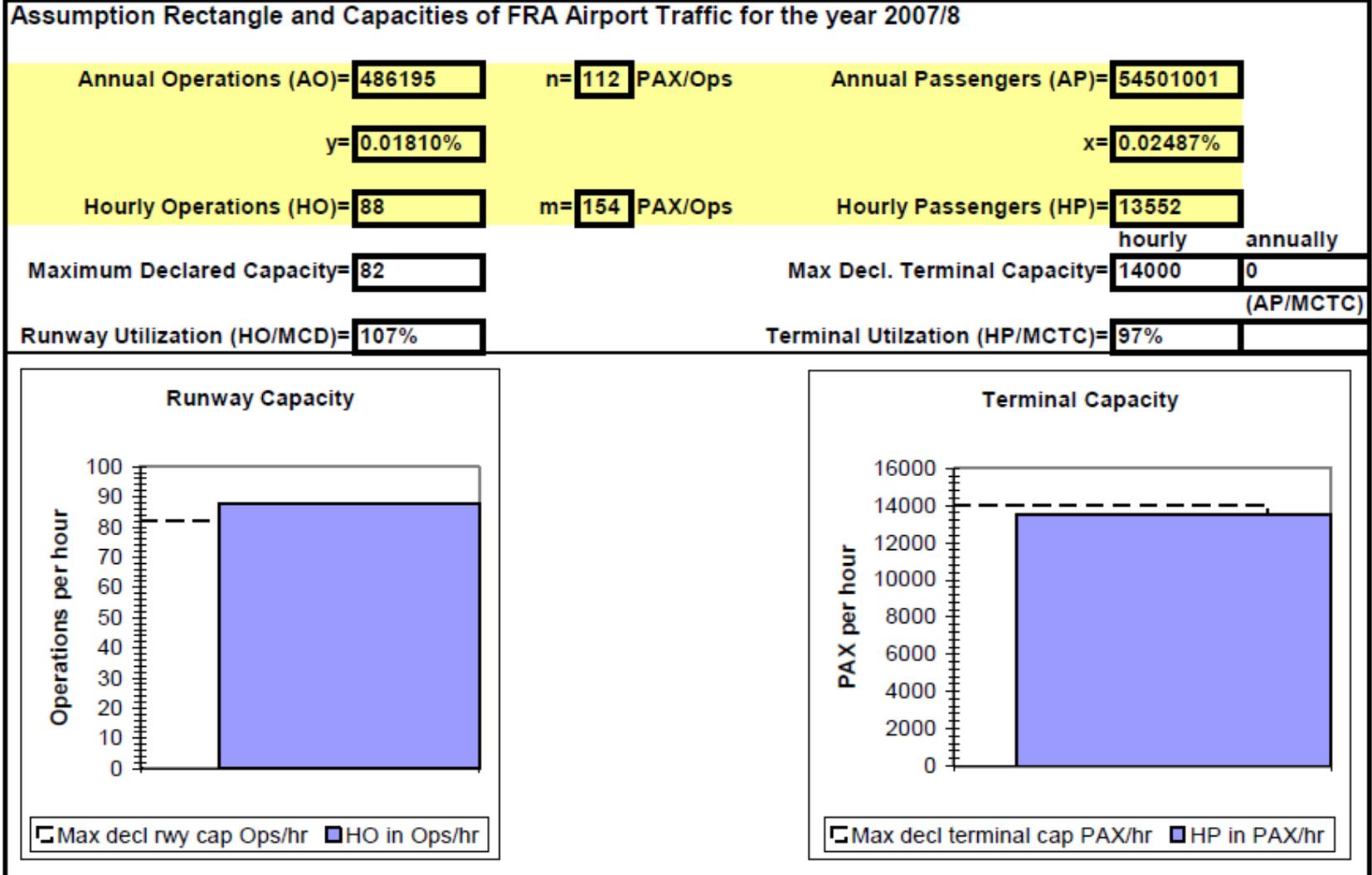
Source: BUBALO 2010

Combining Capacity and Demand Information

Munich Airport
Capacity, Peak Demand and Idle Slots on Busy Day 2009



Combining Annual and Hourly Information



Source: Kanafani 1981; Bubalo 2009

Delays at selected European Airports

Index	Airport Name	IATA	ICAO	Experienced Delay 2006 in Minutes	Annual Delay Costs at 42€ per Minute (Eurocontrol 2009)
1.	LONDON HEATHROW	LHR	EGLL	715761	30,061,962
2.	FRANKFURT MAIN	FRA	EDDF	671693	28,211,106
3.	MILANO MALPENSA	MLP	LIMC	626853	26,327,826
4.	WIEN	VIE	LOWW	534717	22,458,114
5.	ROMA FIUMICINO	FCO	LIRF	464088	19,491,696
6.	MADRID BARAJAS	MAD	LEMD	388094	16,299,948
7.	MUENCHEN	MUC	EDDM	343938	14,445,396
8.	ZURICH	ZRH	LSZH	248709	10,445,778
9.	PARIS ORLY	ORY	LFPO	242897	10,201,674
10.	ISTANBUL - ATATUERK	IST	LTBA	216167	9,079,014
11.	SCHIPHOL	AMS	EHAM	151918	6,380,556
12.	COPENHAGEN/KASTRUP	CPH	EKCH	124148	5,214,216
13.	LONDON CITY	LCY	EGLC	111567	4,685,814
14.	PRAHA RUZYNE	PRG	LKPR	105861	4,446,162
15.	PARIS CH DE GAULLE	CDG	LFPG	81062	3,404,604
