



London Luton Airport: Future Capacity

Luton Borough Council

September 2013

1 Introduction

Purpose

1.1 Following an earlier commission from Luton Borough Council (LBC) in April 2013 to prepare an assessment of the current capacity of London Luton Airport (LTN), CSACL was asked to assess the potential future capacity of the airport. These assessments were needed to assist LBC in its consideration of the Planning Application (Reference 12/01400/FUL) made by the operating company of the airport, London Luton Airport Operations Limited (LLAOL), to increase the capacity of the airport to 18 million passengers per annum (mppa).

Outline of Approach

1.2 The developments proposed by LLAOL in its Planning Application were discussed with the airport operator's management and with one of its advisors, LeighFisher Ltd. LLAOL also provided various data including a proposed 2028 Busy Day flight schedule and this was analysed using the simulation model developed in connection with the assessment of the capacity of the existing facilities. A draft of this report was also discussed with management.

Capacity Considerations

1.3 Airport capacity is not a rigid number, and its assessment is not an exact science. While the hourly capacity of individual elements of the capacity chain at an airport may be assessed with reasonable precision once processes, supporting technologies and service standards have been defined, translation to an annual capacity (or potential throughput) requires consideration of the temporal pattern of traffic over the hours of the day, the days of the week and the months of the year.

1.4 In general, as the overall throughput of an airport increases, its profile of traffic becomes less 'peaky', and it is important in capacity assessments to recognise this trend.

1.5 Since the start of the recession in 2008, patterns of traffic at UK airports including LTN have changed, creating an added uncertainty to this exercise: will traffic return to its historic temporal pattern¹, or will the current temporal pattern continue?

1.6 A lengthier discussion of capacity issues is given in the first CSACL report considering the capacity of the existing facilities in regular use at LTN.

Contents

1.7 Following an Executive Summary (Chapter 2), there is an initial analysis of LLAOL's Busy Day flight schedule (Chapter 3). Chapter 4 examines the individual elements of the capacity chain, for each describing briefly LLAOL's proposals and the capacity issues associated with each. As most elements of capacity appear to be capable of handling in

¹ In the remainder of this report, reference to "traffic pattern" or simply "pattern" is intended to refer to the temporal pattern of passenger traffic over the hours of the day, the days of the week and the months of the year, unless otherwise indicated.



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excess of the Busy Day schedule, this chapter also discusses the level of traffic which the airport could handle with the proposed developments. Chapter 5 assesses the annual demand that the proposed developments might handle. Finally, Chapter 6 assesses the options available to LBC should it wish to limit throughput of the airport to a figure less than its capacity.

1.8 It is assumed that the reader is reasonably familiar with the layout of the airport. This report should be read in conjunction with the first CSACL report assessing the capacity of the current facilities at the airport.

2 Summary

2.1 It is important to recognise that airport capacity is not a single, rigid number. Different approaches to estimating capacity exist and are all valid but equally all have weaknesses. At best, capacity determination is an approximate science. It is also important to recognise that while hourly capacity is relatively precise, the determination of annual capacity inevitably requires consideration of the temporal patterns of traffic to decide potential throughputs. The recession which started in 2008 led to a material change in these patterns at LTN and at many other airports, although it is not known if these changes will be permanent.

2.2 A Busy Day Flight Schedule developed by LLAOL acted as the basis for planning the individual aspects of its Planning Application. The schedule incorporates the 2012 schedule (which was near to actual) and adds flights with the intention of creating a Busy Day typical of the airport when handling around 18 million passengers per annum (mppa). The extra flights are broadly sensible and reasonable, albeit representing just one set of a very large number of possibilities that would be similarly sensible and likely.

2.3 The major concern about the LLAOL Base Schedule is the very limited increase in passengers per movement which it assumes: less than 2% while passenger numbers increase by 81% from the 2012 schedule. This is a very small increase in passengers per movement, especially when the constraining feature of LTN is expected to be its runway system. Since the development of the schedule by LLAOL, easyJet has announced a major order for A320 aircraft which have more seats than the airline's current mainstay, the A319 (180 seats vs 156 seats). Such a change would increase the number of passengers expected with the Busy Day flight schedule. The proposed facilities have been tested with a schedule (referred to for convenience as the 'Enhanced Schedule') which assumes that easyJet's A319s are all replaced by A320 aircraft, but with no additional aircraft movements.

2.4 In the Base Schedule, waves of flights are added by LLAOL at different times of the day, and result in the peak for arrival passengers moving to the late evening (as it has typically been in the past) and the busiest two-way flow of passengers occurring in the afternoon rather than the early morning as at present.

2.5 On the bases of the airport's profile over time of passenger traffic in 2008 and 2012, the schedule is compatible with an annual throughput of around 18 mppa.

2.6 Nine individual elements of the 'capacity chain' have been investigated, and in general can handle the demand produced by the Busy Day schedules. The aircraft-related elements of the apron and runway/taxiway systems are likely to be the most constraining features, with the latter having only 5% 'spare'² aircraft capacity with the LLAOL Busy Day schedule, and 'reserve' stands having to be used for any additional parking over and above that required by the Base Schedule. The area within the terminal under most pressure is

² Consistent with the service standards declared by LLAOL

predicted to be the main Departure Lounge, although the conditions experienced by passengers are likely to be significantly better than are being experienced during busy periods in 2013, even with the Enhanced Schedule. The passenger demand on the surface access system has also been assessed although no view is taken on whether either the proposed airport road system or the surrounding highway system could cope with this demand.

2.7 The Enhanced Schedule is considered by CSACL to create conditions that would correspond to LTN operating at capacity.

2.8 Although on the basis of LTN's busy period to annual ratios when operating at around 10 mppa, the Enhanced Schedule is equivalent to an annual demand of between 17.7 mppa and 18.5 mppa, an airport's peakiness tends to decrease as it handles more passengers. Hence, this range under-estimates the airport's capacity. LLAOL has identified a number of airports around the world that it considers offer guidance on the relationship between capacity provided and achievable throughputs. Consideration of these airports suggests a capacity for LTN with the proposed developments of 20 mppa to 23 mppa. However, CSACL considers the best comparator airport for London Luton is in fact London Stansted, as it has a very similar mix of traffic and has already handled traffic volumes at the levels aspired to by LTN. On the basis of Stansted's busy period to annual ratios in the mid-2000s, LLAOL's Busy Day schedule would be compatible with annual throughputs in the range 17.9 mppa to 19.2 mppa.

2.9 The overall conclusion is that the capacity of LTN with the proposed developments would be between 18 mppa and 20 mppa. The range reflects the many normal uncertainties in capacity assessments, with the greatest of these being whether the existing patterns of traffic will continue (the lower end of the range), or whether historic peak ratios will return (the higher end of the range). The estimated range of the capacity of the existing facilities in use at LTN of 10 mppa to 12 mppa reflects similar uncertainties in the future pattern of traffic.

2.10 It may be appreciated that if traffic maintains its current patterns, then the proposed developments would add capacity of about 8 mppa (18 mppa – 10 mppa) at LTN. Should traffic patterns revert to their historic patterns, then the additional capacity would also be approximately 8 mppa (20 mppa – 12 mppa).

2.11 Should LBC wish to limit the airport to a particular annual throughput, the two options available are to (a) down-size the proposed developments; and (b) apply a legal limit to throughput. The first of these is not recommended in view of the time and expense involved and the potential prudence of providing some 'slack' in the system to cover unexpected developments (e.g. further enhancement of security measures, new immigration or health controls), and to provide greater resilience to handle operational disruptions.



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2.12 Any legal agreement should be based not on a rigid limit for an annual period, but on an annual target and a requirement to achieve an annual average figure over a three or four year period. The agreement should relate to the impact that LBC wishes to limit.

3 LLAOL's 2028 Schedule

Introduction

3.1 In order to assess its development plans, LLAOL prepared a typical busy day schedule of flights in 2028 (the end of its operating concession). This chapter briefly describes and discusses this schedule.

Development

3.2 The foundation of the schedule is the schedule used for assessing 2012. This schedule was the basis of the analysis of the current capacity of the airport presented in the first CSACL report. It may be noted that this schedule was similar (although not identical) to the flight operating programme on the busy day which was observed (24 May 2013).

3.3 LLAOL has added a number of flights to the base 2012 schedule, making a series of judgements about their timing, operating airline and aircraft type, and destination/origin (necessary for both airspace assessment and demand in domestic and international areas of the passenger terminal). LLAOL has also made assumptions about whether aircraft are based at LTN. LLAOL has decreased the proportion of operations undertaken by LTN-based aircraft.

3.4 In total, some 180 flights have been added to the 2012 base schedule. Applying August 2012 passenger load factors to this schedule shows that total daily passenger demand has increased by some 29,000 passengers or about 80%. Domestic growth assumed is much lower. There is though very little assumed increase in passengers per movement, despite LTN's runway system being its binding constraint, and this assumed increase seems low as discussed further below.

Table 3.1: Busy Day Schedule Summary

Schedule	Total Flights	Total Passengers	Passengers per Flight	Domestic Flights	Domestic Passengers
"2012", Current	230	35,538	154.5	36	5,260
Additional	180 (+78%)	28,873 (+81%)		10	1,474 (+28%)
"2028", 18 mppa	410	64,411	157.1 (+1.7%)	46	6,734

Source: CSACL analysis of LLAOL schedule

3.5 The timings of the additional flights look broadly sensible although obviously there is a very large number of alternative and similarly sensible schedules that could be prepared. The LLAOL schedule has been adopted as the basis of the analyses of this report³.

³Minor changes (30 minutes later) were made to the departure times of four flights, as the schedule showed the arriving and departing flights operated by each aircraft, and in these instances the proposed timings of arrival and departing flights were the same in the LLAOL schedule.

3.6 LLAOL's schedule has a significant proportion of demand being carried by easyJet's A319 aircraft, currently the backbone of this airline's fleet. In recent weeks (and therefore after the development of LLAOL's schedule), easyJet has announced a very large order for up to 235 of the slightly larger A320 aircraft. Of the firm order of 135 aircraft, 85 are intended as replacements, and the others are to expand its fleet. The proportion of A319s in the airline's fleet will fall from 68% to 25%. In view of these developments, the impact on facilities of an "Enhanced" schedule with easyJet operating an all A320 fleet through LTN has also been tested. In LLAOL's Base schedule, some 60% of easyJet's operations were assumed to be with A319s. A change in aircraft type to an all A320 operation would increase busy day passengers to 66,881 (88%), and average passengers per movement to 163.1 (+5.6%).

3.7 It should also be noted that the A320 aircraft is not the largest in this family of aircraft, with the A321 able to carry some 214 passengers compared with the A320's current maximum of 180 seats. There has also been unconfirmed media speculation that easyJet has requested Airbus to provide an extra seat row giving six further seats on the A320. The Enhanced Schedule assumes no changes in aircraft type (and hence seat numbers) for other airlines from the LLAOL assumptions.

