Appraisal Framework Module 14. Operational Efficiency: Ground Infrastructure Gatwick Airport Second Runway

04 November 2014

Document Control Sheet

BPP 04 F8
Version 16; October 2013

Project:	Airport Operations, Logistics and Engineering Support		
Client:	Airports Commission	Project No:	B1988000
Document title:	Appraisal Framework Module 14. Operational Efficiency: Ground Infrastructure Gatwick Airport Second Runway		
Ref. No:	GAL01		

Executive Summary

This purpose of this document is to report on the analysis of the Gatwick Airport Second Runway scheme against the Operational Efficiency module of the Airports Commission's Appraisal Framework, April 2014.

The proposed Gatwick Airport Second Runway scheme including an additional runway, taxiways and new terminal is capable of being delivered as a fully safety and security compliant airport. The proposed scheme would provide capacity for substantially greater numbers of flights and passengers, and more cargo to be handled by the airport. A few minor safety compliance issues have been identified which are likely to be able to be resolved by detailed design or addressed through operational procedures.

The proposed additional runway will enable the airport to handle a c 99% increase in air transport movements per annum from the current cap of 280,000 to 560,000. Although a few pinch points in the taxiway network are likely to create congestion at peak times, overall the taxiway network would be able to support those additional movements. The proposed new Midfield Terminal and its scalable pier and satellite, would enable the airport (along with modest improvements to the two existing terminals) to handle the proposed increase in passenger capacity, with a standard of passenger experience comparable to that currently experienced at the airport.

Although the scalability of stand provision is constrained by some limitations on the dimensions of the proposed expanded airport, there is flexibility to configure higher or lower proportions of different sized aircraft to meet future demand scenarios. The expanded airport would be constrained in handling significantly higher proportions of Code F aircraft, due to the inherent dimensional limitations in the taxiway and wider airfield design, but it could be capable of handling in absolute terms the proposed increase in the numbers of flights and passengers.

Although transfer system capacity has not been planned to facilitate high volumes of transfer traffic, it would be able to sustain minimum connection times of around 60 minutes for transfer traffic between terminals. While, as with all airports, it becomes more challenging at peak times, the airport's overall resilience and reliability would be enhanced by the additional runway and associated taxiway and terminal infrastructure.

There is limited scope to expand the airport further on the proposed land area. Given the constrained site, additional runway and terminal capacity would likely require construction of a third runway and associated terminal to the northwest, which may be challenging given the possible environmental impact. It may also require increases in railway and highway capacity that could prove challenging and expensive to deliver.

Contents

1 Introduction

1.1 Purpose

This document consists of the consolidated analysis of the Gatwick Airport Second Runway scheme (hereafter "the scheme" or "the proposal"). The analysis has been undertaken against the Operational Efficiency module of the Airports Commission's Appraisal Framework, April 2014. It is the professional assessment of the key metrics, measures and judgments across the individual units within Operational Efficiency module.

It is structured to report specifically on:

- *Inputs;*
- *Assumptions;*
- *Methodology;*
- *Description;*
- *Analysis; and*
- *Appraisal conclusions.*

It is not an economic, financial or commercial assessment of the scheme, but a technical assessment of the qualities of the scheme according to the specific units within the appraisal module. Key assumptions are made based on best available information of current and reasonably anticipated industry practice, but it should be understood that the judgments made in this document could change if significantly different modes of operation or regulatory conditions were implemented that constituted variations to key assumptions.

Section 2 presents a general overview of the methodology adopted in the assessment. Section 3 provides a high-level overview of the proposed master plan, with Sections 4 to 8 presenting the detail of the assessment of each key component of the master plan from runway to terminal facilities. Each of these sections initially discusses the element of the proposed master plan before presenting the results of the assessment against the Appraisal Framework module unit as set out below. Section 9 briefly comments upon the performance of the scheme with respect to the demand scenarios considered by the Airports Commission.

1.2 Module 14: Operational Efficiency

The Operational Efficiency module assesses how each scheme impacts on the capacity, safety, security, efficiency, reliability, resilience and scalability of the individual airport and the wider airport system. It provides an overall appraisal of what the scheme adds to the airport system, enabling comparisons between schemes and a "do-nothing" scenario, to assess whether the scheme can be implemented to be compliant with safety and security standards, and be sufficiently flexible and scalable to meet changes in demand, modes of operation and safety and security standards.

There are seven units of assessment in this module:

- *Capacity;*
- *Safety and security;*
- *Efficiency;*
- *Reliability and resilience;*
- *Scalability;*

- *Airspace; and*
- *Surface Access.*

This report includes all of these, except for Airspace and Surface Access, which are being reported on separately by NATS and a separate Jacobs report respectively to which reference should be made. In addition, the Civil Aviation Authority (CAA) has undertaken a separate safety analysis of each scheme.

There is considerable overlap between the capacity, efficiency, reliability and resilience units, as restrictions on capacity will also reduce the efficiency, reliability and resilience of the airport, although it is not the only relevant factor. Therefore, the capacity appraisal outlines the overall capacity of the expanded airport, and the limitations on that capacity. These are also referred to in the efficiency, reliability and resilience appraisals to reflect this when relevant.

Scalability includes both the potential for the airport to operate flexibly with different types of traffic and aircraft, and expand its capacity within the proposed infrastructure, and also the potential to expand beyond its proposed land footprint. It summarises the challenges of such expansion, as these could be on a scale similar to the scheme being considered in this report.

Not all components of the airport's operational processes are relevant to all units of the appraisal, for example many process elements are important for safety, but not capacity. Table 1-1, on the following page, sets out which process elements have been assessed according to their relevance to each of the appraisal units.