16.	LONDON GATWICK	LGW	EGKK	79190	3,325,980
17.	ROMA CIAMPINO	CIA	LIRA	60362	2,535,204
18.	MANCHESTER	MAN	EGCC	59495	2,498,790
19.	TEGEL-BERLIN	TXL	EDDT	55816	2,344,272
20.	LONDON STANSTED	STN	EGSS	53408	2,243,136
21.	PALMA DE MALLORCA	PMI	LEPA	44508	1,869,336
	Total			5,380,252	225,970,584

Source: CFMU EUROCONTROL 2006; EUROCONTROL 2009; Bubalo 2010

Conclusions and Outlook

- Peer Groups can be isolated based on Runway Capacity
- Daily and Hourly traffic indicates the fluctuation in demand (Peaks, Daily Variation, Seasonality)
- Airport Airside Performance should include efficiency of runway exits, apron area, aircraft parking positions and taxiways
- Simulation (SIMMOD, TAAM) is the tool of choice to model the airside complexities, including externalities (Delay, Noise, gaseous Emissions) ->ongoing research
- Landside (Terminal) Productivity and access to different ground modes must be assessed and included for a complete picture

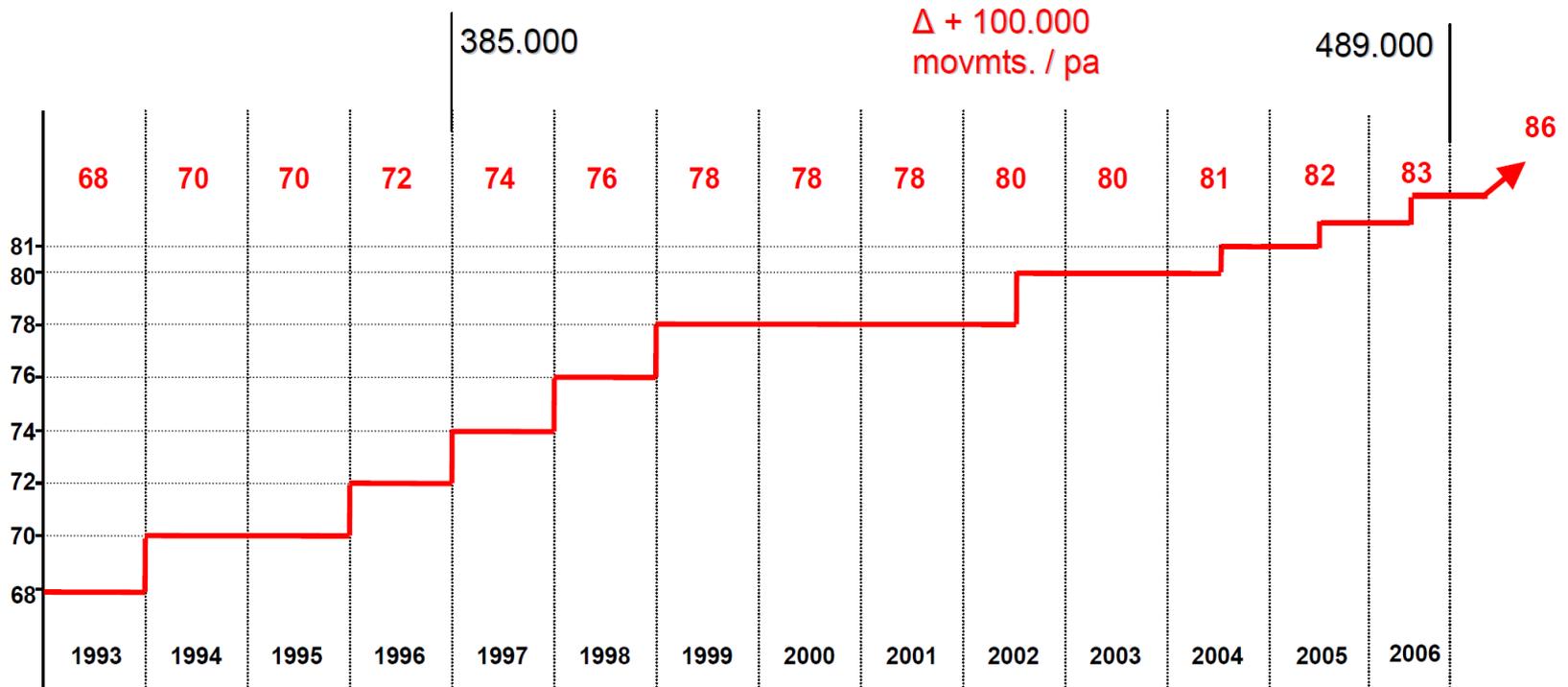
Thank you for your attention! Questions?
Suggestions and Comments are welcome.