3.8 The busy day schedule appears to be broadly representative of at least an 18 mppa throughput with the current relationships between busy period and annual traffic. This though is considered in more detail in Chapter 5. Use of the proportion of passengers on Fridays (the busiest day of the week) in August and the monthly distributions of traffic in 2008 and 2012, suggests that the busy day schedule would be consistent with annual throughputs of between 17.0 mppa and 18.5 mppa.

Table 3.2: Initial Assessment of Equivalent Annual Demand

Schedule	Busy Day Passengers	Annual Demand	
		2008 peakiness	2012 peakiness
Base	64,411	17.9 mppa	17.0 mppa
Enhanced	66,881	18.5 mppa	17.7 mppa

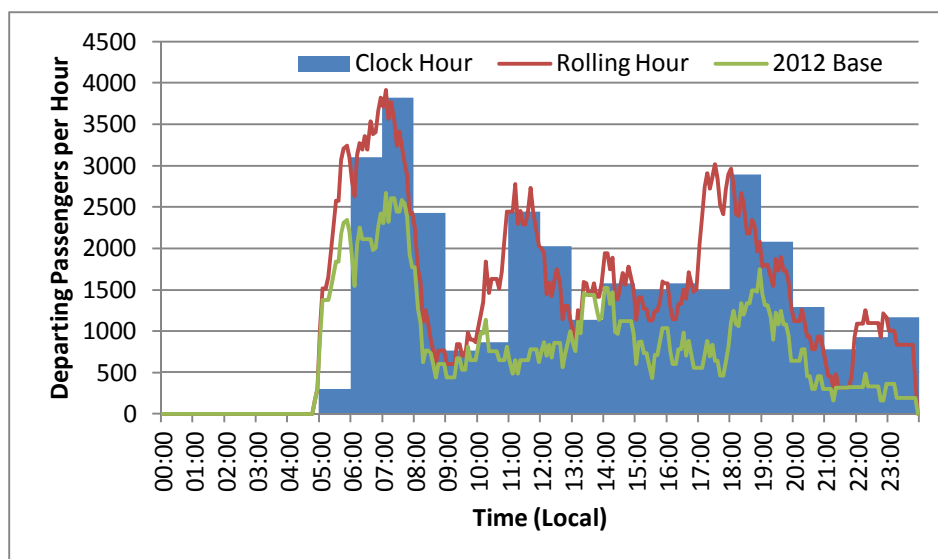
Source: CSACL analysis

Busy Hours

3.9 The simulation model developed to assess LTN's current capacity was used to analyse LLAOL's 2028 mppa schedule. LLAOL has provided more detailed data on the 'turn-up' profile of passengers for the two main airlines (viz. easyJet and Wizz) at different times of the day. However, the differences from the standard profile used in the earlier analysis were very small, so continued use was made of the standard profile.

3.10 With the Base Schedule, the busiest clock hour for departing passengers was 7 am local time with 3,825 passengers. As may be seen, the overall profile of traffic is similar to that of the 2012 schedule, although with the addition of a late morning peak, another peak in early evening and some additional late night departures.

Figure 3.1: Profile of Departing Traffic on Busy Day

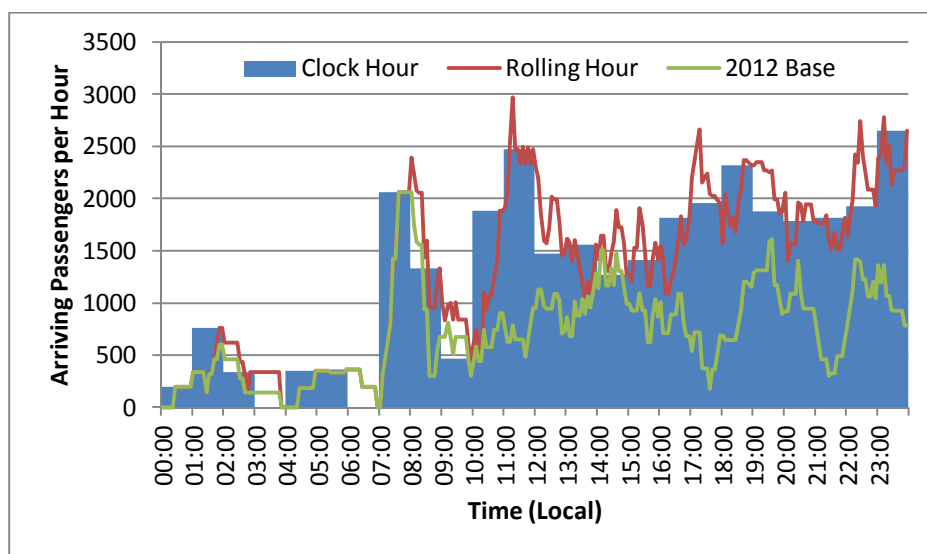


Source: CSACL analysis of LLAOL schedule

3.11 The Enhanced Schedule produces a higher busiest hour flow of 4,000 passengers per hour, again at 7 am local time.

3.12 The busiest hour for arriving traffic is predicted to start at 11 pm local time, with some 2,650 passengers in the Base Schedule (2,715 passengers in the Enhanced Schedule). The timing of the peak has moved back to the late evening where it had historically been until recent years. While there remains an early morning busy period, there are also additional late morning and late afternoon arrival peaks as well as more sustained activity throughout the evening.

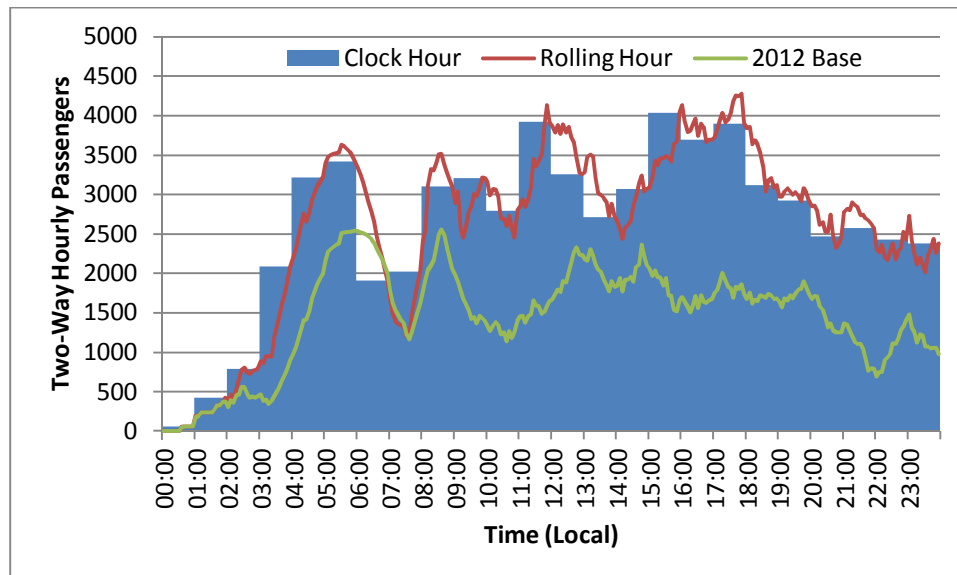
Figure 3.2: Profile of Arriving Traffic on Busy Day



Source: CSACL analysis of LLAOL Schedule

3.13 The timing of the busiest hour for two-way passenger traffic (important for assessment of vehicle traffic on the road system) is also predicted to change from 5 am local time in the 2012 Busy Day Schedule to 3 pm local time in the 2028 Base Schedule, with some 4,050 passengers predicted⁴. With the Enhanced Schedule this increases to 4,200 passengers in the hour. These estimates are based on the assumptions that departing passengers are on the highway system a short time before they appear at the Security Presentation point in the terminal (the first 'data contact' for them)⁵, while arrival passengers are on the highway system 5 minutes after leaving the terminal. This represents a change in the simulation modelling of departing passengers from that used to assess current capacity in the earlier report, but one that better reflects reality.

Figure 3.3: Two-way Profile of Passenger Traffic on Busy Day



Source: CSACL analysis of LLAOL Schedule

Conclusions

3.14 While the LLAOL-developed schedule representing a busy day when the airport is operating at around 18 mppa is an appropriate base to use to analyse most of the developments proposed by LLAOL, its profile of traffic over the hours of the day is different from that currently experienced. The predicted move of the arrival peak from early morning to late evening, and of the two-way peak flow from very early morning to early evening are likely to produce different impacts on the surrounding highway system, than would be the case if the peaks had remained at broadly the same time of day.

⁴ This number is for total passengers and includes a small number of passengers connecting between air services at LTN and who do not use the road system. LLAOL forecasts that such connecting passengers would represent 3.8% of total passengers.

⁵ 10 minutes for passengers without baggage to check-in, 30 minutes for the rest.

3.15 One short-coming of the schedule is the very small increase in passengers per ATM implied, which seems very low. Some compensation for this has been made by analysing an Enhanced Schedule based on the replacement of easyJet's A319s by A320s.

4 Analysis of Individual Capacity Elements

Introduction

4.1 This chapter examines in turn the nine⁶ individual elements of capacity at LTN, describing the development proposed in the Planning Application and assessing the capacity provided and its ability to handle the demand implied by the 2028 schedule. It concludes by assessing the extent to which the proposed facilities could handle demand in excess of that generated by the Base Schedule.

Check-in Area

4.2 LLAOL has not proposed any changes to the check-in and baggage-drop area. It considers that the current facilities are adequate for future passenger growth. The trend towards self check-in either off-airport or at kiosks, and as well as greater flexibility in the use of check-in desks as a result of CUTE (Common User Terminal Equipment) make further expansion unnecessary. LLAOL also considers that there is adequate capacity to check-in hold baggage, given both current trends and the likely growth of self-drop equipment in future years.

4.3 The simulation model has been extended to cover the check-in process. The check-in capacity of LTN has been conservatively assessed at 2,500 passengers per hour, based on the existence of 71 check-in desks, with 90% of them able to be used at any one time; 70% of passengers requiring to use a check-in desk (the proportion of international passengers checking-in baggage⁷); and the average processing time being 90 seconds per passenger. With these assumptions, the check-in demand generated by both Base and Enhanced schedules could be handled without any queuing. In practice, some queues would be expected as airlines would not open sufficient check-in desks even though LLAOL should be able to provide as many as would be required.

Passenger Security Search

4.4 LLAOL's development proposals are based around a relocation of the passenger search area from the first floor to the ground floor of the terminal building. The number of security lanes is to be increased from 12 to 20. This need has been assessed on the basis of neither technological improvements allowing faster processing nor additional security procedures lengthening processing times. This change (with these assumptions) would increase the capacity of the search areas from approximately 2,340 passengers per hour to 3,900 passengers per hour.