	Capacity	Safety and Security	Efficiency	Reliability and Resilience	Scalability
Airfield Components					
Runways	✓	✓	✓	✓	✓
RESA's		✓			✓
Runway approach lighting		✓			✓
Public Safety Zones		✓			✓
Aerodrome safeguarding		✓			✓
Navigation aid safeguarding		✓			✓
Taxiways	✓	✓	✓	✓	✓
Stands and aprons	✓	✓	✓	✓	✓
Cargo facilities	✓				✓
Fuel storage	✓			✓	✓
De-icing facilities	✓			✓	✓
Terminal Components					
Existing terminals	✓	✓	✓	✓	✓
Midfield terminal	✓	✓	✓	✓	✓
Transfer facilities	✓	✓	✓	✓	✓

Table 1-1 Airport Process Components and Relevance to Appraisal Units

1.3 Original Gatwick Airport scheme

In agreement with the Airports Commission, the promoters' proposal has been developed and amended to the scheme now described in this report. A summary of the changes to the scheme from the original Gatwick Airport Ltd (GAL) proposal is contained in Appendix B.

2 Methodology

2.1 Approach

This section sets out a high level overview of the methodology adopted to complete the analysis. Detailed numerical modelling was not undertaken at this stage. The assessments were therefore primarily based upon desk-top reviews of the proposed master plan including its modes of operation against expectation of industry good practice and by reference to professional experience and observations of comparator airports.

A consistent approach was applied to all schemes short-listed by the Airports Commission. The assessment undertaken was prepared on the basis of a number of key principles including avoidance where possible of relying upon assumptions to form an opinion. In the absence of detailed numerical modelling opinion has been based largely upon professional judgment and comparison with comparable airports and/or operations. The largely qualitative analysis has been sufficient to generate valid assessments of the schemes within the scope of the appraisal units.

The proposed new infrastructure has been assessed against the appraisal units by comparing how operations would be affected. It is reasonable to assume that the airport would seek to achieve at least a similar level of safety, security, efficiency, reliability and resilience to that currently experienced at the airport.

2.2 Operational Assessment

To ensure consistency between parallel work streams, a workshop was undertaken with NATS to evaluate the scheme in terms of aircraft ground movements to assess the capacity, efficiency, reliability and resilience of the airfield and coordinate with NATS's assessment of airspace[1]. Each direction of operation was examined in turn for both arriving and departing aircraft, for each key area of the airfield. The results of this workshop have informed the following report and are referenced as required throughout this report.

It was assumed that "compass departures" and "terminal arrivals" would be applied as general practice, although at peak times, especially when the airport approaches capacity, it is likely that this practice will be more difficult to sustain.

Discussions with NATS indicate that sufficient Standard Instrument Departure routes (SIDs) have been developed to accommodate "compass departures" from both runways. NATS has indicated that airspace capacity should not impact this assessment of airfield movements.

2.3 Runways

To assess whether the proposed capacity of the expanded runway system is reasonable, the projected air transport movements (ATM) capacity was examined under the proposed operating parameters. For the purposes of assessment of safety and capacity, the runways were treated in isolation of airspace and airfield constraints, although the previously noted workshop with NATS ensured consistency of assessment.

[1] See Appraisal Module 14. Operational Efficiency: Airspace Efficiency Report.

Independent detailed modelling has not been undertaken at this stage, and therefore, numerical analysis of runway capacity is not provided. However, reasonable comparisons have been made to existing runways in the UK and elsewhere to validate the claims made of capacity against comparator airports.

2.4 Taxiways

The proposed taxiways were checked for geometric compliance with European Aviation Safety Agency (EASA) standards and against the existing provision of taxiways.

The likely high level flow of air traffic on the taxiways was discussed with NATS. An overarching understanding of aircraft flows across the airport was developed under different operating patterns, to identify a series of 'pinch points', where it was determined that the effects of congestion could first appear when approaching capacity. This was based on existing conditions at the airport and operational practices at this and other comparator airports.

2.5 Stands and Aprons

Proposed stand dimensions were checked against CAA, EASA and International Civil Aviation Organisation (ICAO) standards and Gatwick and comparator airport stand dimension norms. This reflected the proposed stand configuration scenarios (e.g. the use of Multi-Aircraft Ramp System (MARS) stands to accommodate wide bodied and narrow bodied aircraft peaks on the same area of apron).

2.6 Ancillary facilities

The proposed cargo facilities were assessed by comparison with other airports to determine if the available area would be sufficient to meet proportionately greater levels of cargo traffic and to assess the expected capacity.

The proposed additional fuel storage provision was compared against existing provision and the proposed demand to assess the acceptability of area provided for fuel storage.

2.7 Terminals and Transfer Facilities

2.7.1 Terminal Sizing and Phasing

In order to determine whether the proposed terminals would be able to handle the suggested annual throughput of passengers, expressed in million passengers per annum (mppa), the level of service provided to a typical design hour passenger was compared to that in the existing facilities.

A detailed modelled assessment would consider the throughput of the slowest performing passenger process as a limit to the whole complex. It would also consider the provision of terminal processes and identify the floor area of the terminals. However, given the current design stage of the master plan and the uncertainties of the future, only a high level assessment of passenger capacity has been undertaken. A two stage process was adopted to assess whether the proposed terminal and associated satellite and pier infrastructure provide adequate processing capacity.

