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REPORT (Revision 1)

CAPACITY ANALYSIS OF LONDON LUTON AIRPORT WITH REFERENCE TO COORDINATED DESIGNATION

Prepared for

London Luton Airport Operations Limited

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INTRODUCTION

Objective

EU regulations effectively provide three categories of airport reflecting the degree of potential congestion. The categories are:

- coordinated: the most congested airports, where all slots must be allocated by an independent coordinator. In the UK, Heathrow, Gatwick, Stansted, London City and Manchester are coordinated airports. This equates to IATA Worldwide Scheduling Guidelines Level 3.
- schedules facilitated: airports where there is a potential for congestion at certain times and where an independent "schedules facilitator" has a formal role under the EC regulations to seek to ensure that planned services can be accommodated by voluntary agreements between operators. Luton is currently designated a schedules facilitated airport along with, in the UK, Aberdeen, Birmingham, Bristol, Edinburgh, Glasgow, Newcastle and Southampton. This equates to IATA Worldwide Scheduling Guidelines Level 2.
- other: less busy airports where air services can generally be accommodated without difficulty.

In the UK the Secretary of State for Transport shall decide whether an airport should be designated as coordinated based upon a capacity analysis carried out by either the management of the airport or by another competent body, and consultation with the management of the airport, its airlines, their representative organisations, general aviation representatives and air traffic control authorities. This report is that required capacity analysis.

An airport shall be designated as coordinated only if a shortfall in capacity is so serious that significant delays cannot be avoided and there is no possibility of resolving the problems in the short term.

London Luton Airport is currently designated as Schedules Facilitated (IATA Level 2). However it has recently experienced significant delays that led to a considerable number of passengers missing their flights[1]. This situation arose as a result of scheduling above the capacity that had been declared for facilitation purposes. Therefore Airport management believes that efficient use of infrastructure is best achieved through coordination of slots. The airport is therefore seeking to be designated as coordinated.

Preparation of Report

This report sets out an analysis of capacity of the airport by process element: airspace, runway, apron, terminal and surface access. These elements of capacity are discussed in each of the subsequent five chapters.

This report has been based, in part, upon other studies undertaken for the airport, specifically:

- NATS: study of runway and airspace
- McAlister Armstrong & Partners: terminal capacity; and
- URS: surface access.

[1] Data from Airport Coordination Limited (ACL) indicating this demand in excess of declared capacity are presented in Appendix A.

AIRSPACE, RUNWAY AND TAXIWAYS CAPACITY

This chapter draws upon work undertaken by NATS assessing airspace and runway capacity, as well as modelling by LeighFisher to assess runway and taxiway capacity. The study seeks to establish the capacity of the runway system, i.e the capacity of the infrastructure to receive or dispatch aircraft to/from the runway to/from surrounding airspace, and to/from the runway to/from the taxiway network. The following chapter considers access to/from the taxiway network to aircraft stands, with the subsequent chapter assessing the movement of passengers from aircraft on stand to/from and through the passenger terminal.

This chapter therefore presents an assessment of the capacity of the runway system: airspace-runway-taxiways. For the purposes of this study, the definition of runway capacity adopted by NATS has been used: runway capacity is "the number of aircraft movements that may be scheduled to use the runway such that their average delay, measured over a period of a given length, does not exceed a specified value."

The capacity determined is representative of a dependable, runway capacity. Demand could exceed that capacity but delay would increase causing the average delay to rise above an acceptable level. That level has been set at 10 minutes averaged across the busy period[2].

The target average delay has a significant impact upon the assessed capacity and the required infrastructure. The appropriate target delay represents a balance between operations and the extent of infrastructure required. A long acceptable delay period would permit a greater runway capacity to be declared, but also requires a greater provision of airfield infrastructure to accommodate the lengths of queues generated. A long delay period would also be generally unacceptable to operators. Conversely a short average delay target may be more attractive to operators, but may not make efficient use of airfield infrastructure as capacity would be determined at an inefficiently low value. 5 minutes average delay may be considered reasonable at airports with relatively low airfield congestion. Experience suggests that the adopted 10 minutes, as employed at the UK airports that are currently coordinated, represents an appropriate balance between effective use of infrastructure and the operational requirements of the airlines to establish a reasonable capacity declaration. Particularly for London Luton Airport, where the operation of its based airlines is dependent upon the peak periods at each end of the operational day, the operators could be expected to accept a higher average delay to enable a greater capacity to be declared.

Airspace

NATS review of the airspace surrounding London Luton Airport highlighted the complexity involved in the management of that airspace and the inter-dependency of the traffic to and from the South East region. The result of this complexity and interaction is that it is not possible to isolate and report on the capacity of the airspace relating only to London Luton Airport: Luton is intrinsically linked to its neighbouring airports and airspace. For Luton arrivals the inter-dependency with Stansted inbound traffic and the shared holding and vectoring areas results in one airport potentially affecting the traffic of the other. Luton departure traffic is affected by the coordination with Northolt and London City airports. At busy times, traffic from more than one of these airports could potentially arrive at the same place, time and level. Therefore coordination of departures is required.

NATS reports that the London Airspace Management Programme (LAMP) is aware of the complexity of the interactions at London Luton Airport. LAMP is a series of activities across airspace and ATM tools designed to significantly improve safety, environmental performance, service and value across London Terminal Control airspace and in the wider South-East region.

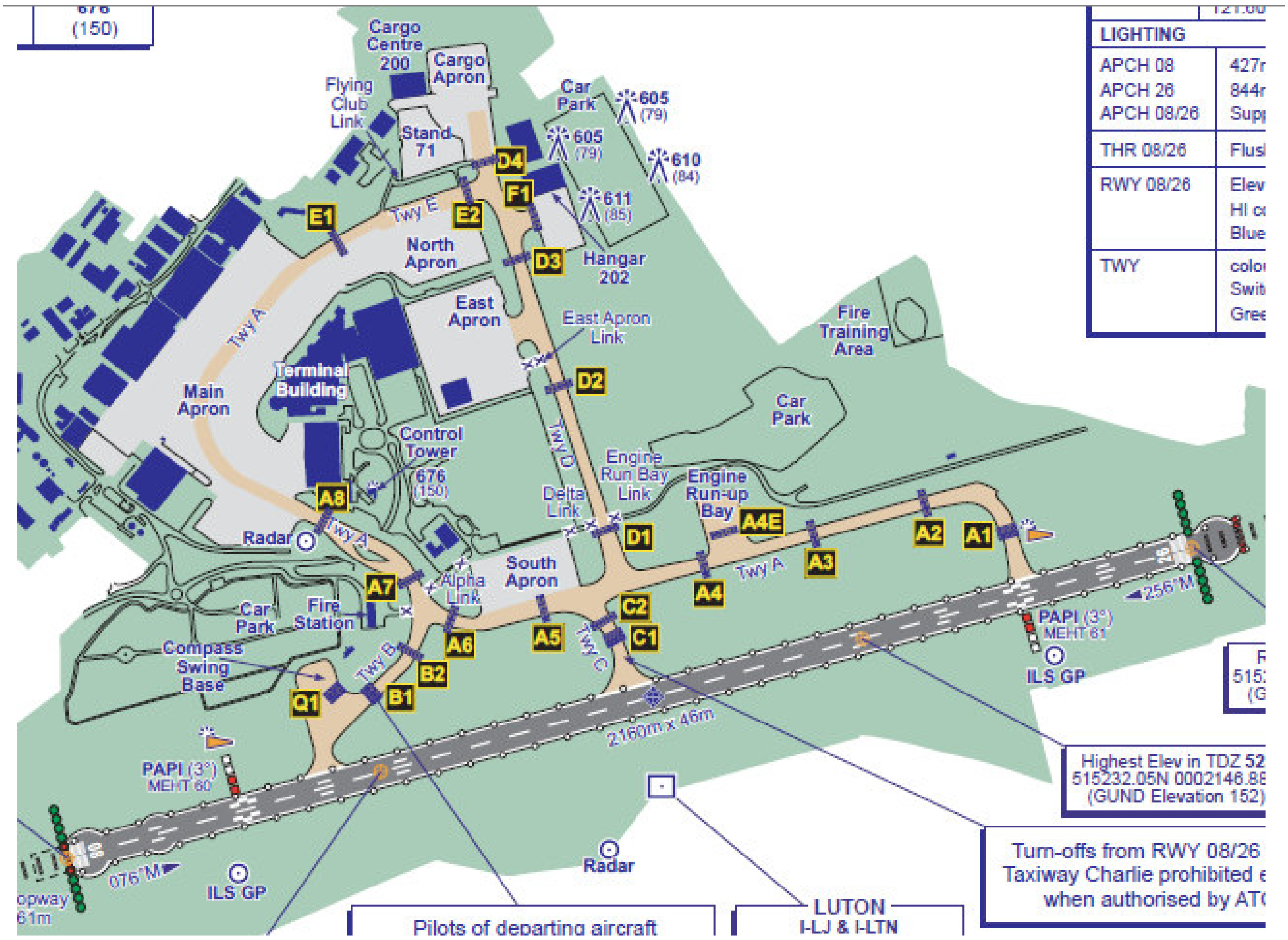
[2] The busy periods over which the delay was averaged, were those periods during the am and pm peak, through which scheduled and actual movements were significantly above the hours either side and close to the absolute peak hour.