4.5 This capacity provision could easily handle the passenger flows associated with not only the Base Schedule but also the Enhanced schedule, with the simulation model showing

⁶ International and Domestic Baggage Reclaim are for descriptive convenience regarded as one element

⁷ The proportion for domestic passengers is lower at 35% and so this is an over-estimate

that at no time would there be queues for security processing⁸. Indeed, the number of security lanes could be reduced from 20 to 16, and the level of queuing would be very similar to that predicted during the Observation Day of 24 May 2013 (as described in the CSACL report on current capacity), with a maximum queue time of about six minutes for a period of just under two hours. These comments assume the same LLAOL policies as currently applied limiting passengers to one piece of hand baggage each. The higher passenger demand of the Enhanced schedule could be met to the same level of performance as the Observation Day with 17 security lanes.

Departure Lounge

4.6 With the passenger search area moving to the ground floor, the area on the first floor that it previously occupied is planned to be converted into a walk-through duty-free/travel value shop. There is to be an extension of the terminal building to the south, and the new first floor area is to be used to provide additional sitting areas and commercial outlets (retail and F&B). There will be some associated re-modelling of the existing departure lounge to allow flows from the new area and to the new pier at the south end of the building.

4.7 With the Base Schedule, the simulation model predicts a maximum of 3,550 passengers in the Departure Lounge at 6:25 am local time, with a further 1,150 passengers in gate areas, producing a total of some 5,000 passengers airside. Indeed, the level of airside passengers is around 4,750 from before 6 am until 7 am. This number of passengers would require a Departure Lounge with some 5,325 m² for waiting at IATA standards of comfort. LLAOL's design provides 9,491 m², so more than meets the requirements. However, the majority of this space is for retail outlets, with just 4,077 m² for general sitting (970 m²) and F&B outlets (3,107 m²). If the IATA criteria were applied to this smaller area, the space would be suitable for just 2,720 passengers. The application of the IATA approach and its weaknesses are discussed further in Appendix A.

4.8 The Enhanced Schedule would place even greater pressure on this facility with a maximum of 3,700 passengers in the Departure Lounge at 6:25 am, with total passengers airside reaching a peak of 5,250 at 6 am.

4.9 In contrast to these outputs of the simulation model, LLAOL's consultants have estimated the maximum number of passengers in the Departure Lounge as 2,625 passengers. This has been derived by applying the dwell time to the estimated Busy Hour Passengers of 3,800, which is very similar to the busiest hour in the Base Schedule with 3,825 departing passengers.

4.10 There are three basic standards against which to measure the capacity of the Departure Lounge, namely the standard IATA approach; an enhanced approach based on IATA standards as described in the Current Capacity report (Paragraph 5.29); and an

⁸ The precise outcome of the simulation model is that everyone presenting at passenger search in each five minute period was processed in the same five minute period.

empirical approach based on the standards that applied during the Observation Day (24 May 2013), judged to be the lowest acceptable.

Table 4.1: Future Capacity of Departure Lounge

Approach	Lounge Area	Standards (Area per Passenger)	Capacity (Passengers)	
			At any one time	Hourly Flow*
IATA, Service Level C	9,491 m ²	1.5 m ²	6,325	8,435
Enhanced Quality	4,107 m ²	1.7 m ² sitting, 1.2 m ² standing, +5% circulation	2,420†	3,230†
Actual 24 May 2013	4,107 m ²	0.81 m ²	5,030	6,710
Demand 2028		LLAOL	2,850	3,800
		Base Schedule	3,550	-
		Enhanced Schedule	3,700	-

* Assumes Average Dwell Time of 45 minutes

† Excludes passengers in retail areas of Departure Lounge

N.B. Application of IATA Level C standard is applied to the full area of the lounge, while the other two approaches are applied to a restricted area covering just general seating and F&B outlets

Source: CSACL analysis

4.11 It may be appreciated that on the basis of the IATA Level C approach the capacity of the Departure Lounge would be materially above that suggested by applying the conditions that existed on 24 May 2013 which were judged to be at the 'just acceptable' level. Application of an enhanced quality standard would though result in a much lower capacity estimate, and is considered to be an inappropriate approach to estimating the capacity of the facility as not only does it take no account of passengers in the retail areas, but also lower quality standards are both permitted by the Concession Agreement and currently accepted by the airport's users (airlines and passengers). Therefore, for the purposes of this assessment, the pragmatic approach based on the application of standards that applied on 24 May 2013, has been adopted.

4.12 The proposed development of the Departure Lounge would be able to handle the demand of the busiest hours of both the Base and Enhanced schedules. Indeed, the average area per passenger in these hours would be higher than that experienced on 24 May, at 1.16 m² and 1.11 m² per passenger respectively.

Gates

4.13 The major proposed work in relation to gates is the construction of a new pier (Pier B) to serve the stands on the southern side of the East Apron. It is also proposed to create more space in Pier A (on the northern side) by filling in some vacant areas, possibly to provide some additional F&B facilities (which currently are very limited outside the main Departure Lounge). These works would in total provide seven additional contact gates and four more for remote boarding to be added to the current 19 contact gates.

4.14 LLAOL's design area for gates has been calculated using the assumed Busy Hour figure of 3,800 departing passengers, an average area per passenger of 1.2 m² (assuming all

are standing – restricting the ability to hold passengers in the gate area for an excessively long period), and that gates are on average only available for 65% of the time (the ‘Occupancy Level’). This latter assumption is an IATA standard and as LLAOL’s architect, McAlister Armstrong & Partners (MAP), notes (correctly) this is not appropriate for an airport served predominantly by Low Cost Carriers and charter airlines with turnarounds typically of 30 to 45 minutes: with such operating practices, an assumed Occupancy Level of at least 100% if not higher (perhaps 150%) would be more appropriate. This calculation suggests a total area for all gates of 7,016 m² would be required and the design application is based on an area of 7,191 m².

4.15 For gates, their number is at least as important as their size, since individual gates need to be assigned to individual flights. The maximum number of departures in LLAOL’s 2028 schedule is 24 movements, which is less than the number of contact gates proposed in the future. Hence, LTN would have sufficient gates to handle the anticipated demand even without the use of the coaching gates to serve remote stands or using some contact gates twice in the same hour, a practice which would be perfectly feasible with 30 minute turnaround times.

Immigration

4.16 LLAOL intends to enlarge the International Arrivals area. In addition to providing space for three extra manned HM Border Agency Immigration Desks, the queuing area is to be increased to 844 m². Based on IATA Service Level C standards, this area would be able to accommodate 844 passengers.

4.17 Assessment of the processing capacity of the Immigration area is complex as there are two types of examination points available (viz. 15 manned control points/desks and six automatic E-gates) and two basic categories of passengers (EU and non-EU passport holders) with very different rates of average processing times. E-gates may only be used by EU passport holders, giving these passengers a choice of paths. The proportions using the two different channels will be influenced by, *inter alia*, queue length, which in turn is influenced by the arrival of other flights and by their origins and the proportion of non-EU passengers on board. While the overall proportion of non-EU passport holders at LTN is only 8%, many will be travelling on the flights operated by Wizz from Eastern Europe, and this airline does operate a wave structure into LTN, potentially creating significant variations from the average in the proportion of non-EU passport holders.

Table 4.2: Immigration Processing Times

Examination Channel	Type of Passenger	Average Processing Time
Manned Desk	EU Passport Holder	10 seconds
Manned Desk	Non-EU Passport Holder	100 seconds
E-gate	EU Passport Holder	80 seconds

Source: LLAOL

4.18 Rather than attempting to model the possible flows and estimating the average processing time, a more pragmatic approach has been adopted. LLAOL assesses the capacity

of the existing Immigration facilities (11 Manned Desks and five E-gates) as 2,170 passengers per hour. Based on the average processing time of 80 seconds, the E-gates contribute a theoretical maximum of 45 passenger capacity per hour per E-gate, suggesting that the average achievable for a Manned Desk is 177 passengers per hour. On this simplistic basis, the planned development would have a capacity of 2,920 passengers per hour (=177x15 manned desks + 45x6 E-gates).

4.19 With this processing rate, there are several periods during the busy day when the simulation model suggests that queues for Immigration would build up. However, the maximum predicted queue length with the Base Schedule is 9 minutes, and the queue would not exceed the capacity of the queuing area of 844 passengers, the maximum predicted being 750 passengers (and that for one five minute period only). With the higher demand of the Enhanced Schedule, there are a more periods during the day when queues of 6 to 8 minutes are predicted, but the maximum wait is still predicted as 9 minutes and the maximum number of passengers queuing as 800. It should be noted though that these analyses assume the average processing rate derived above which will be based on the average proportion of non-EU passport holders.

Baggage Reclaim

4.20 As part of its development application, LLAOL is planning to provide four additional baggage reclaim units for international passengers to provide eight in total, and to re-locate the single unit for domestic passengers. The doubling of the international reclaim capability should take capacity to 3,920 passengers per hour. The floor area of the two baggage reclaim areas will also increase.

Table 4.3: Baggage Reclaim Areas

	Current		Future		
	Number	Area	Number	Area required	Area provided
International	4	1,743 m ²	8	1,797 m ²	4,697 m ²
Domestic	1	395 m ²	1	257 m ²	508 m ²

Source: LLAOL ("London Luton Capacity Calculations - RESULTS 2012-04-17 (17.8m PAX)")

4.21 The ability of the baggage reclaim area to handle demand depends on both the number of reclaim units and the area available for waiting passengers. In the international area, although the maximum of international arrivals in any one clock hour is 14 flights, on a rolling hour basis it rises to 18 flights (or some 1,750 passengers entering the reclaim area), while on a rolling half-hour basis the maximum is 12 flights. This suggests that there may be occasions when two flights are allocated to the same baggage reclaim unit. The maximum occupancy of the international reclaim area is predicted to be 1,025 passengers in both the Base and Enhanced Schedules. At IATA Service Level C, there should be 1.7 m² for each passenger, or a total area of some 1,750 m².

4.22 The maximum number of passengers in the domestic baggage reclaim area at any one is predicted to be 285 with both the Base and Enhanced schedules. This translates into

a space requirement of 485 m², somewhat higher than LLAOL's architect's estimate but still less than the space planned to be provided. However, in the 2028 Busy Day schedule there is some bunching of domestic arrivals, particularly in the early morning, with one 30 minute period when five flights are scheduled. There will therefore be a need for several flights to have baggage delivered to the same reclaim unit at the same time or a need for the schedule co-ordinator to require place restrictions on the timing of domestic arrivals.