Firstly, based upon international benchmarks an appropriate "design hour" passenger flow was determined from the annual capacity for the airport. This "passenger design hour" is the hypothetical 30th busiest hour in the year for which the facilities are usually designed. Analysis at a range of international airports demonstrates that the annual throughput drives the factor between that throughput and the passenger design hour. As shown in Figure 2-1, as the annual throughput increases the factor between the throughput and the passenger design hour decreases, i.e. the design hour itself increases, but at a proportionally lower rate than the annual throughput, i.e. the daily (and indeed annual) process becomes less "peaky".[2]

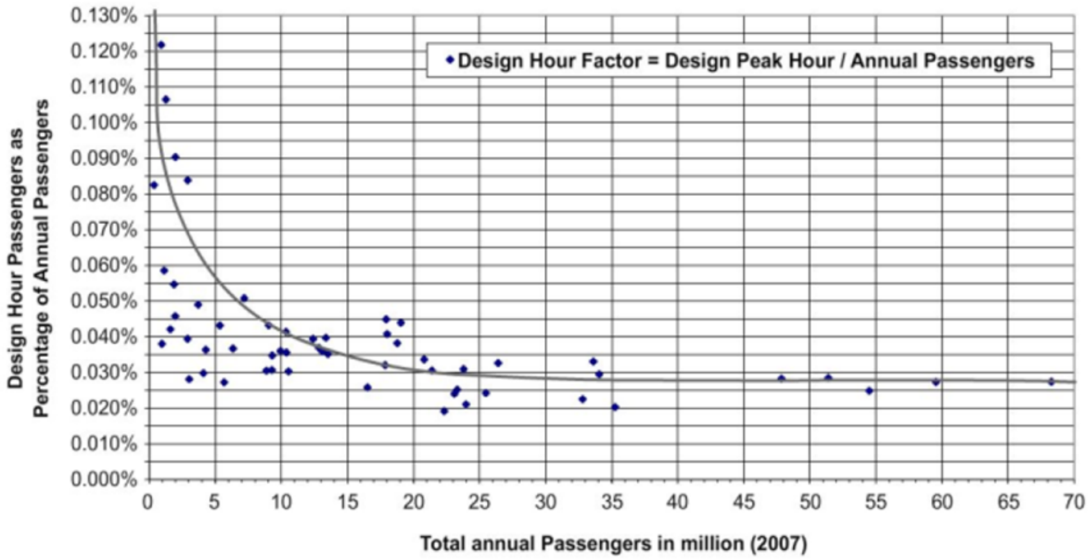

Figure 2-1 Relationship Between Annual Passengers and Design Hour (Source: Airport Evolution and Capacity Forecasting, Bubalo, 2011)

Secondly, the resulting space planning factor (the gross terminal floor area per design hour passenger) was determined and compared to industry experience and benchmarking to assess the resulting likely level of service that the terminal facilities would be expected to deliver. In this way, not only the provision of space is assessed, but also the peak characteristics of an airport are reflected in this high level assessment of the terminal buildings. Other metrics are available to determine the appropriate size of a passenger terminal building; however, these metrics may not include the peak characteristics that can be observed in an airport. As any facility at the airport should be designed to appropriately accommodate the peaking characteristic of demand, the adopted space planning factor metric is appropriate to be used.

It is acknowledged that the provision of gross floor area (GFA) per design hour passenger (DHP) has evolved over recent years particularly with the rise of low cost airlines. Although the scale of GFA per DHP is a continuum with no distinct thresholds, for the purposes of this analysis, the definitions set out on the following page have been adopted largely based upon IATA recommendations (see Airport Development Reference Manual (ADRM)) as well as professional experience.

[2] Note that the absolute minimum is 0.016% for a 17h operating airport. This represents an airport with a uniformly distributed, flat profile of passenger flows across the day and year.

- *15 to 20 m² per DHP was regarded as being at the low end of the benchmarking, i.e. a very cost efficient and value engineered terminal appropriate for a small facility serving predominantly the low cost market with a corresponding passenger experience;*
- *Approximately 20 m² to 35 m² per DHP was regarded as an average passenger service level appropriate for most mid-range terminal facilities;*
- *Approximately 35 m² to 40 m² per DHP was seen as a good passenger service level appropriate for many airports;*
- *40 m² to 50 m² per DHP was regarded as being at the upper end of the benchmarking expectation for a typical western European gateway airport.*

Such comparisons should be treated with care as each airport, likely serving a balance of different market segments, with differing commercial strategies, across terminals of differing sizes and internal configurations, should ideally be treated upon its individual merits. Nonetheless, this approach is considered appropriate at the current level of detail and provides instructive observations that are based upon empirical observation and not only on a theoretical treatment.

These definitions are not absolute and there is no correct interpretation. The above parameters were adopted on the basis that they provide an appropriate range of service levels within a European and UK context. It is noted that many airports aspire to deliver service standards in excess of the upper end of the above range and that in some regions of the world cultural and/or political aspirations drive space provision far in excess of this upper end.

To provide an indicative comparator, the DHP space planning factors for a range of airports around the world are depicted in Figure 2-2 below. Each point represents an airport in a continent/region, indicating the relatively wide range of standards for different airports.