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Personal Background

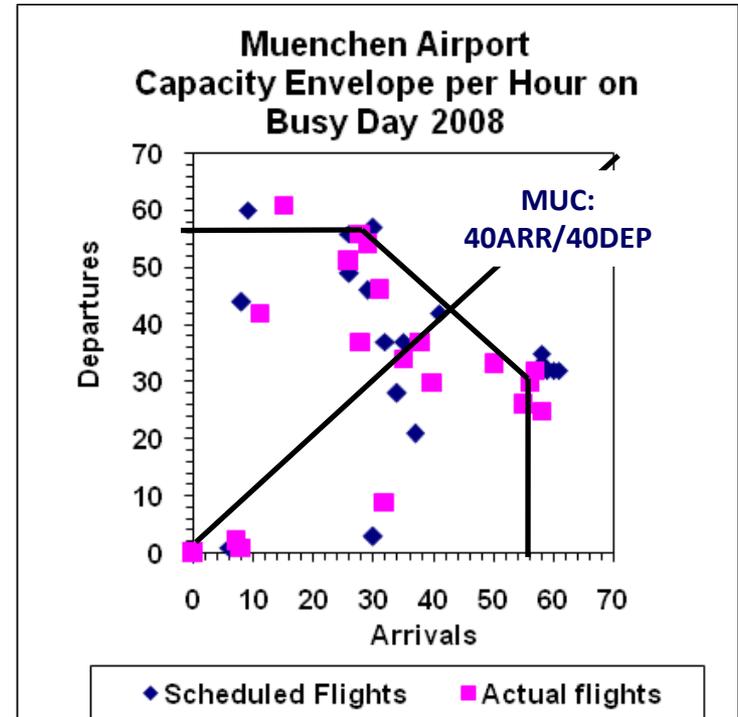
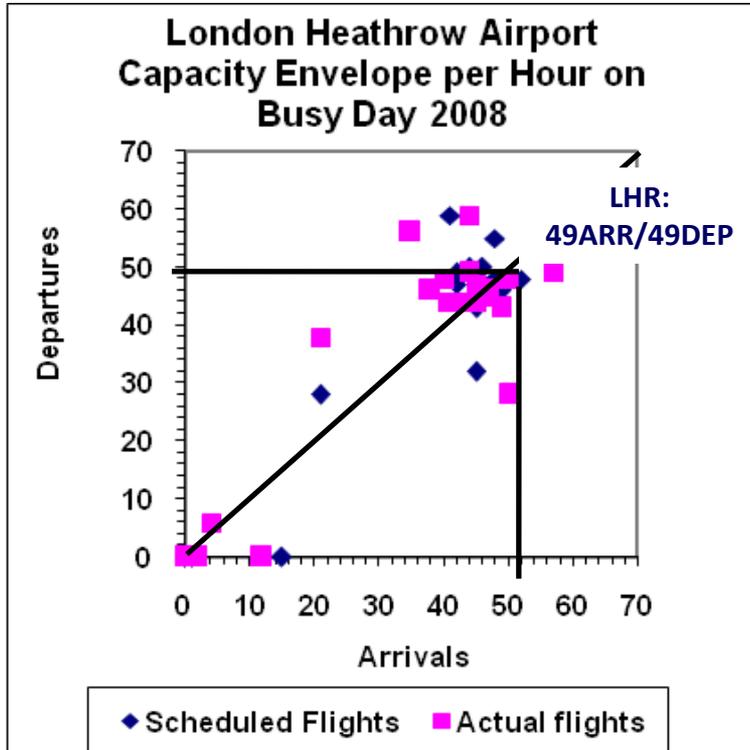
- Graduate in Business Administration and Engineering from Berlin School of Economics and Law (BSEL) and University of Applied Sciences Berlin
- Diploma Thesis (2009): “Benchmarking Airport Productivity and the Role of Capacity Utilization”
- 4th year in German Airport Performance Research Project at Berlin School of Economics and Law
- Conducted Benchmarking studies of European Airports and Airlines (75 Airports, 50 Airlines)
- Consultation in MIME Project, funded by EU Commission, studying Noise mitigation around airports, by market-based instruments
- Looking for new opportunities in Air Transportation Research & Development and PhD position

Frankfurt Capacity Development through Technical Change



Source: FRAPORT

Parallel Runway Airport Efficiency



Source: Gilbo 2001; Bubalo 2009; Flightstats.com

- Constructing Envelope around long-term demand data for revealing “practical” Capacity and efficient Utilization