Surface Access System

4.23 LLAOL's development application includes provision for a re-modelling of the coach and bus area, with drive-in, reverse out bays replacing the current 'parallel parking' bays. There is an increased separation of the taxi and passenger drop-off zones, changes to the short-term car park layout, the addition of a multi-storey car park, and some consequential re-modelling of the road system, including a dual carriageway between the Holiday Inn roundabout under Taxiway Alpha and into the terminal area.

4.24 LLAOL's application is based on the increased use of public transport to arrive at and leave the airport.

Table 4.4: Actual and Assumed Modal Split of Passengers at LTN, 2012 and 2017

Mode	2012	2017 Onwards
Car (drop-off)	26.9%	22.2%
Car Parking (On-site)	14.7%	12.7%
Car Parking (Off-Site)	7.9%	7.8%
Taxi	16.9%	16.2%
Train	16.5%	21.3%
Bus/Coach	16.3%	19.4%
Other	0.8%	0.4%

Source: CAA Passenger Survey (provided by LLAOL) and LLAOL assumptions adjusted by CSACL to reflect split of terminating passengers (LLAOL source gives split including passengers connecting by air at LTN, assumed to be 3.8% of total passengers in 2017 and beyond)

4.25 To test the impact of an 18 mppa demand on the access road system, these splits were applied to the busiest two-way hourly flow of passengers on the busy day, having allowed for an assumed 3.8% of passengers making air connections at LTN and hence not contributing to the demand on service access infrastructure. Vehicle occupancies were either those typically observed at LTN or for the public transport modes an assumed frequency of service, adopting the LLOAL assumption that increased demand would be divided equally between greater occupancy and higher frequency. The detail predictions for the Base Case with LLAOL assumed modal splits is given in Table 4.5, while Table 4.6 summarises the assessments for four scenarios based on the Base and Enhanced schedules and current and assumed future modal splits.

Table 4.5: Estimate of Passenger-generated Vehicle Journeys in Two-Way Busy Hour: Base Case, LLAOL Assumed Modal Split

Mode	Passengers	Vehicle Occupancy	Movements per Vehicle	Number of Vehicle Movements
Car (drop-off)	861	1.2	2	1,435
Car Parking (Short Term)	144	1.3	1	111
Car Parking (Medium, Long and Off-Site)	651	13*	2	50*
Taxi	629	1.2	2	1,048
Train	826	52*	2	16*
Bus/Coach	753	47*	2	16*
Other	16			0
Total	3,880			2,676

Note: Figures shown to nearest passenger/vehicle to facilitate further analysis and not to imply level of accuracy

Source: CSACL derived using LLAOL Occupancy and coach/bus schedules

* Derived from hourly schedule rather than occupancy-related calculation

Table 4.6: Summary of Vehicle Movements in Busiest Hour by Scenario and Modal Split Assumption

Scenario	Modal Split	
	2012	LLAOL Assumed
Base	3,039 vehicles	2,676 vehicles
Enhanced	3,161 vehicles	2,784 vehicles

Note: Figures shown to nearest vehicle to facilitate further analysis and not to imply level of accuracy

Source: CSACL

4.26 As the busiest hour for two-way passengers is predicted in the future to be at 3 pm in the afternoon (rather than 5 am in the morning), there would be a greater ability of passengers to use public transport modes of access to the airport.

4.27 Table 4.7 presents the number of passengers (with a standard 3.8% reduction for connecting passengers) in each hour throughout the day for both Base and Enhanced Schedules. To facilitate further modelling, it also indicates the proportion of these passengers which is departing by air.

Table 4.7: Hourly Two-Way Terminating Passenger Flows

Hour Commencing	Passengers		of which Departing† Proportion	
	Base	Enhanced	Base	Enhanced
Midnight*	909	1,355	0%	0%
1:00 am	407	434	0%	0%
2:00 am	762	818	40%	40%
3:00 am	2,010	2,134	84%	84%
4:00 am	3,099	3,237	98%	98%
5:00 am	3,290	3,379	90%	90%
6:00 am	1,839	1,878	84%	84%
7:00 am	1,949	1,996	43%	45%
8:00 am	2,999	3,073	49%	50%
9:00 am	3,092	3,180	67%	66%
10:00 am	2,725	2,843	62%	62%
11:00 am	3,777	3,892	36%	37%
Midday	3,132	3,280	48%	48%
1:00 pm	2,630	2,770	51%	51%
2:00 pm	2,955	3,053	52%	52%
3:00 pm	3,880	4,037	58%	57%
4:00 pm	3,552	3,707	65%	65%
5:00 pm	3,750	3,898	45%	46%
6:00 pm	2,999	3,080	35%	35%
7:00 pm	2,824	2,976	23%	22%
8:00 pm	2,382	2,396	36%	36%
9:00 pm	2,475	2,517	30%	29%
10:00 pm	2,368	2,436	7%	7%
11:00 pm	2,321	2,383	0%	0%

Note: Figures shown to nearest passenger to facilitate further analysis and not to imply level of accuracy

* Figures for the hour commencing at Midnight include passengers landing before Midnight of the Busy Day (i.e. in the hour commencing at 11 pm) but not leaving the terminal until after the hour

† Departing by Air

Source: CSACL analysis of LLAOL schedule

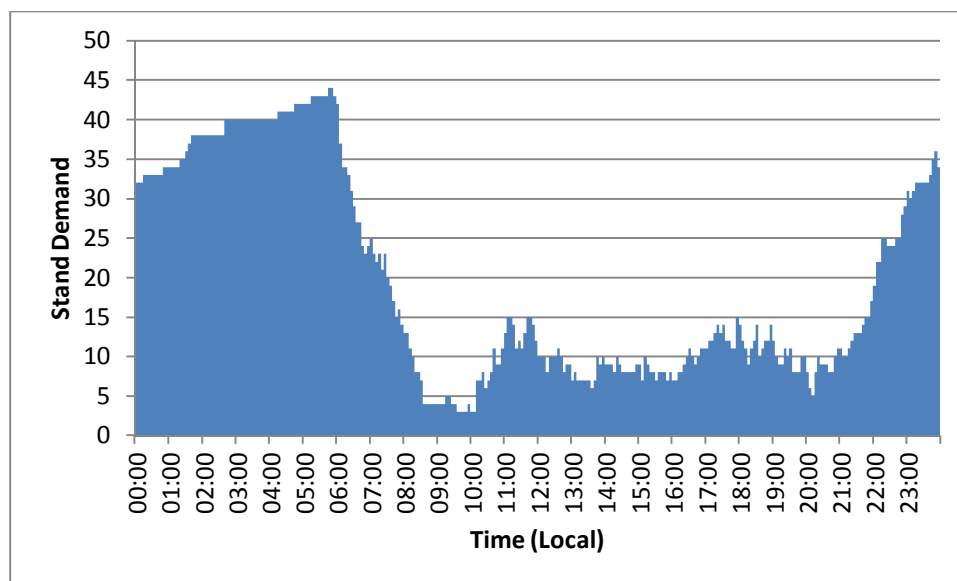
Stands

4.28 The development proposals from LLAOL see an increase in aircraft stands from 35 to 48, of which four are considered to be held in reserve for longer term parking and cargo operations. Of the 44 'operational' stands, 25 are contact stands (i.e. are adjacent to the terminal building), and 19 are remote requiring airside buses to carry passengers to and from the aircraft. The additional stands are to be provided by a mix of stand re-marking; reclaim of apron areas from one/two Fixed Based Operators (FBOs); and laying of some additional concrete (e.g. two stands on the South Apron).

4.29 LLAOL's 2028 schedule indicates 43 aircraft night-stopping and one overnight flight arriving before the first departing flight, giving a maximum operational stand requirement of

44 stands shortly before 6 am local time. The latest departures of night-stopping aircraft are at 8:30 and 9 am, so that arguably these aircraft might use two of the four reserve stands. An assessment based on assuming stand availability five minutes before the arrival of a flight and stand occupancy five minutes after scheduled departure time yields the same results. An increase in these intervals to 10 minutes⁹ does not change overall stand requirement.

Figure 4.1: Stand Demand on Busy Day 2028



Source: CSACL analysis of LLAOL schedule

4.30 A LeighFisher report of March 2012 assessed maximum stand demand as occurring in the period between 5:30 and 6 am, and while a table in its report indicates 42 stands are required, the supporting text indicates the figure is 43 Code C Stands as “...one is blocked due to presence of larger Code D aircraft...”. However, in the flight schedule supplied to CSACL, there is no Code D aircraft present at LTN overnight or during this period, and the only four movements throughout the day with Code D aircraft are operated by non-based aircraft.

4.31 Separately, LeighFisher has also suggested that there should be a surplus of 10% to allow for “...unexpected movements, operational spare aircraft and aircraft visiting for maintenance...”.

4.32 LLAOL does note the possibility that advances in aircraft technology may result in aircraft wingspans increasing. However, Airbus’s website indicates that the A320 has the same wingspan as the A319 (34.1m), although if fitted with winglets it is the same as that of the B737-800 (with winglets) at 35.8m. The International Civil Aviation Organisation (ICAO) categorises aircraft as Code C if their wingspan is from 24m up to but not including 36m. Given the prevalence of Code C aircraft and Code C stands around the world, it is unlikely

⁹ The 10 minute interval for both arrivals and departures effectively provides a 20 minute buffer between operations, which is higher than LLAOL’s current practice of 15 minutes.

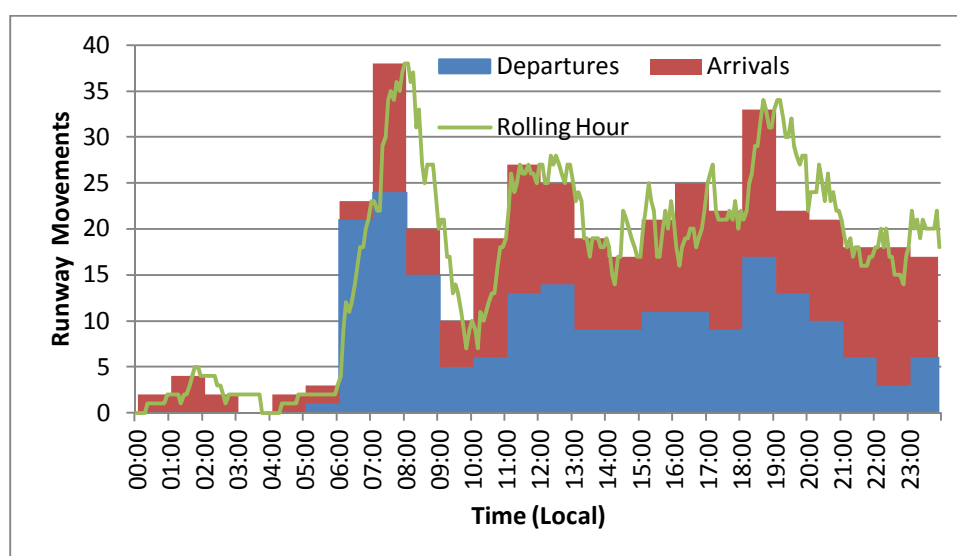
that Airbus would develop its new A320 variant with a wingspan that breached this definition. A potential problem lies with 12 of LTN's stands being too narrow to accommodate the maximum Code C wingspan.