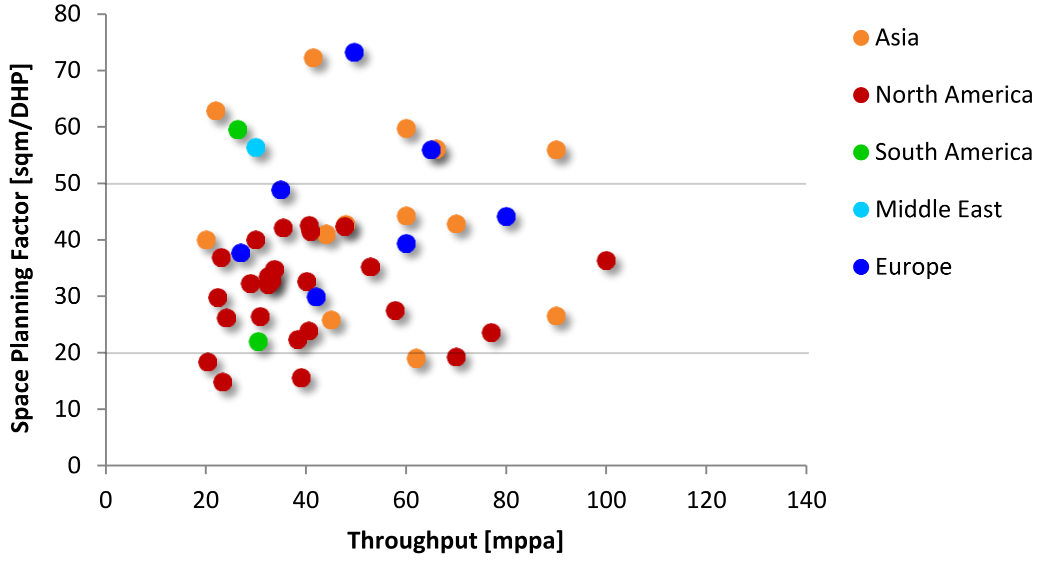

Figure 2-2 Space Planning Factor for Airports with more than 20 mppa

2.7.2 Departures

The departure process, including gates and retail, has been analysed at a high level considering the overall concept of operations.

2.7.3 Gates and Retail

As the area required for gate processes has a significant impact upon the dimensions of the piers and satellite, detailed calculations, insofar as the available data allowed, were undertaken to assess the required area. With the addition of circulation and commercial areas the total size and width of both piers and satellite were determined and their level of passenger service assessed.

2.7.4 Arrivals

The arrivals process was analysed at a high level considering the overall concept of operations.

2.7.5 Transfers

The transfer process has been analysed at a step-by-step level using reasonable industry benchmarks for airport transfer steps. The Minimum Connection Times (MCTs) were estimated for both passengers and their baggage.

2.7.6 Automatic People Mover Systems

The proposed Automatic People Mover (APM) systems were considered at a high level in comparison to similar such systems at other airports.

3 Master Plan and Operations

3.1 Master Plan

From an over-arching perspective, the proposed master plan (see Figure 3-1) follows well established planning conventions. It represents a well understood two-runway configuration with a midfield terminal in addition to the existing infrastructure.

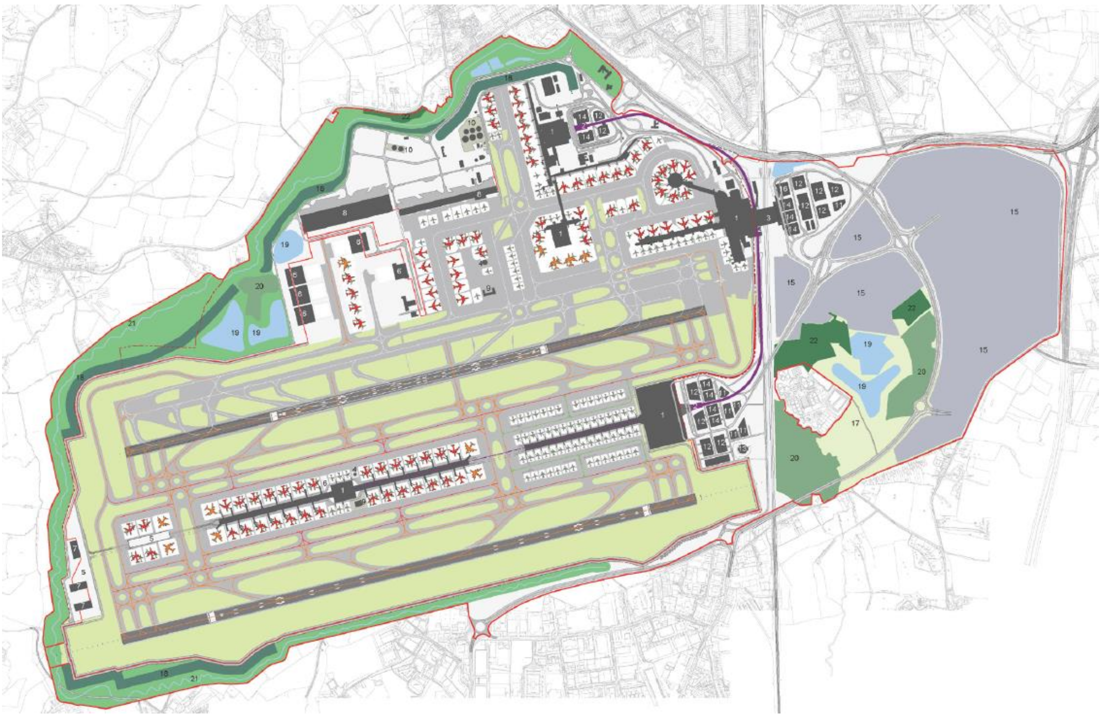

Figure 3-1 Gatwick Airport Second Runway Master Plan (base plan for midfield apron)

The master plan appears to have been laid out in accordance with CAP168.[3] It is anticipated that it will be also be necessary to be compliant with EASA regulations, which differ from CAP168.[4] The airfield proposal does not appear to comply with current EASA requirements in a few instances as discussed in the followings sections. It is possible the UK CAA could seek a permanent variation from EASA regulations for this scheme (based upon GAL demonstrating that the airport could operate safely with appropriate operating procedures in place). In addition, EASA has issued a consultation paper that proposes to reduce taxiway clearances, in line with ICAO proposals to do so from 2016.[5] If the EASA proposals were adopted, then the taxiway clearances requirements would be less onerous than at present.