Concept development is in progress at NATS with the intention of delivering a series of capability changes in the medium term from 2014 to 2020.

Runway and Taxiway Network

The current layout of the airport is shown in Figure 1. The airport provides a single runway (08-26) operated in mixed mode. Approximately 70% of total annual movements use Runway 26 and 30% use Runway 08.

Figure 1: London Luton Airport Current Layout



Source: UKAIP

Capacity Analysis

Runway capacity was modelled using the SIMMOD airfield modelling software package based upon a forecast busy day schedule. To determine capacity, a suite of schedules was prepared increasing or decreasing the number of movements whilst retaining the underlying nature of the base schedule (i.e. maintaining the ratios of based to non-based aircraft and of peak to off-peak movements), to determine the scheduled throughput at which average delay reached and/or exceeded 10 minutes.

Neither the base schedule, nor the suite of schedules, was "optimised" to achieve a theoretical, but in reality impractical, throughput rate. Perfect scheduling of arrivals and departures may deliver a theoretical capacity that would be a few movements per hour greater, but in reality, with the inevitable minor disruptions to scheduled operations, such an assessed capacity would be unachievable and were it scheduled, the observed delay would be expected to be greater than the above average delay criterion.

Operations on both Runway 08 and 26 were modelled. With the greater length of parallel taxiway available for Runway 26 and therefore the greater length of departure queue that could be accommodated before the queue "backed-up" into the apron area (with increased delay consequences discussed below), compared to Runway 08 departures where the queue more rapidly "backs-up" into the apron, at all throughput rates Runway 26 operates with a lower average delay, or conversely, for a given average delay, Runway 26 has a greater capacity. It would be possible to declare two capacities (one for each runway), however given that the periods when either runway could be operationally available are not predictable, it is appropriate to declare a capacity for the purpose of scheduling potentially months in advance, on the lowest certain capacity. It is acknowledged that this assumption could be seen as conservative as it understates capacity when Runway 26 is in use. However, it is considered more appropriate to determine a robust capacity and therefore the following presents capacity assessed for Runway 08 operations in order to avoid excessive delay when Runway 08 is in use.

The modelled schedules included only commercial aircraft movements. General aviation (GA), cargo and maintenance positioning flights were excluded in order to determine the average delay caused by the schedule and airfield infrastructure and thus establish the maximum capacity available for commercial aircraft movements. Any spare capacity would be used by GA, cargo or maintenance movements.

Use of Intersection Departures

The airport currently operates with a high proportion of "intersection departures", whereby aircraft enter the runway at either of the current parallel taxiway entry points and depart from that point, i.e. departing aircraft do not make full use of the full runway length. This mode of operation can only be sustained for as long as it is acceptable to the operators. It may be that changing operational needs would require that full length runway departures are adopted. With the current infrastructure, this would require all departing aircraft (to both runways) to enter the runway and "back-track" to the end of the runway, turn and take-off. Currently, only a few aircraft undertake this manoeuvre and therefore do not adversely impact capacity. This manoeuvre requires each departing aircraft to occupy the runway for approximately 3 minutes. Therefore capacity of both runways is in the order of 20-25 movements per hour only could be achieved with this operational requirement.

Modelling Results

The analysis demonstrated two critical aspects of the behaviour of the runway-taxiway network:

- as discussed above, in the absence of intersection departures and extensions to the parallel taxiway, aircraft are required to "back-track" and runway capacity is severely constrained. Therefore extensions to the parallel taxiway are required should operators no longer be prepared to adopt intersection departures[3]; and
- specifically, in addition to delay caused by aircraft movements around the aerodrome, delay was driven by the capacity of Runway 08 to clear the departure queue before it increased to such an extent that it "backed-up" into the apron area. Once the queue had extended into the apron area average delay rapidly increased and exceeded the average delay criterion.

The limiting factor is the capacity of Taxiway Bravo to accommodate the departure queue.

[3] This is conveniently considered as either requiring the start of the runway for departures to be "moved" to the location of the parallel taxiway intersection (as is the current case with intersection departures), or the point of intersection is "moved" to the start of the runway through an extension of the parallel taxiway as proposed in the airport's master plan.

A number of schedules were modelled. This demonstrated that although the schedules had peak hours that varied between 36 and 45 movements per hour, the actual movement rate from the runway was around 30 to 34 movements per hour at peak. As the scheduled peak rate increased the actual movement rate marginally increased (as the additional scheduled movements made more efficient use of the available capacity), but the average delay also significantly increased as the departure queue, enabling the efficient use of schedule gaps between arrivals, increased.

The study indicated that at peak approximately 34 actual runway movements could be accommodated on the current runway (21 departures and 13 arrivals) in a single hour. The greater number of scheduled movements caused average delay to increase, but across the busy period, not to a level that exceeded the average delay criterion.

Impact of Airspace

The above assessment adopted the current airspace restrictions on runway operations. In particular, the current departure-arrival separation, at 5 nm, is greater than may be considered common. Therefore, capacity was also assessed with a reduced 4 nm separation. This showed that capacity could be increased by approximately two to three movements per hour. In the medium term, NATS structural work to resolve constraints in the broader South East airspace may enable additional capacity to be declared, but in the short term, this is considered to be an unreasonable assumption and therefore the capacity as determined above was adopted.

Period of Sustained Capacity

The analysis determined that between 30 and 34 two-way movements could be achieved during the busy periods of approximately three hours. However this rate could not be sustained and it would be necessary to schedule fire-breaks[4] to allow accumulated delay to dissipate. A single peak hour of 34 movements required the hour before to not “overspill” and the subsequent hour required fewer movements. Conversely, a flatter profile of up to 30 movements could be sustained over approximately three hours, with a fourth hour of substantially fewer movements.

Conclusion

The analysis outlined above demonstrated that, with an average delay criterion of 10 minutes averaged over the busy period and so long as a similarly high proportion of intersection departures as currently observed are employed, runway capacity is around 30 two-way movements over a busy three hour period. This however cannot be sustained for more than three hours and “fire breaks” are required to permit the accumulated delay to dissipate.

Further analysis would be required to determine a detailed daily profile of scheduled demand that would not breach the average delay criterion.

Should intersection departures be no longer possible either runway capacity would be significantly degraded, or the extensions of the parallel taxiway as set out in the airport’s master plan would be required in order to maintain schedule capacity.

This analysis suggests that scheduling around 30 movements per hour across a three hour period is achievable although the hours either side of this busy period would require substantially lower throughput rates. Conversely, a single peak hour of around 34 movements is possible, although the hours either side would require lower throughput rates to prevent delay accumulating.