Runway and Taxiway System

4.33 LLAOL's application includes provision for extensions at both ends of the parallel taxiway which would then become almost full length. LLAOL has suggested that this would almost completely avoid the need for any aircraft to any destination likely to be served having to back-track along the runway to have the necessary take-off length¹⁰. In addition to this gain, the extensions are seen as being necessary to provide queuing space for aircraft waiting to depart, especially on Runway 08 to the East. Without this, a queue of aircraft waiting to take-off could reach back into the stand area and prevent efficient circulation of aircraft around the apron system. LLAOL indicated that apron circulation is one of the considerations for the provision of a new taxiway (Foxtrot) parallel and to the east of Taxiway Delta. This taxiway would also provide a waiting area for aircraft arriving early and would also allow some 'sequencing' of aircraft after push-back to optimise runway and airspace capacity.

4.34 LLAOL's schedule suggests that maximum two-way demand on the runway would be 38 movements per hour starting at 7 am local time and consisting of 24 departures and 14 arrivals. This assessment is based on assuming a five minute taxi time, so that arrivals are assumed to be 'on the runway' five minutes before the stand time given in LLAOL schedule, and departures five minutes after the LLAOL schedule time.

Figure 4.2: Runway Movements, Busy Day 2028



Source: CSACL analysis of LLAOL schedule

¹⁰ It also noted that some airlines, such as Monarch, have maintained as a company policy the use maximum available take-off distance, thereby requiring some taxiing on the runway.

4.35 LeighFisher's airfield simulation of March 2012 identified a peak hour also starting at 7 am local time but having 39 movements. The difference with the CSACL assessment is believed to be due to different interpretations of the time in the LLAOL schedule. LeighFisher also identified an early evening peak hour starting at 6.30 pm with 38 movements, although on the schedule provided by LLAOL the highest rolling hour total around this time is 34 movements by commercial passenger aircraft. It is believed that the LeighFisher figure includes executive jet movements. While such movements could add to demand on the runway, they would only be permitted if there were available runway slots, and they would not be granted slots if they were likely to cause delays. Hence, their inclusion in this analysis is not appropriate.

4.36 LeighFisher used an airfield simulation model (SIMMOD) to assess the capacity of LTN with the proposed additional stands and extensions to both the east and the west of the parallel taxiway. The simulation, however, did not include the new Taxiway Foxtrot, and only investigated operations on Runway 08, as the major constraining feature of the airfield is the backlog of aircraft waiting to depart, and this queue reaches the apron more quickly with easterly departures from Runway 08 than westerly departures using Runway 26.

4.37 The simulation showed that with 39 two-way aircraft movements scheduled in an hour, the average delay would be 8 minutes over a three hour period (with 33 movements actually taking place in the hour and six aircraft being delayed until the next hour). A schedule with 42 planned movements led to average delay increasing to 10½ minutes (with 34 movements taking place in the hour and eight flights being delayed until the next hour). Performance from Runway 26 would be better, while a reduction in departure-arrival airspace separation also improves performance. LeighFisher has indicated that in its opinion Taxiway Foxtrot would reduce delays slightly but would be more important to increase the airport's resilience to difficult operation conditions.

4.38 LeighFisher considered a number of scenarios, but did not identify the level of scheduled movements at which the average delay was predicted to be LLAOL's policy maximum of 10 minutes. This level would, however, appear, *ceteris paribus*, to be between 39 and 42 movements per hour.

Table 4.8: Summary of SIMMOD Results

Planned Movements	Airspace Separation	Average Delay (minutes:seconds)
36 per hour	Normal	4:57
39 per hour	Normal	8:01
42 per hour	Normal	10:26
39 per hour	Reduced	4:20

Source: LeighFisher Final Report Appendix – Airfield Simulation Modelling, Page 4

4.39 It should be noted though that LeighFisher:

- Did not include the new Taxiway Foxtrot in its simulations;
- Did not assume reduced airspace separation in its primary scenarios;

- Considered that actual air traffic controllers would probably perform a little better than the results predicted by the simulation; and
- Concluded that “.....a schedule with 42 busy-hour two-way scheduled movements can be accommodated within the acceptable delay threshold provided that the adjacent hours have fewer scheduled movements...”¹¹

4.40 On the basis of these points, it would appear that the movement capacity of LTN with the proposed LLAOL developments in place, is likely to be higher than 39 movements per hour, while still achieving an average delay of less than 10 minutes, and is conservatively assumed to be 40 movements per hour.

Summary of Capacity of Individual Elements

4.41 The different elements of capacity with proposed developments are stressed to varying extents by the Busy Day Schedule developed by LLAOL, as summarised below. Table 4.9 also provides a view of the extent to which the throughput of the proposed facilities could handle demand in excess of that generated by the Busy Day Schedule but still within LLAOL’s design and service quality standards. It may be noted that no capacity is given for the surface access system, although the demand placed on it is noted.

Table 4.9: Summary of Capacity Elements

Element	Hourly Capacity	‘Consumed’ by Base Schedule	Potential Upside*	Comments
Check-in	2,500	2,300	+10%	Unlikely to constrain growth, given move to self-service
Security	3,900	3,300	+18%	
Departure Lounge	5,030	3,550	+40%	Dependent on accepting current service levels or better
Gates	30	24	+25%	Unlikely to constrain growth
Immigration	2,920	2,500	+17%	If queue length increased to a maximum of 10 minutes
Baggage Reclaim	3,920	1,750	+125%	Mathematical upside too high, but unlikely to constrain growth
Stands	44	44	0%	Excludes 4 stands held for cargo, maintenance etc.
Runway	40	38	+5%	Aircraft capacity
Surface Access	?	2,676	?	Capacity not assessed

* From Base Schedule demand

N.B. Capacities and throughputs are passengers per hour, except Gates and Stands (numbers), Runway (aircraft movements per hour) and Surface Access (vehicles per hour)

4.42 Leaving to one side the surface access element of the capacity chain, the capacity elements under next greatest pressure are the apron and runway/taxiway system.

¹¹ LeighFisher Final Report Appendix – Airfield Simulation Modelling, Page 60.

4.43 Other capacity elements are unlikely to constrain growth. The Departure Lounge is likely to operate to standards provoking most passenger reaction, although those standards are likely to be above those currently experienced by passengers in busy periods.

4.44 In summary, with the proposed developments, LTN could handle the demand associated with the 2028 Busy Day flight schedule (both Base and Enhanced versions), with some elements coping more easily than others. This assessment assumes the surface access system can handle demand. It may also be appreciated that there is upside potential for handling a higher level of demand than inherent to the 2028 Busy Day schedule, if the runway and apron systems could deliver more passengers through any combination of more passengers per flight, more runway movements, or more use of the reserve stands.

Capacity of Proposed Developments

4.45 While some additional aircraft movements on the runway might be possible for the reasons outlined, this and the greater use of the four reserve stands is not considered further. However, more passengers could be carried on the movements that LLAOL has assumed on the Busy Day. Analysis of the Enhanced Schedule (which is based only on the use of A320s rather than A319s by easyJet so the same number of aircraft movements) has shown that the passenger related elements of the proposed developments can handle the additional demand.

4.46 As noted earlier, the LLAOL schedule has inherent within it a very modest increase from present levels in passengers per movement, just 1.7% in the Base Schedule and only 5.6% even with the Enhanced Schedule. Increase in numbers of passengers between the 2012 and 2028 schedules is 81% in the Base Schedule and 88% in the Enhanced Schedule, with aircraft movements increasing by 78% in both. LTN will be in different stage in its evolution between now and 2028 than it has been over the last 15 years, and indeed already has a significant proportion of Code C aircraft operating its flights. The relative growth rates of passengers and passengers per movement in the LLAOL schedule though still seems extreme, and the assumption that the bulk of the growth would be carried by movements is unrealistic.

4.47 When considered over a sufficiently long period, airlines as a whole have generally always increased the number of passengers carried per movement. This is illustrated by the experience at LTN in the 15 years between 1998 and 2012 when passenger numbers increased by 155% and passengers per movement grew by 55%. Indeed, over the period to 2028, LLAOL's Master Plan is forecasting annual passenger growth of 85% (from 2012 levels) supported by ATM growth of 61% and growth in passengers per ATM of 15% to 154.1 passengers per ATM. These Master Plan forecasts suggest that (a) busy day ATMs grow faster than annual ATMs; and (b) passengers per ATM are only 1.9% higher on the Busy Day than annually (157.1 vs. 154.1): both of these propositions are in CSACL's view unlikely.

4.48 Hence, the assumed increase in passengers per movement in the Enhanced Schedule is considered a reasonable if not a conservative figure. Even if easyJet did not replace all its A319 operations through LTN with A320s, any deficiency is likely to be off-set

by other airlines using larger aircraft than assumed by LLAOL, as easyJet is assumed to provide only 43% of the flights in the Busy Day Schedule¹².

4.49 On this basis, it is considered that the throughput that might be carried through the proposed facilities at LTN, and hence the airport's capacity with the proposed developments, is represented by the Enhanced Schedule, would produce a busiest hour of 4,000 departing passengers and a Busy Day of 66,881 passengers.

¹² The LLAOL base schedule did not assign operating airline codes to many of the flights added to the 2012 schedule to produce the 2028 schedule. CSACL added codes based on aircraft types, origin/destinations and whether aircraft were indicated as being based at LTN, and the flights considered likely to be operated by easyJet (namely those flown to current easyJet destinations and with based A319 or A320 aircraft) are included in the figure of 43%.

5 Overall Annual Capacity of LTN

Introduction

5.1 This chapter takes the analysis and conclusions on hourly and busy day capacity of the previous chapter, and estimates the annual capacity of LTN if all developments proposed by LLAOL were permitted and constructed. A number of different approaches are investigated.

Initial Conversion to Annual Capacity

5.2 An initial assessment of the annual demand that would be consistent with the 2028 Busy Day schedule was made in Chapter 3. For convenience, the results of that exercise are repeated here.

Table 5.1: Estimates of Annual Throughput based on Recent Peakiness

Schedule	Busy Day Passengers	Annual Capacity	
		2008 peakiness	2012 peakiness
Base	64,411	17.9 mppa	17.0 mppa
Enhanced	66,881	18.5 mppa	17.7 mppa

Source: CSACL analysis

5.3 This assessment is of course based on the relationships between busy period and annual demand when annual throughput is around 10 mppa. As described in the first CSACL report on the capacity of the current infrastructure of LTN, there is a recognised trend for peakiness to decrease as annual throughput increases. Therefore, ratios relating to current levels of throughput of around 10 mppa are not the most appropriate ones to use, and are likely to under-estimate equivalent annual throughput.