However, if existing EASA regulations are confirmed to be mandatory, there nonetheless appears to be sufficient space to accommodate the additional clearances necessary to meet EASA regulations, although this would reduce the space currently allocated to stand depth, airside roads and terminal structure

[3] Licensing of Aerodromes, 10th Edition, 2014, CAA.
[4] For example, the UK CAA regulations set out in CAP 168 currently allow for reduced taxiway clearances for Code E/F aircraft in comparison to ICAO recommendations and EASA regulations. The taxiway clearances identified in CAP 168 were applied after monitoring of aircraft movements where Code E/F aircraft are commonly in operation. Typically, larger aircraft are more likely to follow marked centrelines to a higher degree of accuracy than smaller aircraft enabling the CAA to permit reduced taxiway clearances for larger aircraft.
[5] EASA NPA 2014/21.

For the purpose of this report, it is assumed that end around taxiways (EATs) are an essential element of the proposed scheme to provide reliability and resilience in the taxiway system as demand requires it. Failure to provide EATs to meet such demand over time will introduce significant runway crossings which would in turn compromise capacity, efficiency, resilience and safety. In addition, CAA policy has a presumption against incorporating runway crossings by design.

3.2 Operations

It is proposed to use both runways in independent mixed mode and to use "compass departures"[6] and terminal arrivals throughout the day. However, to maximise throughput at peak times, terminal departures may also need to be adopted. Operations have been assessed on the basis that they will be optimised according to levels of demand.

[6] Departures are allocated to runways based on their routing with aircraft heading to the north using the existing northern runway and those heading south using the new southern runway. Such an approach avoids the need to de-conflict departing aircraft in airspace. Reference should be made to Appraisal Module 14. Operational Efficiency: Airspace Efficiency Report.

4 Runways

4.1 Runway System

Gatwick currently has one runway operating in mixed mode, with an emergency runway (which is also the parallel taxiway and available only when the primary runway is out of operation).[7] Gatwick currently handles just over 250,000 ATMs per annum, with a declared capacity cap of 280,000.

The proposed scheme is for a second parallel runway with its centreline 1,045m offset from the existing northern runway. This is in line with current ICAO, CAA and EASA minimum separation requirements (1,035m) for mixed mode independent runways subject to the provision of appropriate navigation aids. The new runway would be compliant with ICAO recommendations and EASA regulations for Code F aircraft (i.e. 60m wide with 7.5m shoulders). It is proposed that operating both runways in mixed mode will enable the airport to handle up to 560,000 ATMs with fewer delays and improved resilience than at present.

Gatwick currently declares up to 55 movements per hour[8] at peak times, from the single runway. Given that this is already one of the busiest single runway airports in the world, little additional capacity could be achieved from this runway at peak times, although the runway does not currently operate at this rate all of the day. It is proposed that the hourly peak with two runways would be 98 movements, with a maximum of 60 departures or 53 landing movements. This would appear to be reasonable given existing operations at Gatwick, and by comparison with other two runway airports, including Heathrow, reflecting the high level of throughput achieved with Gatwick's single runway operation today.

Discussions with NATS indicate that sufficient Standard Instrument Departure routes (SIDs) have been developed that would accommodate compass departures from all runways. In principle, arriving aircraft will be allocated a runway according to their arrival terminal. The overall operation does not change significantly whether operating under easterlies or westerlies.

The runway system should be capable of handling all types of aircraft expected and forecast to use Gatwick under typical operating conditions.

4.1.1 Declared Distances

Current declared distances on the existing runway are depicted in Table 4-1 below.[9]

Runway	**TORA** (m)	**TODA** (m)	**ASDA** (m)	**LDA** (m)
08	3,159	3,311	3,233	2,766
26	3,255	3,407	3,316	2,831

Table 4-1 Current Runway Declared Distances

[7] It is assumed that the emergency runway will remain under the master plan.
[8] Source: ACL Summer 2014.
[9] TORA: take off run available; TODA: take off distance available, ASDA: accelerate-stop distance available; LDA: landing distance available.

The existing runway is being reconfigured with revised declared distances provided as follows:

Runway	TORA (m)	TODA (m)	ASDA (m)	LDA (m)
08	3,159	3,311	3,233	2,500
26	3,255	3,399	3,316	2,500

Table 4-2 Proposed Northern Runway Revised Declared Distances[10]

The declared distances for the proposed second runway are as follows:

Runway	TORA (m)	TODA (m)	ASDA (m)	LDA (m)
08	3,340	3,400	3,400	2,885
26	3,340	3,400	3,400	3,132

Table 4-3 Proposed Southern Runway Declared Distances

The proposed declared distances are comparable to existing operating conditions. The new runway provides marginally longer declared distances than the current runway, which increases flexibility for those few aircraft which may currently face operational restrictions.

4.2 Runway End Safety Area Provision

Full 240m long by 150m wide Runway End Safety Areas (RESA), as recommended by ICAO, have been proposed for all runways, which are fully safety compliant. The displacement of all runway thresholds significantly improves undershoot RESA provision across the airfield, and is a safety improvement.

4.3 Approach Lighting

Standard 900m full approach lighting systems commensurate with ICAO, EASA and CAP168 requirements for Category III instrument runways, have been proposed based on the new threshold positions.

The approach light planes have been assessed and are compliant with ICAO, EASA and CAP168 requirements.