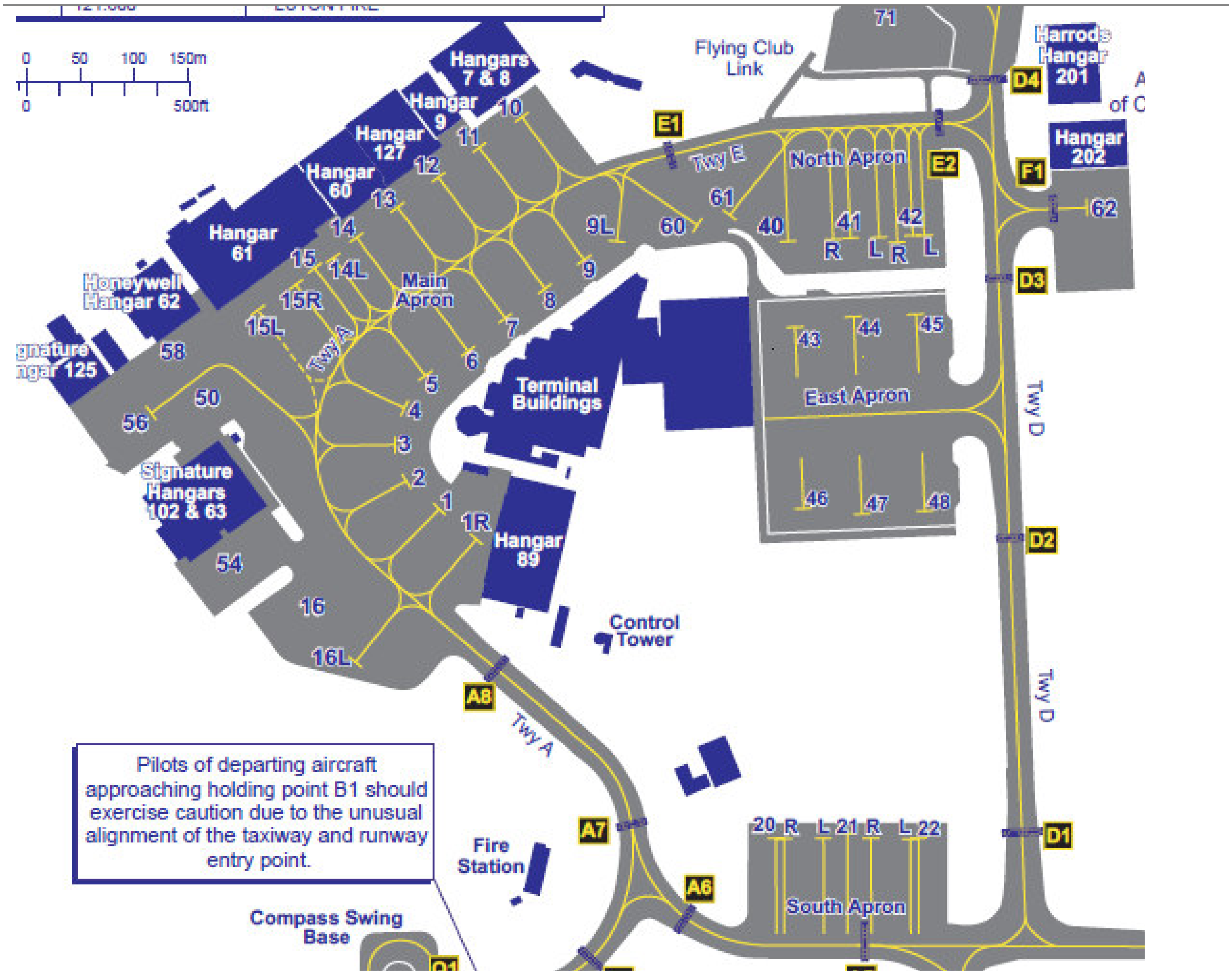
[4] A fire-break being a period, typically of one to two hours duration, following the busy period when the declared runway capacity is reduced to allow any accumulated delay to dissipate.

APRON CAPACITY

Apron Layout

The current layout of stands is shown in Figure 2.

Figure 2: London Luton Airport Current Apron Layout



Source: UKAIP

This layout provides, depending upon which MARS stands are included, up to 33 stands that are routinely available for commercial passenger and supporting operations. A 10% surplus is retained to accommodate unexpected movements, operational spare aircraft and aircraft visiting for maintenance, and therefore 30 stands are routinely available for commercial passenger operations. In addition to these stands further apron areas are provided for general aviation and cargo operations.

The principal apron areas (Main, North and East Aprons) are accessed from the taxiway "loop" Alpha-Echo-Delta. This taxiway network was modelled to operate in a one-way flow configuration with clockwise circulation employed for Runway 26 operations and anti-clockwise when using Runway 08. During off peak periods it may be possible to operate a two-way flow. However, to avoid conflict during busy periods, a one-way flow was modelled at all times.

All commercial aircraft are parked nose-in requiring push-back to depart. Push-back from the main and northern aprons effectively blocks the free-flow of aircraft taxiing to other stands.

Modelling of Apron Capacity

Apron capacity was modelled using LeighFisher's proprietary gate allocation software. This model flexibly allocates aircraft movements to stands based upon a wide range of user set parameters. For this analysis those key assumptions included:

- prioritisation of flights to contact stands;
- flexible use of wide-body parking positions;
- preferential airline stand allocation as currently observed;
- allocation of contact stands to carriers whose business model benefit most from short turnaround times;
- 15 minute schedule buffer include before each arrival movement; and
- a variable manoeuvring buffer by airline, based upon current observations, on each push-back.

As discussed above a number of design schedules were analysed to determine the capacity of the current stand provision as well as the provision which was included within the airport's master plan.

Stand Capacity

Two principal conclusions were drawn from the analysis of stand demand. Firstly, peak stand demand does not coincide with the busy movement periods. Peak stand demand occurred in the hour before the start of the morning peak. In the subsequent hour, sufficient aircraft were scheduled to depart such that arriving aircraft could be accommodated within those vacated stands. Secondly, the number of based aircraft drove stand demand. Given the first observation, additional non-based movements could be accommodated within the stand demand driven by the number of based aircraft, but any increased number of based aircraft would also drive additional stand demand.

It is difficult to express stand capacity in terms of a runway movement rate, as the potential utilisation of available stands is driven by the nature of the schedule. For example, in theory, the current 30 available stands (excluding the 3 reserve stands), with a 35 minute turn-around, could accommodate around 50 two-way peak hour movements.

London Luton Airport's stand demand is driven by the number of based aircraft. The forecast base schedule is characterised as follows:

- an outbound wave (as based aircraft depart during the first hour of operation);
- overlapped with an inbound wave,
- which sustains an outbound demand as those arrivals are swiftly turned and depart.
- This process is reversed in the evening as the based aircraft return from their final sector.

Therefore, although the analysis of the base schedule concludes that peak stand demand is driven by the number of aircraft requiring overnight parking, the apron could accommodate more movements in the busy hour with short turnaround times.

It is not unreasonable to assume that the current 30 stands, even excluding the 3 reserve stands, are sufficient, with careful scheduling, to support the runway capacity (approximately 30 to 34 in the peak hour) determined above. However, it is also reasonable to conclude that the current stand demand is unlikely to be sufficient to accommodate significant growth in runway demand if driven by an increased number of aircraft requiring overnight parking.

The analysis also demonstrated the empirical observation that the stand layout is sensitive to aircraft operating off-schedule as, particularly for early arriving aircraft, aircraft unable to access their allocated stand are required to hold on the taxiway effectively blocking the entire Alpha-Echo-Delta taxiway loop. This is most critical during the busy early morning period, when early arrivals are unable to access their stand as it is not yet freed by its based aircraft, such that the early arrival blocks the taxiway loop and causes rapidly escalating airfield delay which is not dissipated until the busy morning period has passed.

PASSENGER TERMINAL CAPACITY

Capacity Modelling

This chapter draws upon work carried out by McAlister Armstrong & Partners. The capacity of the existing terminal was assessed on a process element by process element basis using IATA methodology as set out in its Airport Development Reference Manual[5]. It is acknowledged that this is a static model and therefore has only a limited ability to model the interaction of successive process elements. However, given that the purpose of the analysis was to determine the capacity of the individual process elements, based upon current provision, the analysis is considered sufficient. The current layout and number of processors was modelled with the exception of central security which assessed the proposed increased number of lanes to be opened in summer 2012. The model was based upon data provided by the airport of observed process times whenever possible, otherwise upon assumed processing times based upon reasonable expectation of benchmark performance.