LLAOL Benchmarking

5.4 LLAOL has developed a table of busy hour parameters for a range of annual throughputs based on the experiences at other airports, in order to assist in its assessment of future needs at LTN. While LLAOL regards these as 'input' tables, there is no obvious reason why they should not be used as a guide for 'outputs' i.e. resulting capacity. There is a considerable mix of airports used to compile this table, although LLAOL has constrained the sample to be single runway airports with 95% of operations to short haul destinations with predominantly Code C aircraft. Although data were collected for 28 airports (including Luton), only 13 of them had traffic greater than 10 mppa. The airports were in the UK (Gatwick, Manchester and Stansted), Ireland (Dublin), the USA (Chicago Midway, Oakland, San Diego and Tampa), China (Chengdu, Kunming, Shanghai Hongqiao and Shenzhen) and Brazil (Sao Paulo Congonhas). It is understood that Busy Hour definitions were not uniform; and that actual data were not always available, with LLAOL having to make estimates based on scheduled capacity and assumed load factors. However, the data correlated well with experience at LTN up to that time.

5.5 The seven airports with throughputs in the range 18 mppa to 23 mppa had an average of 192 Busy Hour Departing passengers per million annual passengers. Table 5.2 also provides another estimate of LTN's future capacity based on these data.

Table 5.2: LLAOL Benchmark Airports' Busy Hours

Airport	Annual Passengers (million)	Departure Busy Hour Passengers	Busy Hour to Annual (Pax per mppa)
Shanghai Hongqiao	19	4,280	225
Shenzen	18	3,630	202
Stansted	23	4,650	202
Dublin	21	4,100	195
Chicago Midway	19	3,150	166
San Diego	18	3,502	195
Tampa	19	2,984	157
Average	19.6	3,757	192
LTN 2028			
Base Schedule	19.9	3,825	192
Enhanced Schedule	20.8	4,000	192

Note: No Departure Busy Hour data was given for Manchester, so it is not included here

Source: CSACL analysis of LLAOL base data

5.6 LLAOL has used the data gathered from these and the other benchmark airports to prepare charts showing the development of the different parameters as airport size increases. The data inevitably show some scatter, so that three curves have been fitted to it. From these curves, the average value of each parameter at particular annual airport throughputs has been determined, and summarised by LLAOL in its Benchmark Table. This table was developed in 2008 and used to assist in planning developments at the airport. It is therefore more representative of historic patterns of traffic. The elements of that table relevant to the current and future capacities are summarised below.

Table 5.3: Extracts from Original Benchmarking Table

Source	Annual Throughput	Departure Busy Hour Passengers	Annual Throughput	Comments
Benchmark Table	12.5 mppa	2,725		
Benchmark Table	13.0 mppa	2,792		
LTN Current Capacity		2,740	12.6 mppa	Interpolated
Benchmark Table	21.0 mppa	3,774		
Benchmark Table	21.5 mppa	3,831		
2028 Base Schedule		3,825	21.5 mppa	Interpolated
Benchmark Table	23.0 mppa	3,999		
Benchmark Table	23.5 mppa	4,055		
2028 Enhanced Schedule		4,000	23.0 mppa	Interpolated

Source: LLAOL Benchmark Table, CSACL interpolation

5.7 LLAOL has subsequently revised its Benchmark Table, as changes in the pattern of demand at LTN since 2008 had resulted in a loss of correlation with the experience at LTN.

Adjustments were made to reflect changes in the composition of the busy hour at LTN with an increased level of arrivals by non-based airlines in the early morning period and increases in the number of passengers per aircraft movement. The table is therefore intended to be representative of current patterns of traffic.

Table 5.4: Extracts from Revised Benchmark Table

Source	Annual Throughput	Departure Busy Hour Passengers	Annual Throughput	Comments
Benchmark Table	9.3 mppa	2,489		
Benchmark Table	9.9 mppa	2,780		
LTN Current Capacity		2,740	9.8 mppa	Interpolated
Benchmark Table	18.7 mppa	3,802		
Benchmark Table	19.4 mppa	3,981		
2028 Base Schedule		3,825	18.8 mppa	Interpolated
Benchmark Table	19.4 mppa	3,981		
Benchmark Table	19.8 mppa	4,008		
2028 Enhanced Schedule		4,000	19.6 mppa	Interpolated

Source: LLAOL Benchmark Table, CSACL interpolation

Stansted Benchmark

5.8 In reality, easily the most appropriate analogue for LTN is London Stansted (STN) Airport:

- It has operated at and above the levels of annual traffic that the proposals from LLAOL are intended to handle;
- It has a very similar mix and type of traffic as LTN, with Ryanair and easyJet being its primary customers; and
- Its geographic proximity means that air services will be operating within similar constraints and considerations of commercial acceptability of particular flights timings.

5.9 No analogies are perfect, and while in 2011 international leisure passengers represented 80% of business at both airports (with charter passengers being 3% at STN and 4% at LTN), foreign residents were more important at STN (41% at STN vs 28% at LTN). While the majority of passengers at both airports are carried on scheduled flights by airlines operating essentially to a low cost business model, there are variations within this model, from the ultra low cost approach of Ryanair, to a more consumer-aware approach of, say, easyJet or Monarch. While the level of fares between these airlines varies, the airlines all accept lower revenues per passenger in the off-peak seasons than they achieve in the peak season. Currently, easyJet's revenues per passenger in its weakest quarter are 76% of its peak quarter unit revenues, slightly lower than the performance of Ryanair (78%)¹³. These performances are similar to the levels Ryanair was achieving in 2006 and 2007 of 80% and

¹³ Figures are network wide.

75%, respectively, when STN was operating at annual passenger volumes similar to that planned for LTN in the future. Hence, it is considered that STN continues to be a valid comparator for the future pattern of traffic at LTN.

5.10 In the mid-2000s, capacity at STN was coming under pressure, and its owners applied for permission to extend the facilities of the airport. Supporting documents provide data on both Busy Hour and Busy Day passenger numbers, covering periods when the airport was under pressure and when some peak spreading could be assumed to have occurred. The airport was handling over 20 mppa at the time, closer to the intended throughput of LTN (after the developments), making application of these busy to annual ratios more appropriate. In view of the pressure on capacity at the time, a Stansted analogy provides an insight of airline scheduling behaviour when faced with a shortage of capacity.

5.11 In 2004, STN handled 20.9 mppa, and had a 5% Busy Hour¹⁴ of 3,540 departing passengers. However, the 5% Busy Hour tends to be less busy than the 30th Busy Hour, and an application of the STN ratio would produce annual capacity estimates for LTN that were likely to be too high. Some degree of compensation would be provided by the fact that the busiest hour determined by the simulation model from the Busy Day schedule in 2012 was less than the 30th Busy Hour. On balance, however, because of these uncertainties reliance could not be placed on any assessments based on STN's 5% Busy Hour.

5.12 The STN planning application documentation also provides actual data on passenger numbers on, *inter alia*, average September weekdays for both 2004 and 2006. The LLAOL schedule is for a Friday and the analysis in this report has applied average August passenger load factors to estimate passenger numbers. Hence, some adjustments to the base inputs are needed.

5.13 For LTN, Friday is the busiest day of the week in August, so that the average weekday has fewer passengers. The 2028 Busy Day figures have been converted to average weekday figures in August based on Friday to total weekday proportions in 2008 (considered to be a more representative year than 2012 for LTN). The average passenger load factors have been assumed to be the same on each day. To align with the LTN data, the STN September figures have been converted to an August average based on the relative traffic and number of days in each month.

¹⁴ The concept of a 5% Busy Hour is very similar to that of the 30th Busy Hour, with the difference being that the 5% Hour is the hour with a rate above which only 5% of annual passengers is handled.

Table 5.5: Determination of Annual Throughput from STN Busy Day Passengers

	STN 2004	STN 2006
STN Average September Weekday Passengers	64,864	71,024
STN Average August Weekday Passengers	70,051	75,648
STN Annual Passengers	20.9 mppa	23.7 mppa
LTN Base Schedule		
LTN August Friday Passengers	64,411	64,411
LTN August Weekday Passengers	61,933	61,933
LTN Annual Passengers	18.5 mppa	19.4 mppa
LTN Enhanced Schedule		
LTN August Friday Passengers	66,881	66,881
LTN August Weekday Passengers	64,308	64,308
LTN Annual Passengers	19.2 mppa	20.1 mppa

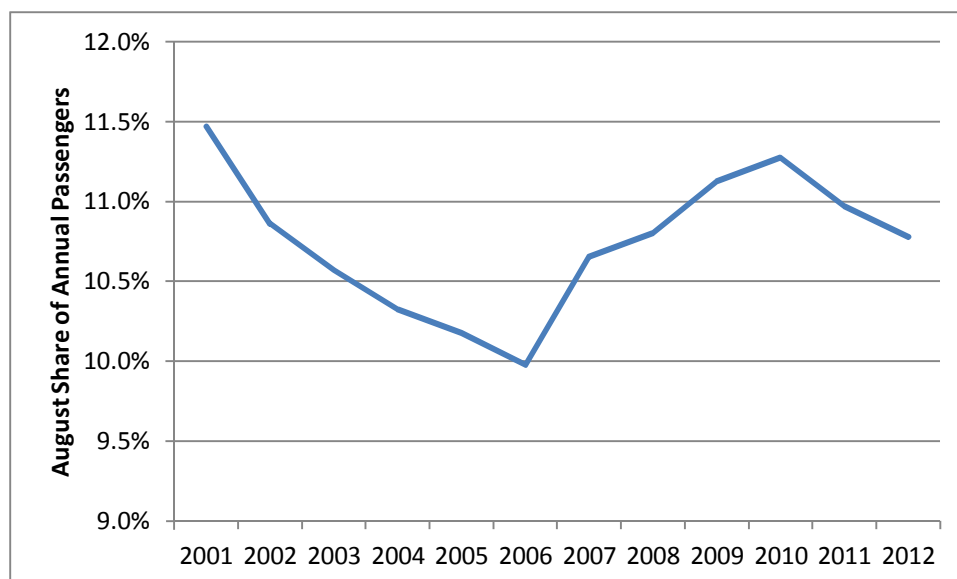
Source: STN G1 Environmental Statement Vol 16 Traffic Forecasts, BAA plc; CSACL analysis

5.14 It may be seen that the annual demand consistent with LLAOL's Busy Day schedule is higher than 18 mppa on the basis of comparison with the characteristics of Stansted. The ratios used to produce these estimates are though associated with higher annual throughputs than result from their application to an LTN busy day and therefore the resultant estimates are likely to be too high, although less so for the 2004 based calculation.