4.4 Public Safety Zones

The scheme includes Public Safety Zones (PSZs) at all runway ends based on an analysis of future aircraft movements across both runways. Two scenarios have been tested by NATS, the first assuming that EATs are provided, and the second assumes that they are not. The proposed provision for PSZs is considered reasonable in comparison to the provision at the existing runway and it is not envisaged that any properties will fall within the PSZ areas.

Figure 4-1, on the next page, illustrates the proposed PSZ contours. At this stage of planning, the contours should be considered to be indicative only and subject to change dependent on future operating parameters and aircraft mix.

[10] Note: The existing emergency runway remains in operation under its current configuration.

PSZ contours are calculated using criteria set out by the Department for Transport. Key variables in determining the extent and shape of the contours include; the expected aircraft mix, the number of ATMs and the split of landing and take-off movements.

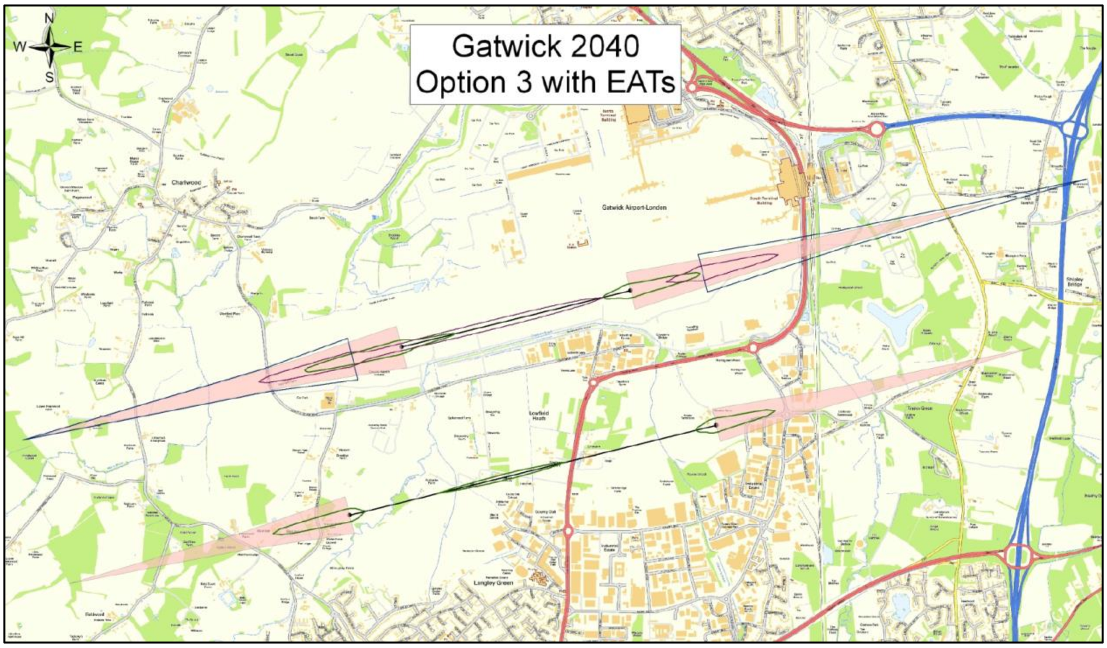

Figure 4-1 Gatwick Airport Second Runway Proposed PSZs (Source: Gatwick Airport Ltd submission to the Airports Commission)

4.5 Obstacle Limitation Surfaces

Assessment of obstacle limitation surfaces (OLS) safeguarding has been limited to consideration of the approach, take-off and climb, and transitional surfaces for areas in the immediate vicinity of the airfield. It is recognised that there are other safeguarded surfaces (inner and outer horizontal and conical surfaces). However, penetrations of these surfaces will either be similar to the north of the airfield or to the south, whilst unknown, are unlikely to have a significant impact on the safety and efficiency of airfield operations sufficient to invalidate the master plan.

4.5.1 Approach Surfaces

The origins of the approach surfaces will reflect the new displaced threshold locations. This will have two impacts:

- *Obstacles that may currently infringe the approach surface would subsequently penetrate the surface by less or not at all; and*
- *New obstacles would infringe the redefined surface such as tail fins of aircraft at runway holding points.*

The first impact is a safety improvement on the current situation. The second impact raises a safety issue, although this is not an uncommon practice at airports around the world. It is reasonable to assume that this impact could be mitigated by operational procedures.

The approach surface amendments do not raise any safety compliance issues that cannot be managed by operational procedures.

4.5.2 Take Off and Climb Surfaces

The take-off and climb surfaces (TOCS) do not appear to raise any safety compliance issues. No significant penetrations to the TOCS are foreseen.

4.5.3 Transitional Surfaces

The master plan layout does not indicate any significant new penetrations to the transitional surfaces. Any new development on the airport's land (e.g. hotels to the east, or ancillary buildings to the west) would be designed with the transitional surfaces in mind and so be subject to height restrictions. Therefore, this does not raise any safety compliance issues.

4.5.4 Obstacle Free Zone

The proposed obstacle free zones (OFZ) should remain protected with aircraft holding outside the missed approach surfaces. With appropriate operational controls on aircraft ground movements, the OFZs appear to be compliant and adequate for safety purposes.

4.6 Navigation Aid Safeguarding

Careful detailed planning will be necessary regarding taxiways and glide path locations on the northern runway given the proposed taxiway layout. Sufficient clearance should be maintained between the runway and the inner parallel taxiway to allow the installation of the glide path system and the required protected areas. Typically, a glide path aerial is located not less than 120m from the runway centreline[11], and then requires around 90m to the next object, i.e. giving rise to around 210m from the runway centreline to nearest object depending on local terrain and aircraft operating at the airport. The scheme provides for only 190m between centrelines of the runway and inner parallel taxiway, which would result in restrictions in use of the parallel taxiway during landing operations (i.e. inner parallel taxiway closed).