For each process element the current provision (number of desks, for example at check-in, or area available for queuing, for example through central security) was back analysed through the IATA methodology to determine the passenger throughput rate that enabled the infrastructure to meet the space requirements of IATA Level of Service C. This level is defined by IATA as being the throughput rate at which a good level of service is provided with conditions of stable flow, acceptable delays and good levels of comfort. The analysis therefore determined capacity as the throughput rate above which these conditions would be no longer met and conditions for passengers would be no longer considered acceptable.

Previous sections have considered the capacity of the runway and aprons in terms of aircraft per hour. This chapter determines the capacity of the passenger terminal in terms of passengers per hour. Although it is possible to convert passengers per hour into aircraft per hour through consideration of the average number of passengers per aircraft, that number is not constant. Although London Luton Airport, particularly during the busy periods, handles a reasonably homogenous aircraft fleet (principally B737 and A319/20/21 sized aircraft), it would be expected that the average number of passengers per aircraft would vary and therefore any indication of passenger terminal capacity in terms of aircraft movements is indicative only. The equivalent one-way aircraft movement rate has been assessed at an average 139 passenger per aircraft (as observed by the airport in 2011). It should be noted that as departing passengers are processed in the two to three hours before departure and arriving passengers in the one or two hours after arrival, the equivalent processing rate is only applicable in a constant flow state and is not reflective of actual runway movement rates given the significantly peaked schedule observed in practice at the airport.

Terminal Capacity

Based upon the above approach, all process elements of the terminal were assessed. Many process elements have sufficient capacity significantly in excess of forecast demand. Therefore only key process elements are summarised in Figure 3 and briefly discussed subsequently.

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[5] 9th Edition, January 2004.

Figure 3: Key Terminal Process Element Capacities

Process Element	Capacity (pax/hr)
Departures	
Check-In	2,350
Central Security	2,630
Arrivals	
Immigration	1,810
Baggage Reclaim - International	1,370
Baggage Reclaim - Domestic	250

Source: McAlister Armstrong & Partners

Note: these capacities are constant flow rates. If the flight schedule is not similarly constant, runway scheduled capacity could exceeded these terminal process element rates in a single hour or over the busy period.

Check-In

The assessed capacity assumes that 71 of the provided 72 desks are available on a full CUTE basis (one desk is poorly located and hardly used). With the increasing up-take of on-line check-in and decline in hold baggage (both driven by low cost carriers prevalent at the airport), typically 33% of passengers (and over 50% at certain times of the year) of passengers proceed directly to security without requiring airport check-in. The check-in facility therefore only handles, at maximum, 67% of departing passengers. Therefore although the capacity assessed as above of the check-in facility is low compared to the departure process, the effective capacity, including straight to security passengers, is 50% greater than that stated above and in excess of the forecast demand. Consequently therefore, given that the capacity on a CUTE basis significantly exceeds the equivalent one-way runway demand, the analysis on the basis of a fully CUTE assumption is not considered inappropriate and check-in is not considered to provide a constraint to capacity.

Central Security

The capacity of the central security, even including the proposed expansion, is on the verge of being insufficient to permit the one-way departure capacity of the runway to be achieved. At the average passengers per aircraft rate, the capacity equates to approximately 19 aircraft. However, should aircraft during the busy period operate at higher than average occupancy this equivalent movement rate would be reduced. For example, if occupancy was 150 passengers per aircraft during busy periods, capacity reduces to approximately 18 aircraft movements. Therefore, although this assessment does not take into account the distribution of passengers through security in the roughly two hour period before scheduled departure time, it is likely that at busy times, central security will limit use of runway capacity.

Immigration

The capacity of the immigration facility stated above equates to the current infrastructure which is reduced from approximately 2,100 passengers per hour, previously available before the loss of "Smart Zone"[6]. The currently available capacity equates to approximately 13 aircraft at average occupancy. If occupancy were increased to 150 passengers per aircraft during peak

[6] Smart Zone was a product trialled at London Luton Airport by UKBA, withdrawn at the end of 2011.

periods, this capacity reduces to approximately 12 aircraft. The airport has plans to increase capacity for summer 2012. However this is dependent upon agreement with UKBA. Without this increased capacity it is likely that existing capacity will be reached during busy arrival periods.

Baggage Reclaim

As with check-in above the stated capacity relates to the capacity of the reclaim infrastructure and excludes the proportion of passengers without hold luggage. Based upon the observed proportion, the effective capacities of the reclaim facilities increase to 1,960 for international arrivals and 700 for domestic.

The analysis of the available length of carousels indicates that capacity is likely to be adequate. It should be noted however that this is achieved from relatively few, reasonably long carousels. An individual carousel therefore handles a number of simultaneous flights.

Conclusion

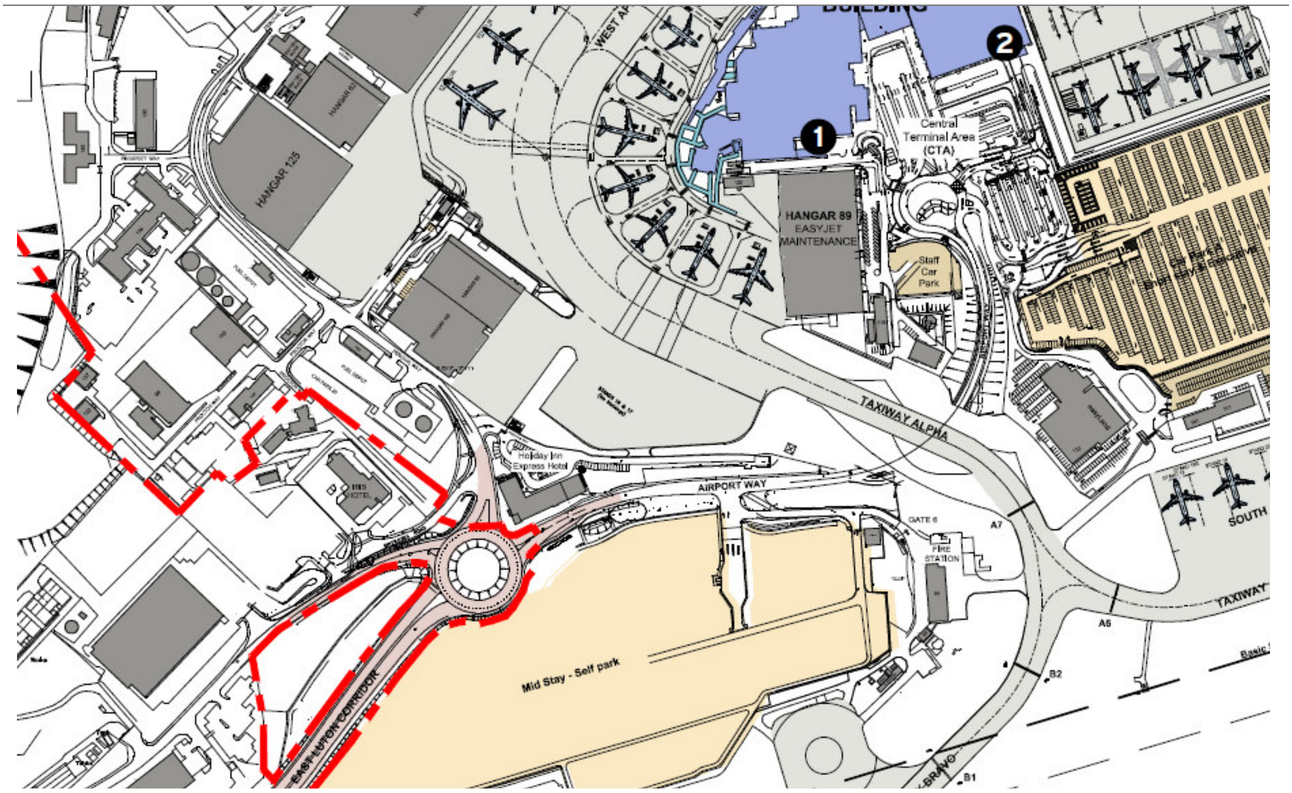
The analysis suggests that the critical constraints are central security and immigration. Even with the proposed expansion, central security capacity is on the verge of being inadequate to sustain the determined one-way runway capacity. With the significant morning out-bound wave as all based aircraft depart, typically at higher than average passengers per aircraft, there is a risk that security capacity would be exceeded leading to either passengers missing their flights, or aircraft being held on stand with consequent delay experienced within the apron-taxiway-runway network. Equally, the capacity of the immigration facility may be exceeded during busy arrivals periods. This would increase queuing time through immigration but would not impact runway capacity.