5.15 The difference between the results based on Stansted 2004 and 2006 profiles stems from changes in the profile of traffic at the airport between these two years. Daily passenger numbers at STN at the present time are not published, so it is not possible to use the above approach with 2012 traffic volumes to assess a potential throughput for LTN based on the current profile at STN. An alternative approximation involves consideration of monthly traffic.

5.16 It may be seen (Figure 5.1) that the proportion of annual passengers handled in August at STN reached a low point in 2006. In other words, the airport was least seasonal in this year. The seasonality increased after 2006, initially as a result of Ryanair's reactions to the ending of discounts to airport charges at STN in 2007, with the economic recession contributing to this from 2008 and off-peak travel being more adversely affected than peak season. However, in both 2011 and 2012 seasonality decreased. While the situation in 2013 is not yet known, passenger traffic in the first half of the year (largely off-peak months) increased on a like-for-like basis, but both July and August saw decreases in traffic despite UK airports on the whole experiencing an increase. This suggests that 2013 will see a continuation of the trend for seasonality to decrease.

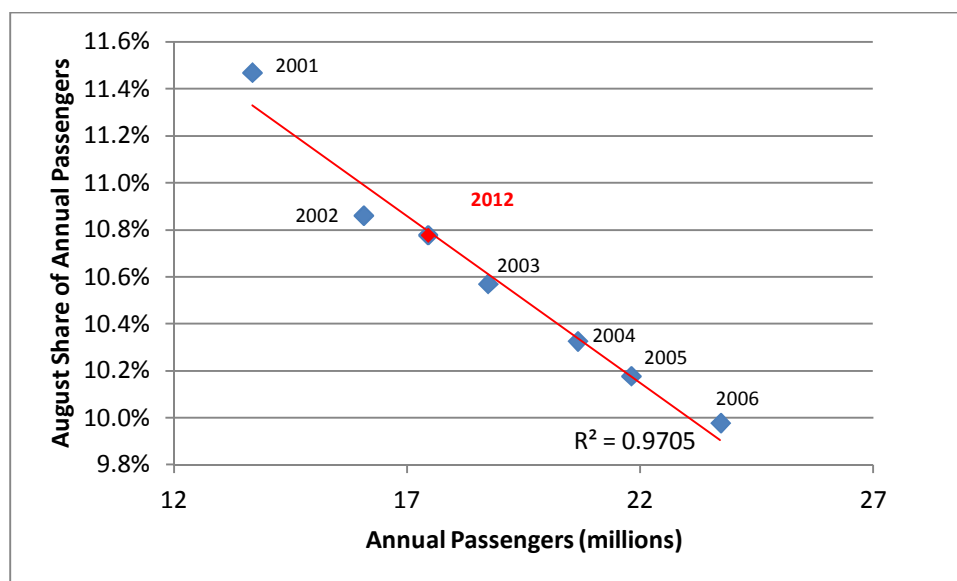
Figure 5.1: Progression of Stansted's Seasonality



Source: CSACL analysis of UK CAA data provided by LLAOL

5.17 The increase in seasonality (a form of peakiness) from 2007 to 2010 is though at least partially linked to the decrease in annual passenger volume at STN over the period. Indeed, the 2012 seasonality is exactly on the trend line for the airport's seasonality between 2001 and 2006 (Figure 5.2), implying that in 2012 the seasonality had reverted to the historic pattern.

Figure 5.2: Seasonality and Annual Throughput



Source: CSACL analysis

5.18 This relationship may be used to convert future LTN daily passenger volumes to annual volumes, although it does require the application of a further assumption about the proportion of August monthly traffic that is handled on a busy day (Friday) in the month. As may be seen, although the differences in daily percentages at LTN between 2008 and 2012 appear small, they are magnified when converted into an annual volume.

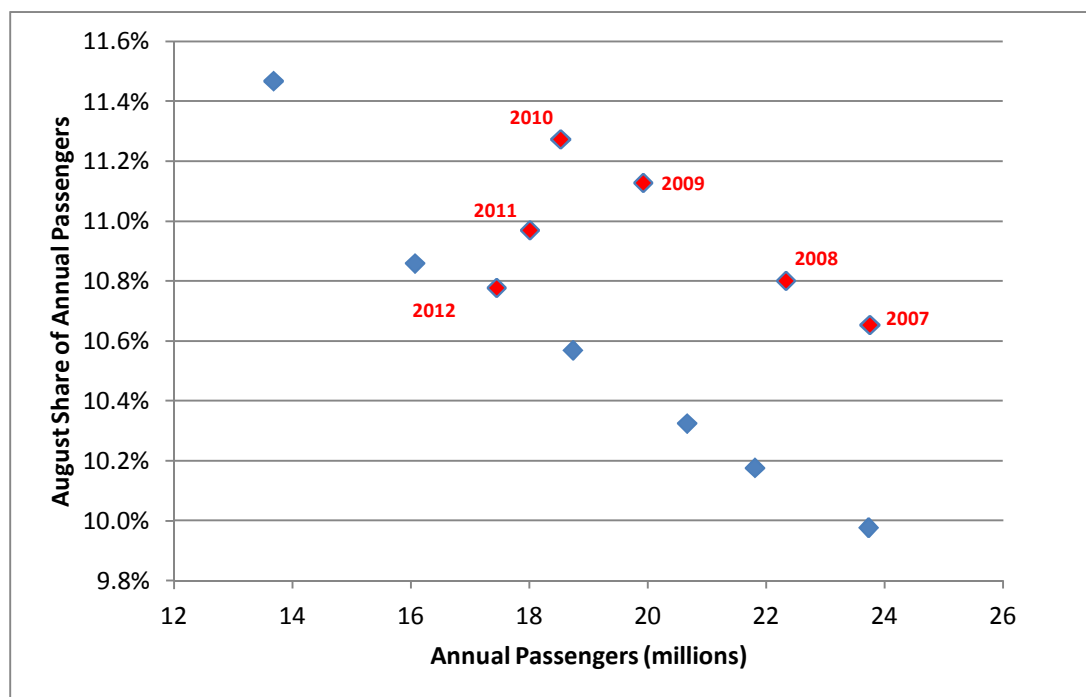
Table 5.6: LTN Annual Capacity based on STN Seasonality

	Annual Capacity	
	2008 Pattern (LTN Historic)	2012 Pattern (LTN Current)
Traffic on Friday as % of August Total	3.353%	3.491%
Annual Capacity		
Base Schedule	17.9 mppa	17.0 mppa
Enhanced Schedule	18.8 mppa	17.9 mppa

Source: CSACL analysis

5.19 Consideration of all August proportions of annual passengers at STN since 2001, shows that seasonality is lower the higher the volume of annual passengers although there is no obvious mathematical relationship between all data points (Figure 5.3), and certainly not between the data points since 2007.

Figure 5.3: STN Seasonality, 2001 to 2012



Source: CSACL analysis

5.20 Irrespective of whatever mathematical relationships may or may not be established, changes in the pattern of demand, peakiness and seasonality etc. are in reality determined

by airline decisions. When cutting back its services at Stansted, Ryanair claimed that the decisions were driven by increases in airport charges at the airport; by higher levels of Air Passenger Duty (APD) in the UK; and by higher fuel prices.

5.21 The DfT's longer term passenger forecasts assume an economic recovery. With disposable incomes higher than now, a proportion of potential passengers would then be able to sustain higher off-peak fares than were previously levied by Ryanair, even if the costs it incurs do not return to the levels previously experienced. Also, if Ryanair and other airlines are able to generate less profit in the winter months, they will be striving to compensate with higher fares in the summer, thereby depressing peak traffic to an extent.

5.22 The key issue that will determine the throughput which the proposed developments at LTN could handle is whether the changes in patterns of traffic seen at most airports since 2008 are permanent, or whether the profile of traffic returns to that experienced prior to the recession. While there is some evidence to support a return to historic patterns traffic, the economy and air travel are still only at the start of the recovery phase. In view of this and other uncertainties, the future capacity of LTN is given as a range. Table 5.7 summarises the different annual capacity estimates for LTN under the two broad scenarios of (a) a continuation of the current seasonality of demand; and of (b) a return to historic patterns of traffic.

Table 5.7: Summary of Annual Capacity Estimates for LTN

Capacity Approach	Report Reference	Annual Capacity	
		Current Traffic Patterns	Historic Traffic Patterns
Current Capacity			
CSACL First Report	Para 6.6 (1 st report)	9.7 mppa	11.9 mppa ¹⁵
LLAOL Benchmarking	Tables 5.3 + 5.4	9.8 mppa	12.6 mppa
2028 Base Schedule			
Initial Assessment	Table 5.1	17.0 mppa	17.9 mppa
LLAOL Benchmark Airports	Table 5.2	-	19.9 mppa
LLAOL Benchmarking	Tables 5.3 + 5.4	18.8 mppa	21.5 mppa
STN Busy Day Analogue	Table 5.5	-	18.5 mppa
STN August Analogue	Table 5.6	17.0 mppa	17.9 mppa
2028 Enhanced Schedule			
Initial Assessment	Table 5.1	17.7mppa	18.5 mppa
LLAOL Benchmark Airports	Table 5.2	-	20.8 mppa
LLAOL Benchmarking	Tables 5.3 + 5.4	19.6 mppa	23.0 mppa
STN Busy Day Analogue	Table 5.5	-	19.2 mppa
STN August Analogue	Table 5.6	17.9 mppa	18.8 mppa

Source: CSACL Analysis

5.23 It may be seen that the different approaches to estimating annual capacities produce different answers. No approach is without its weaknesses:

¹⁵ This figure was rounded to 12 mppa in the report on current capacity

- The 'Initial Assessment' approach is based on the application of the seasonality seen at a 10 mppa LTN, and inherently the estimates produced should be too low as no account is taken of the decrease of peakiness as an airport grows;
- Benchmarking against LLAOL's sample of 28 airports produces the highest estimates of LTN's capacity, on either the original or locally adjusted bases, which are taken to be broadly equivalent to historic and current patterns of traffic respectively. However, of LLAOL's benchmark sample the most comparable is Stansted, and there may be inherent unreliability of base data and different traffic patterns at the other airports;
- The assessment based on STN busy days should potentially be a little high, as they are based on ratios for the airport (STN) when operating at nearly 21 mppa¹⁶; and
- Mathematically, the estimates based on STN's August traffic profile are probably the most robust, but for the Base Schedule are the same as the 'Initial Assessment' (which are probably too low), and only a little higher than the Initial Assessment with the Enhanced Schedule.