The safeguarded areas for the glide path aerials will be an important element in determining where runway RETS/links should be located.

Provision for glide path safeguarding has been made south of the new, southern, runway, as with the northern runway. This includes provision for taxiways and the boundary fence surrounding the glide path protected areas.

The security fence alignment also takes this glide path protected surface into account, reflected in the new boundary fence alignment to the south of the new runway.

It is acknowledged that operational restrictions may be required on sections of the parallel taxiway system under certain operations. Given the expectation that current instrument landing system (ILS) technology will be phased out and replaced with newer technology over time, the operational impact of this element of the master plan may reduce and should be adequately addressed during the detailed design phase.

[11] Ref 2.4.1 ATT C-15, ICAO Annex 10.

4.7 Appraisal

4.7.1 Safety and Security

The proposed second runway does not present any significant issues in terms of safety and security and appears capable of being delivered against relevant safety and security standards. The consequence of the scheme appears to be to maintain and in some cases incrementally improve the safety of the airport. No elements have been identified that are inconsistent with known likely future changes in safety and security standards.

Some minor issues have been identified that could be reasonably expected to be resolved through detailed design or the adoption of appropriate operating procedures. The two most notable are:

- *The displaced threshold locations mean that new obstacles would infringe the redefined approach surfaces. This can be mitigated by operational procedures;*
- *For the northern runway there are runway crossings close to the areas that could be designated for the ILS glide path given the proposed displaced thresholds. The relationship between these will need to be addressed in the detailed design phase.*

4.7.2 Capacity

Table 4-4 states the current usage and capacity and future estimated capacities.

	2014 Actual Usage	2014 Capacity	2025[12] Capacity	2050 Capacity
ATMs	250,520	280,000	560,000	560,000

Table 4-4 Gatwick Throughput and Proposed Capacity with Scheme

Gatwick currently declares up to 55 movements per hour and has proposed to increase this to a maximum of 98 per hour.

The proposed future ATM capacity is considered to be realistic. It does not double the existing rate, but is still around 48 movements per runway during the peak hour. This is at the top end of runway utilisation. Other airports that achieve similar rates include Heathrow (current declared rolling hour peak of 46 movements/hour – Summer 2014 ACL Declaration), but given that both runways are proposed to operate in mixed mode (whereas Heathrow's runways operate in segregated mode), this is considered to be realistic, safe and efficient, although this is likely to represent close to the upper limit of available potential capacity. If Gatwick were to operate in segregated mode, the airport would need to be limited to a lower capacity, if it were to avoid unacceptable reliability and resilience issues at peak times.

The proposed runway would have a positive net impact on capacity in the wider London airport system and is not anticipated to reduce capacity at other major airports, subject to re-configuration of the London airspace system.

[12] For the purpose of this assessment, it has been assumed that the second runway opens when 280,000 ATMs is reached. However, due to the length of the time needed for planning and regulatory approval, 2025 is considered to be the earliest point at which the new runway will open.

4.7.3 Efficiency

The scheme appears to be capable of efficiently handling the proposed ATMs in total and at the proposed peak levels of departures and arrivals per hour, subject to appropriate slot co-ordination.

The runway system would be able to handle a wide range of commercial aircraft up to and including Code F (although reference should be made to the potential restriction on aircraft sizes that could be freely accommodated by the proposed taxiway network, see Section 5).

The scheme would enable the two runways to operate fully independently in mixed mode, segregated mode or with a combination of runway operating scenarios. The scheme should enhance the airport's efficiency, as the additional capacity should reduce delays on the ground; although delays would be expected to occur at peak times as demand approaches the expanded runway system capacity, these can be mitigated through airport collaborative decision making (A-CDM) and 4-D linear holding. Segregated mode operations would need to be accompanied by a lower capacity declaration to ensure the expanded airport could operate efficiently.

In conclusion, the design of the runway system should be adequate to allow efficient operation of the airport.

4.7.4 Reliability and Resilience

The scheme would enhance the reliability and resilience of the airport given the additional flexibility inherent in operating a two runway airport compared to a single runway. If an incident occurred that would restrict or close operations on one runway, the airport is likely to be able to continue to operate safely. However, as with airports generally, the greater the level of demand the less capacity there is to manage unplanned events.

With full independent mixed mode operations the airport would be better able to ensure resilience and reliability of departing and arriving aircraft than should the two runways be operated in segregated mode.

Given the additional flexibility inherent in operating a two runway airport, the airport is expected to achieve improved levels of resilience against severe weather than it does at present, and is expected to improve further as technology for automated landings continues to develop.

4.7.5 Scalability

The proposed runways are compatible with a wide range of fleet mix scenarios that may accompany different commercial models the airport may pursue. This includes Code E and Code F aircraft, and all current and envisaged aircraft likely to be used by different types of airlines and for different varieties of airline traffic. However, reference should be made to the potential restriction on aircraft sizes that could be freely accommodated by the proposed taxiway network, see Section 5.

The Operational Efficiency module of the Appraisal Framework includes consideration of the further scalability of schemes. Therefore, the potential for further runway development at the site of each shortlisted scheme has been assessed, to provide a high level indication of the likely challenges. This does not represent a comprehensive assessment of the scope or case for the further runway options under consideration

A third runway at Gatwick would require the acquisition of a significant area of land parallel to the existing runways, for runway, terminal and surface access construction. No land has been safeguarded for such expansion, so this would likely require demolition and removal of residential and commercial property, loss of agricultural land, river diversion and potential loss of ancient woodland and national cultural heritage designations. This would be likely to have significant environmental and social impacts. It is unlikely to be viable to extend the airport boundary further south or east given the existing built infrastructure adjacent to the existing airport and the proposed boundary at Crawley. Therefore, the potential sites for further runways are likely to be restricted to the northwest of the airport.