SURFACE ACCESS CAPACITY

This chapter is based upon the Transport Statement[7] prepared by URS, dated 26 October 2011. This statement considered the current demands placed upon the existing ground access infrastructure and assessed the case for additional surface access capacity.

Although the wider surface access network will impact the capacity of the entire network serving the airport, critically the airport terminal is located in a cul-de-sac and is served by a single carriageway road (i.e. one 7.3m carriageway with a single 3.65m lane in each direction), Airport Way. The road connects the central terminal zone to the highway network at the Percival Way roundabout via a bridge beneath Taxiway Alpha to the southwest of the terminal zone, as shown in Figure 4. The airport's master plan envisages dualling this road.

Figure 4: Current Central Terminal Zone Highway Access



Source: LLAOL

Highway Capacity

The capacity of the highway network is conditioned by the individual capacities of the link roads and junctions. The network serving the central terminal zone is complex needing to accommodate various vehicle and pedestrian movements that are attracted by the range of facilities in the central zone. The demand and pattern of movements can impact the operational effectiveness and capacity of the link road. In terms of the link road the Design Manual for Roads and Bridges suggests two Urban All Purpose Roads (UAP) designations that are appropriate when applied to the conditions of the terminal zone[8]. The capacity of a single

[7] London-Luton Airport – Highway Acess Improvements. Transport Statement. October 2011. This work is ongoing as part of preparation of the Airport's master plan. The analysis presented here is based upon the draft report which may be subject to change in the final version

[8] Volume 5 Section 1 Part 3 TA79/99 Amendments No 1 (see Appendix Table G2) and 4; and Volume 6 Section 2 Part 1 TD22/06Figures 2/3 and 2/5 and tables 3/1a (see Appendix Table G3).

carriageway road is typically around 1,500 one-way vehicles per hour for UAP2 and slightly less at approximately 1,300 for UAP3.

However the complex flow of vehicles into the central terminal zone, into and out of the drop-off and short-stay car parks, causes achievable capacity of the road network (access roads, drop-off and access to/from the short-stay car park) to be lower than this capacity.

Recent and proposed revisions to the drop off zone have improved flows through the network however the network capacity is still very sensitive at around 1,000 one-way vehicles per hour. Flow breakdown is to be expected at or above this level as the various vehicle interactions surrounding the terminal facilities interact to such a degree that effective vehicle throughput is suppressed.

The URS report states that the current vehicular demand placed upon the network is typically 1,000 one-way vehicles per hour at busy times (as observed in October 2011). The demand at these times results in a negative impact on capacity, with queuing, congestion and delay the observed response.

These however, are observed demand and capacity thresholds stated in terms of vehicles and not passenger movements.

Observations by the airport suggest that in any hour up to approximately 200 one-way movements are staff, delivery or other non-passenger vehicle movements. This tends to be lower during busy passenger periods at approximately 150 vehicles per hour. Therefore, vehicle throughput that is available to carry passengers is reduced to approximately 850 vehicles per hour.

Passenger demand is distributed across the three hours before a departing flight and the hour of and after an arriving flight. Furthermore, a proportion of vehicles entering the central terminal zone is collecting arriving passengers and therefore enters the terminal zone carrying zero passengers. Similarly a proportion of exiting vehicles carry no passengers having dropped-off departing passengers.

To assess potential demand, based upon observations from the airport and assumptions of:

- the average passenger occupancy per vehicle;
- the periods before and after departure/arrival that the vehicle enters and departs the terminal zone;
- based upon an assumed busy period profile peaking at 30 movements per hour, and
- shoulder hours of 25 movements;

the peak hour passenger vehicle demand is approximately 840 one-way movements. This is effectively the passenger capacity of the highway network, taking account of staff and non-passenger vehicles. This is based upon current modal split and current average vehicle passenger occupancy.

Passenger capacity could be increased through either, in the long term, an amended modal split decreasing the number of cars or, in the medium term, through limiting staff and other non-passenger vehicle movement during the busy periods, although this would require investment to relocate staff parking outside the central terminal zone and would replace staff vehicles with shuttle busses serving the relocated car parks. It should however be noted that the vehicle demand generated by staff movements only (excluding deliveries, etc, which may be less easily displaced from the busy periods) is relatively small and would equate to less than one equivalent aircraft movement per hour.

Conclusion

URS observed that the capacity of the road network serving the central terminal zone is approximately 1,000 one-way vehicles per hour. This equates to approximately 850 passenger vehicle movements excluding staff and other non-passenger vehicle movements. This suggests that there is just about sufficient capacity providing declared capacity limits are observed. Any over scheduling will result in congestion in the highway network.

CONCLUSION

System Capacities

This analysis has determined, based upon current infrastructure, key process elements as summarised in Figure 5.

Figure 5: Process Element Capacities

Process Element	Capacity (one-way pax/hr)	Capacity (two-way ATM/hr)	Notes
Runway		30-34	With careful scheduling a single peak hour greater than 30 movements could be achieved, provided the previous and subsequent hour has substantially fewer movements.
Apron		30+	Peak overnight capacity. Operational two-way movement could be significantly greater depending scheduling.
Terminal: Departures			
Check-In	2,350		This is the capacity of the check-in facility excluding passengers proceeding directly to security.
Central Security	2,630		Based upon the proposed expanded central security facility to be opened summer 2012.
Terminal: Arrivals			
Immigration	1,810		
Baggage Reclaim - International	1,370		This is the capacity of the reclaim facility excluding passengers without hold luggage who proceeding directly to customs.
Baggage Reclaim - Domestic	250		This is the capacity of the reclaim facility excluding passengers without hold luggage who proceeding directly to customs.
Surface Access	1,000 pcu/hr		

Source: LeighFisher Analysis

Critical system elements are the runway-taxiway-apron network, central security, immigration and surface access. These are discussed in below.

Runway-Taxiway-Apron Network

The modelling of runway capacity established that 30 to 34 two-way peak hour aircraft movements could be achieved. This single peak hour however could not be sustained. A longer busy period would not enable accumulated delay to dissipate before breaching the 10 minute average delay criterion across this period.

Apron capacity is driven by overnight based aircraft demand. Peak stand demand occurred in the hour before the start of the morning busy period. Through that busy period sufficient aircraft depart to enable the arriving aircraft to be accommodated on the vacated stands. However given that no alternate taxi routes are available for aircraft, the network is sensitive to off-slot movements. For example, an aircraft that arrives early, and is unable to access its designated stand (being still occupied before its scheduled departure time), is required to hold on the taxiway effectively blocking the entire taxiway network.

Central Security

The capacity of central security (as proposed to be expanded in summer 2012) is similarly on the verge of being unable to support the runway one-way departure capacity. With the significant morning out-bound wave, security capacity may be exceeded leading to either passengers missing their flights, or aircraft being held on stand with consequent delay experienced within the apron-taxiway-runway network and knock-on impact to inbound aircraft unable to access their designated stand.

Immigration

With the loss of the “Smart Zone” facility in 2011, the currently available capacity is likely to be reached during busy arrival periods. The airport, however, has in place proposals, subject to agreement with UKBA, to increase capacity in the short term.

Surface Access

The capacity of the single carriageway access to the central terminal zone, combined with the constrictions to free-flow caused by access to and egress from the drop-off and short stay car park, surface access capacity is approximately 1,000 one-way vehicles per hour. Excluding non-passenger movements, this delivers approximately 850 passenger vehicle movement per hour capacity. This capacity is reached during busy periods.