5.24 On balance, the capacity of LTN after the proposed developments is likely to be between 18 mppa and 20 mppa, based on the Enhanced Schedule. The lower end of this range is compatible with the continuation of the current pattern of traffic at LTN, while the upper end assumes a return towards the historic seasonality of traffic. Both figures assume that the road and surface access systems into and beyond the airport can cope with this level of demand. There are a number of conservative assumptions within this assessment, including:

- A modest increase in average passengers per ATM of 5.6% over the period; and
- No increase in the maximum planned movements per hour above the 39 assumed by LLAOL.

5.25 Table 5.7 also includes for convenience the assessed capacity of the current facilities (assuming that the Second Security Channel is not in normal use). The lower estimates of some 9.7 mppa are effectively saying that the airport is currently operating at or close to capacity, which corresponds to actual observation. The higher assessment of some 12 mppa would require the pattern of traffic at the airport to be similar to that seen historically.

5.26 It may be appreciated that if traffic maintains its current patterns, then the proposed developments would add capacity of about 8 mppa (18 mppa – 10 mppa) at LTN. Should traffic patterns revert to their historic patterns, then the added capacity would also be approximately 8 mppa (20 mppa – 12 mppa).

¹⁶ The higher 2006-based estimates when STN was operating at nearly 24 mppa are not included in Table 5.7.

6 Limitation to 18 mppa Throughput

Introduction

6.1 This chapter discusses briefly two approaches available to LBC to restrict LTN to a throughput of approximately 18 mppa, or indeed any figure below its actual physical capacity. The mechanism for any restriction should though reflect the objective in imposing a restriction, so that, for example, concerns over aircraft noise should be based on implementing a noise quota or basket, while concerns over surface access might be reflected in a passenger cap. While the discussion which follows is based on a passenger limitation, similar considerations could apply to the implementation of a noise quota.

Physical Development Constraint

6.2 The first approach would be to agree with LLAOL a reduction in the size of the different development proposals such that they could handle only 18 mppa. This is not recommended as not only would this be expensive and time-consuming, but also it would not be a foolproof means of restricting capacity. As noted in this report, capacity estimation is an inexact science, and with the uncertainties of peak spreading it would be impossible to guarantee that any reduced proposals would be incapable of handling up to but no more than 18 mppa. Perhaps as importantly, LLAOL would sensibly wish to incorporate into its developments prudent capabilities to respond to unexpected developments in the air transport industry, such as requirements for additional security screening, immigration controls, health screening and different standards for aircraft separation.

Legal Limitations

6.3 The second and more sensible approach would be to seek legal undertakings that throughput would not on average exceed 18 mppa. The undertakings might take various forms, ranging from development controls to a formal legal agreement of the type reached between BAA plc as the owner of London Gatwick Airport and West Sussex County Council preventing the development of a second runway at the airport before 2019. LBC will no doubt be familiar with the options at its disposal.

6.4 It is important that any agreement does not set the figure of 18 mppa as a rigid figure not to be exceeded: it would be in no one's interest for the airport to be closed on, say, Christmas Eve as the 18 millionth passenger passed through the airport. Instead, the limit should be both an annual target and an average figure to be achieved over a longer period of time. While the number of flights and seats can be controlled in advance, the number of seats sold (i.e. passengers) can only be estimated.

6.5 The annual control period could be either a calendar year, or a period consisting of an IATA Winter and an IATA Summer scheduling period. The airlines' trade association, IATA, divides for mutual convenience the year into two periods, and airlines plan their services for a season at a time, and hence this is a reason for selecting an IATA year as the

control period. The Winter period generally starts on the last Sunday of October and runs to the last Saturday in March the following year, with the Summer season starting the next day on the last Sunday in March. This timing normally coincides with the clock change in the UK (and Europe) from winter (GMT) to summer (BST). There are though years when the dates vary which means that the number of days in an IATA year is not constant. However, should an IATA year be chosen as the control period, it should start with a Winter period to ensure that each period includes an Easter: starting with a Summer period would mean that there would be some periods with two Easters and some with none.

6.6 Airline network plans and flight plans are prepared on a seasonal basis so that airports may decide if the schedules prepared by all the different airlines can be accommodated within the capacities of each airport's facility in order to avoid over-subscription and congestion. This process of Schedule Co-ordination has become very organised over the decades, and within the EU has been enshrined in law through the Airport Slot Regulation. Under this Regulation, LTN is a schedule co-ordinated airport and slots must be obtained from its co-ordinator to operate from the airport. At present, the slot co-ordinator for LTN is Airport Co-ordination Limited (ACL), a company owned under guarantee by some nine UK airlines.

6.7 Schedules are co-ordinated (i.e. checked and accepted/approved, perhaps after modification) twice a year, in June for the next Winter season and November for the following Summer season¹⁷.

6.8 If in an annual control period the throughput of LTN exceeded 18 million passengers, the number of slots that could be allocated in a subsequent period (or periods) would need to be reduced, so that the average throughput at the airport was at or below 18 mppa. It should be noted that the reduction of slots could be an iterative process. With the lead times involved, a reduction in throughput at LTN might only be seen in the next-but-one control period, suggesting that the average throughput of 18 mppa would need to be taken over three or perhaps even four control periods if the first reductions do not achieve the desired result. It will be appreciated that before there is confirmation that the annual limit has been exceeded, the schedules for one future co-ordination period will already have been approved.

¹⁷ Ad hoc requests may be made at any later time, but the majority of schedules are put in place at these two times

Table 6.1: Summary Time Table of Control Processes

	Control Period	
	Calendar Year	IATA Year
End of Control Period	31 December, Year N	~31 March, Year N
Awareness of Limit exceeded	Mid-January, N+1	Mid-April, N+1
Next Schedule Co-ordination Conference	June N+1	November, Year N+1 [†]
Period Covered	Winter	Summer, Year N+2
Reductions start	November N+1	April N+2
Reduction effective	Control Period N+2	Control Period N+2

[†] Airline plans for Winter N+1 season probably too advanced to be modified for June N+1 Conference

Source: CSACL

6.9 It is possible that there may be a need for reductions to be shared across winter and summer seasons, as there could easily be airlines that operate only in summer, making it unfair for the airlines that operate in winter to absorb the entire reduction in capacity.

6.10 To use a numerical example, if in Calendar Year 2020, LTN's throughput were 18.2 mppa, the schedules approved for Winter 21/22 and Summer 22, would need to target a throughput of 17.8 mppa, or possibly less should Calendar Year 2021 also appear by, say, August 2021 to be likely to exceed 18 mppa as well.

6.11 A potential legal difficulty that could arise is that under the current Regulation¹⁸, airlines are entitled to the same slots that they were previously awarded provided that they meet 'use-it-or-lose-it' requirements. While a slot may be defined to relate to a specific aircraft type (thereby preventing larger aircraft being introduced by an airline), it is not normal for slots to define the number of passengers allowed (although this might be a mechanism to explore).

6.12 Decisions would need to be taken about whether any allowance should be made for the extra day in Leap Years, and whether passengers using the executive jet terminals should be included in the facilities. The treatment of flights diverted to LTN from other airports would also need to be determined.

¹⁸ The first Regulation (95/93) avoided this difficulty by only granting the right to airlines to request slots previously operated and not obliging the co-ordinator to allocate the slots

Appendix A: Capacity of Airside Lounge

Introduction

A1 Although the conditions experienced in the Airside Departure Lounge both currently and predicted with the planned developments, appear to be unsatisfactory, the developments are consistent with the standards of IATA Level C for passenger terminals. This appendix discusses this in a little more detail.

A2 IATA's Terminal Design Manual sets out the basis of calculating the size of the major elements of a passenger terminal at different levels of quality of service (Levels A to E). This approach has been applied by LLAOL's architects, MAP, to determine the space requirements of each area of the terminal.

A3 For the airside Departure Lounge, the first step is to determine how many passengers need to be accommodated in this area. In accordance with the IATA methodology, MAP multiplies a departure busy hour figure of passengers by the average dwell time in the facility. This is a relatively simple approach and does not require the use of a simulation model. For the Planning Application, MAP has used a Busy Hour figure of 3,800 passengers and a dwell time of 45 minutes on average. The predicted number of passengers to be accommodated in this area is 2,850.

A4 The second step in the calculation is to convert this number into a surface area for the lounge. Although IATA applies different quality of service standards in most other aspects of terminal 'sizing' depending on the Level being designed for, for airside waiting areas its guidelines suggest a single value for all service levels of 1.5 m² per passenger. This value lies between the 1.2 m² recommended for standing passengers and the 1.7 m² for sitting passengers in the Gate Holding areas. This lack of variation in either space standards or proportions of standing and sitting passengers between IATA Levels, appears inconsistent with the initial objective of defining different quality standards.

A5 Application of the 1.5 m² standard to the 2,850 passengers suggests an area for the Departure Lounge of 4,275 m². In most airports, the main departure lounge includes a mix of space, covering retail outlets, Food & Beverage outlets, general sitting and standing areas and circulation space. It is understood that LLAOL and LLAL have agreed that 50% of the retail space may be included in area allocated for passenger waiting as calculated using the IATA approach. The MAP documentation provides for a total Departure Lounge area after development of 9,491 m², of which 4,071 m² is for general seating and F&B outlets. The size of the proposed Departure Lounge is significantly higher than a design to Level C would require. Hence, the proposed facilities are of sufficient size to meet the IATA Level C operating requirement imposed by the Concession Agreement controlling LLAOL's management of the facility.

A6 In a similar exercise undertaken with current passenger throughputs and the current facilities also shows that the IATA Level C specification is met. However, observation of the

terminal when operating at busy times suggests that far from there being significant 'headroom' in the capacity of the building (as the IATA Level C would suggest), the conditions experienced by passengers in the busiest hours are at or close to the lowest sustainable level. Hence, it would appear that the IATA Level C design specifications in this area are inadequate for assessing the capacity of the facility.

A7 In view of this problem, this report has also considered:

- The capacity requirement based on more specific proportions of sitting and standing passengers with an explicit allowance for circulation space; and
- A pragmatic assessment based on comparison with experience on the Observation Day on 24 May 2013.

A8 The first of these approaches assumes that seats are provided for 80% of passengers with the remaining standing. In addition, a further 5% is allowed for circulation. The capacity is calculated based on the area allocated to general seating and F&B outlets in the LLAOL Planning Application. It does though make no allowance for passengers in the retail areas of the Departure Lounge.

A9 During the busiest hour of the Observation Day (24 May 2013) conditions experienced in the Departure Lounge were judged to be as crowded as could be planned for: above this level, LTN's reputation for customer service would be likely to deteriorate and physical movement within the facility would become increasingly difficult leading to delayed/missed flights. Analysis of departures at that time suggested that the average space per passenger was 0.81 m^2 , and this has been assumed to be the minimum that LLAOL would plan to provide, notwithstanding any legal ability it might have to decrease the area per passenger and still meet the requirements of the Concession Agreement of achieving IATA Level C standard.