Implications of Capacity Constraints

The short term expansion of central security will increase capacity to meet current demand. Although the expansion will relieve the constraint, capacity will continue to remain a key aspect of the passenger terminal’s capacity to serve runway capacity and it would be sensitive to unscheduled additional demand.

Similarly surface access capacity is reached during busy periods. However, in the medium term effective capacity could be increased through a reduction in non-passenger vehicle movements during the busy periods, which would increase capacity by between 15 and 20%. In the longer term, a change in modal split to reduce dependency on cars would further increase passenger capacity within the above vehicle capacity.

The runway-taxiway-apron network is sensitive to off-slot movements. This is particularly acute during the morning busy period. Peak stand demand is observed in the hour before this busy period. In the first busy hour of operations, sufficient based-aircraft depart enabling the arriving aircraft to be accommodated on the vacated stands, leading to fewer stands demanded during the busy period. However, early arriving aircraft are unable to access their designated stand and are, in the absence of alternative taxi routes, required to be held on the taxiway effectively blocking the entire taxiway network.

Alternative to Coordinated Designation

For an airport to be designated as coordinated it is a requirement of legislation that the following two issues should be established. Firstly that the shortfall in capacity is so serious that significant delays cannot be avoided and, secondly, that no short term solution is available.

The following considers each of the identified three capacity constraints against these two criteria.

Surface Access

As the central terminal zone is located within the airfield, with Airport Way as the only means of ingress and egress, short of constructing an entirely new access route into the terminal zone, the only option to expand surface access capacity into the terminal zone is to widen the current single carriageway road into a dual carriageway. Planning Permission for such a proposal was rejected by Luton Borough Council in December 2011 and therefore no current solution to increasing vehicle capacity exists. However, although current capacity is reached during busy periods a medium term solution, to restrict the number of staff or other non-passenger vehicle movements during busy periods, does exist.

It is therefore concluded that although a shortfall in capacity does exist a reasonably short term solution is available, and that therefore the constraint to airport capacity imposed by surface access capacity is not considered ground for coordination.

Central Security

The proposed short term works to expand central security will increase capacity to broadly current demand. However, security would be sensitive to any unscheduled additional movements. Particularly during the busy early morning period, additional demand could not be accommodated and passengers would therefore be delayed through security and either fail to make their flight, or the flight would be held on stand. As discussed below, aircraft held on stand during this critical period cause significant knock-on delay.

Further expansion of security is planned as part of the master plan which considers a fundamental reconfiguration of the terminal and is not readily achieved within the current process layout. These works require planning permission and are therefore not available in the short term.

It is therefore concluded that although sufficient capacity is provided to accommodate the planned scheduled, the lack of any buffer capacity is so serious that unless appropriately managed significant delays cannot be avoided. Secondly, no other short-term solution exists outside the proposed master plan.

The constraint to airport capacity imposed by central security capacity is therefore considered grounds for coordination.

Runway-Taxiway-Apron Network

The layout of the runway-taxiway-apron network causes it to be particularly sensitive to two aspects:

- the capability of the runway to dispatch departing aircraft such that the departure queue does not back-up into the apron areas; and
- at certain times of the day, aircraft arriving early are unable to access their designated stand and consequently block the entire taxiway network.

The first aspect impacts the departing capacity of the runway. In the absence of coordination, increasing demand for departing aircraft quickly exceeds the capacity of the runway to feed departures into the arrival-departure stream, such that the departure queue backs-up through the taxiway network causing delay to rapidly escalate. This is particularly critical for Runway 08 operations as Taxiways Bravo-Alpha have a limited queue length available.

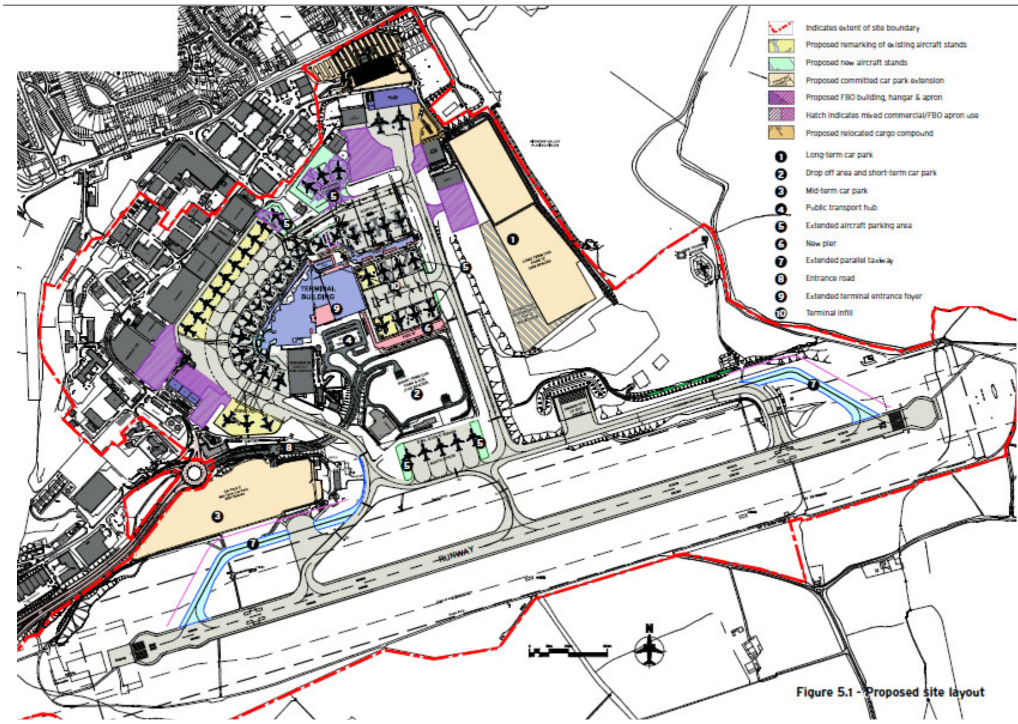
The second aspect impacts the arrivals capacity of the runway and aprons. The stand layout is sensitive to aircraft operating off-schedule as, particularly for early arriving aircraft, aircraft unable to access their allocated stand are required to hold on the taxiway effectively blocking the entire Alpha-Echo-Delta taxiway loop. This is most critical during the busy early morning period, when early arrivals are unable to access their stand as it is not yet freed by its based aircraft, such that the early arrival blocks the taxiway loop and causes rapidly escalating airfield delay which is not dissipated until the busy morning period has passed.

Both aspects give rise to a shortfall of capacity that, uncoordinated, would cause significant delay.

The first constraint could be relieved by either the construction of extensions to the parallel taxiway, or through amendment to ATC requirements to reduce the departure-arrival separation. It is considered unlikely that airspace could be restructured in the short term. Similarly, construction of extensions to the parallel taxiway, whilst feasible in the medium term, given the need to obtain planning permission is considered unlikely to be achieved in the short term.

The second constraint could be relived by the construction of additional taxiway and apron capacity. This is envisaged in the airport's master plan, as shown in Figure 6, however, given the need to obtain planning permission, this is considered unlikely to be achieved in the short term.

Figure 6: London Luton Airport Master Plan



Source: LLAOL

It is therefore concluded that the shortfall is so serious that unless addressed significant delays cannot be avoided and that secondly, no short term solution does exist. The constraint to airport capacity imposed by the runway-taxiway-apron network is therefore considered grounds for coordination.

Conclusion

For an airport to be designated as coordinated it is a requirement of legislation that the following two issues should be established. Firstly that the shortfall in capacity is so serious that significant delays cannot be avoided and, secondly, that no short term solution is available.

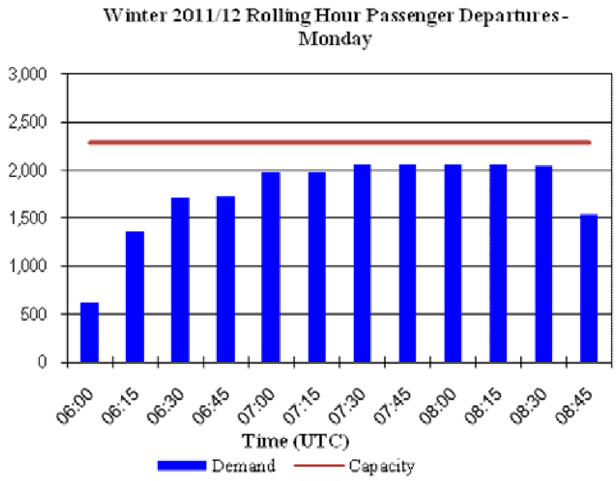
This analysis concludes that the constraint to overall airport capacity caused by the individual capacities of central security and of the runway-taxiway network meets both criteria: they individually are sufficiently serious that delay would become unacceptable if inappropriately managed, and that in each case no short term solution, other than coordination, is available.

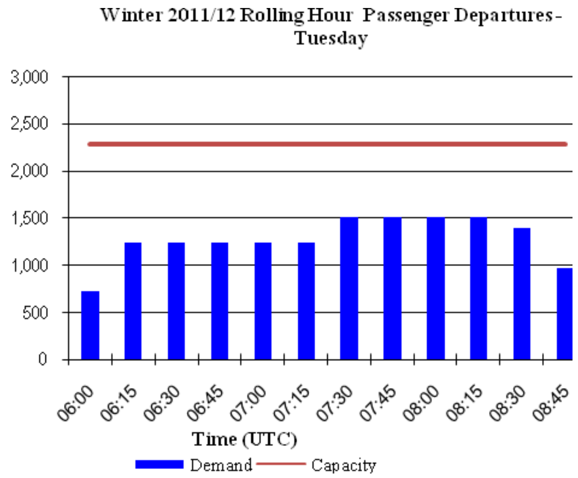
APPENDIX A

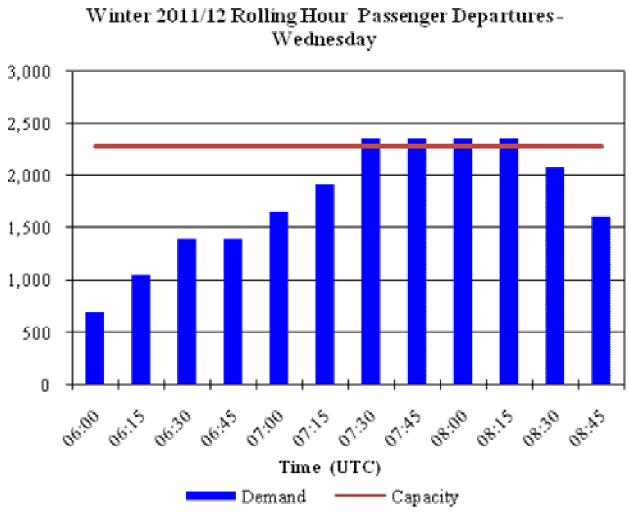
Airport Coordination Limited 2011/12 Data

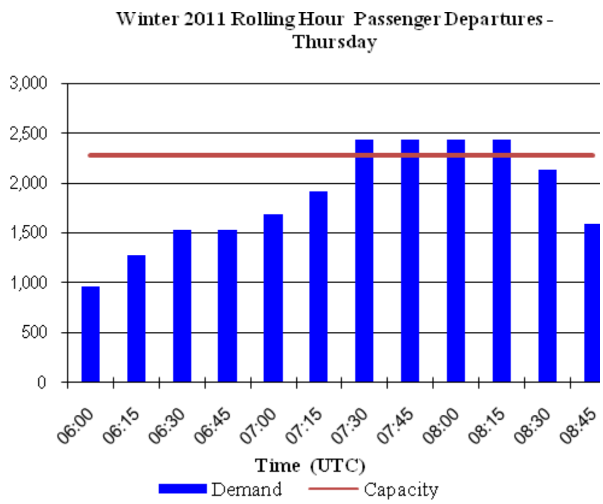
Demand Exceeds Capacity

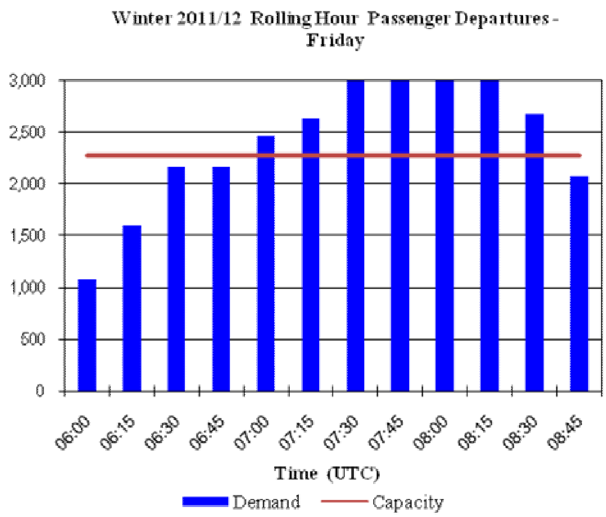
During Winter 2011/12 demand for the morning peak outweighed the declared capacity in particular on Wednesday, Thursday, Friday and Saturday. The following charts are based on operators required times during a busy week:

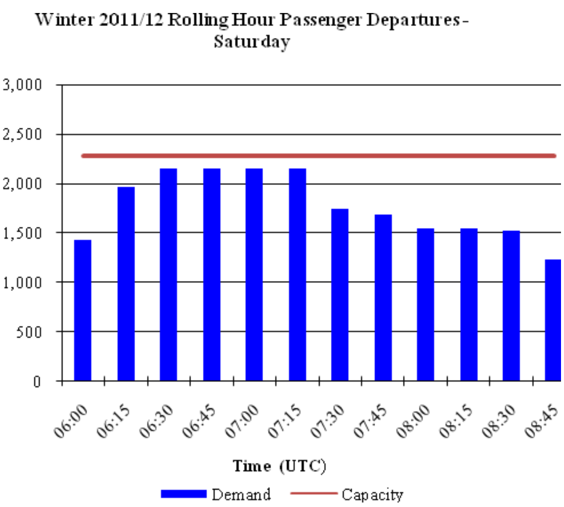


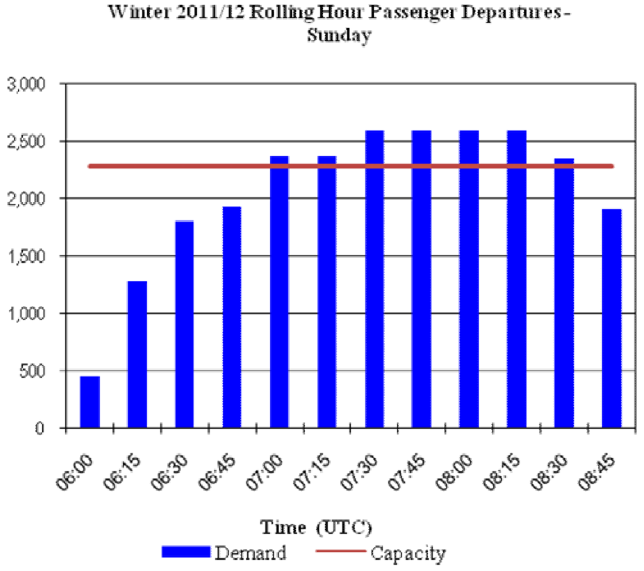




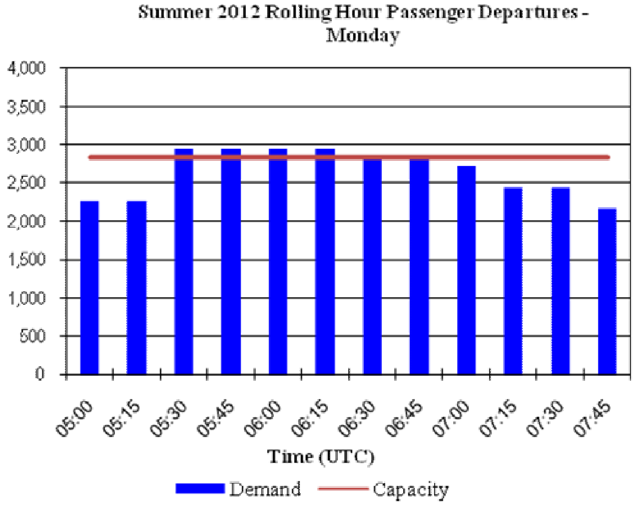


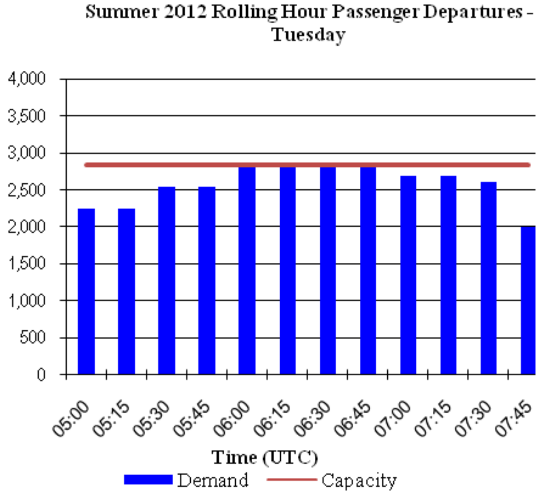


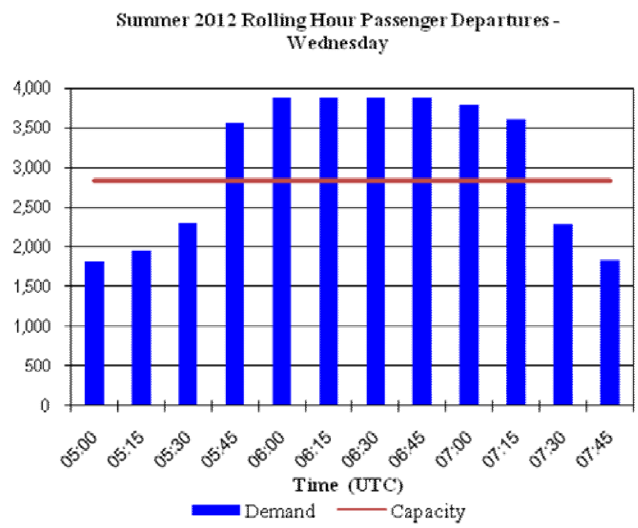


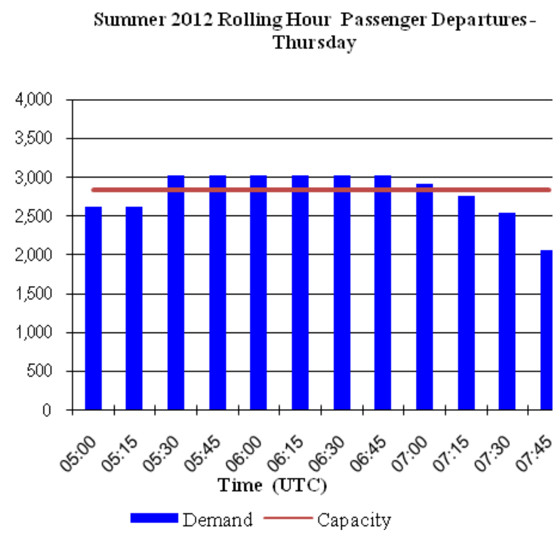


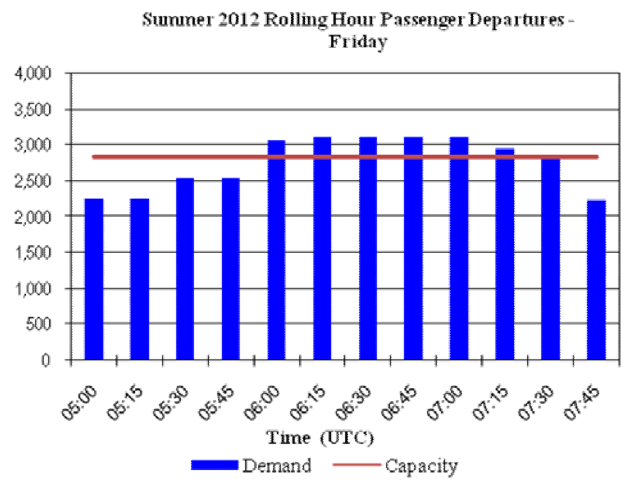
During Summer 12 London Luton Airport will be designated as Level 3 for the Olympic period therefore a higher level of slot compliance has been seen for this season. The following charts show the initial demand at the IATA slot submission deadline date for a busy week where demand exceeded the declared capacity on all days with the exception of Tuesday and Saturday:

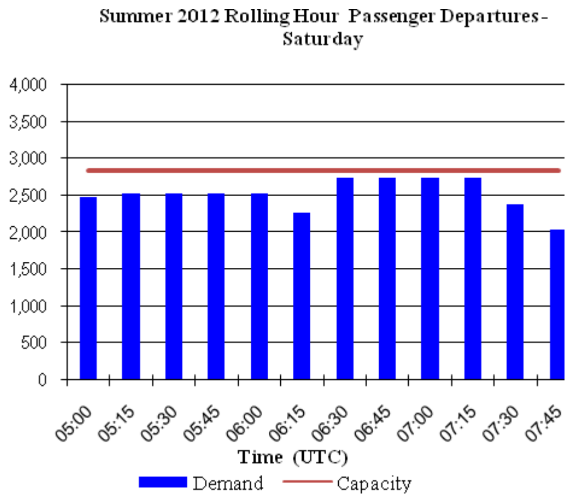


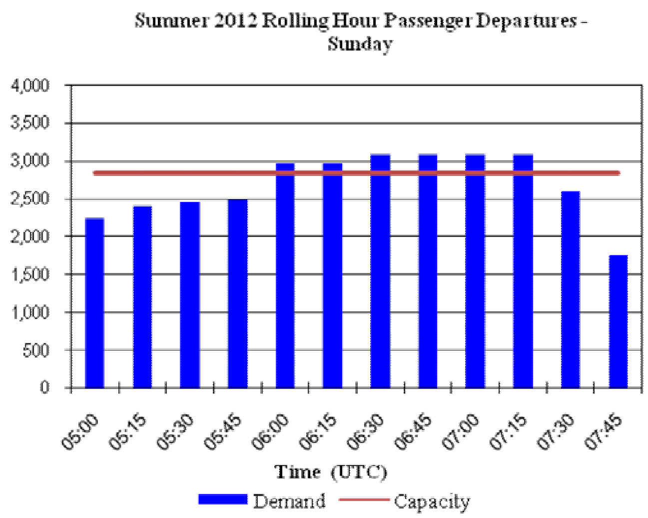



Summer 2012 Rolling Hour Passenger Departures - Wednesday
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
05:00
05:15
05:30
05:45
06:00
06:15
06:30
06:45
07:00
07:15
07:30
07:45
Time (UTC)
Demand
Capacity


Summer 2012 Rolling Hour Passenger Departures - Thursday
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
05:00
05:15
05:30
05:45
06:00
06:15
06:30
06:45
07:00
07:15
07:30
07:45
Time (UTC)
Demand
Capacity


Summer 2012 Rolling Hour Passenger Departures - Friday
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
05:00
05:15
05:30
05:45
06:00
06:15
06:30
06:45
07:00
07:15
07:30
07:45
Time (UTC)
Demand
Capacity


Summer 2012 Rolling Hour Passenger Departures - Saturday
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
05:00
05:15
05:30
05:45
06:00
06:15
06:30
06:45
07:00
07:15
07:30
07:45
Time (UTC)
Demand
Capacity


Summer 2012 Rolling Hour Passenger Departures - Sunday
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
05:00
05:15
05:30
05:45
06:00
06:15
06:30
06:45
07:00
07:15
07:30
07:45
Time (UTC)
Demand
Capacity

The following table shows the percentage of flights which breached the declared capacity during the morning peak and were requested to move. Figures are based on a busy week during Winter 2011/12.

Percentage of flights exceeding the Declared Capacity Limits that refused to move – Winter 2011/12

	Mon	Tue	Wed	Thu	Fri	Sat	Sun
0700	6%		6%	7%	19%	9%	14%
0800	33%	8%	13%	27%	47%		40%

Source: ACL

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