Conceptually, it may be possible to build a third runway to the northwest, although this development would require a greater degree of land acquisition than is proposed for the second runway and associated facilities. It is likely to have a particularly impact on Horley, given its immediate proximity to the area. Wider impacts may arise if expansion of the Brighton Main Line and the M23 are necessary to accommodate the additional demand.

5 Taxiways

5.1 Proposed Taxiway Network

The proposal is for expansion of the taxiway network including new parallel taxiways adjacent to the proposed Midfield Terminal and satellite, to service the new runway and associated stands and terminals.

The proposed network would appear to be adequate to manage aircraft efficiently on the airfield. However, some bottlenecks have been identified in the network that could cause congestion during peak periods. These are highlighted in Figure 5-1 below.

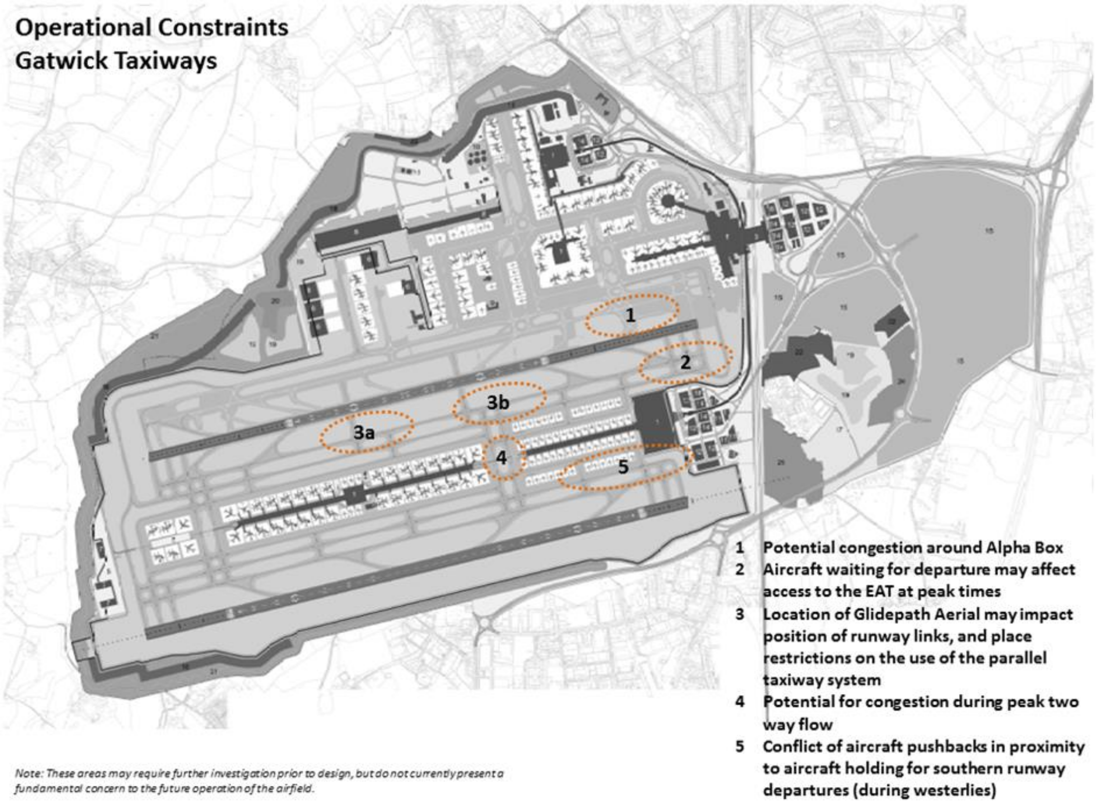

Figure 5-1 Taxiway Operational Pinch Points

The dimensions of the proposed new taxiways indicate that most have been planned for Code E aircraft, and are compliant with CAP168. However, the Code F to Code E taxiway separation of the proposed new taxiways is not compliant with current EASA regulations. For example the distance between the inner taxiway (Code F closest to the runway) centreline to the outer Code E taxiway centreline is given as 87.5m, which does not meet the EASA standard (90m). Existing airfield layouts at both Gatwick and Heathrow have been allowed dispensations on occasion, to adhere to CAP168 rather than the more onerous EASA taxiway clearances; indeed GAL is currently undertaking a programme of works to improve taxiway clearances to meet EASA regulations. It is not clear whether similar dispensations will be permitted for new developments.

Such a variance will only have limited implications for safety or capacity of the system, and could be mitigated by reducing terminal or stand depth, although the scope for such reductions would have operational implications for these elements of the master plan as discussed further below.

In addition, EASA is currently consulting on a proposal to amend taxiway clearances.[13] If adopted, this proposal would mean that the taxiway clearance requirements would be less onerous than at present.

The proposed taxiways around the remote stands to the west of the airfield are not Code F compliant. However, it should be possible within the final design of the airfield to achieve appropriate clearance if required, by making changes to stand layouts. This would involve a reconfiguration of stand sizes to enable Code F taxiways at this location if needed. Alternatively operational procedures could be adopted to restrict movement of Code F aircraft at this location.

5.2 Runway Access Taxiways

Three Runway Access Taxiways (RATs) are proposed for each end of each runway. This is commensurate with the current runway and is considered to be good design practice. The taxiways crossing the runway are discussed below.

The proposed RATs are suitable for the overall master plan, would meet safety and security standards and be adequate to service the proposed capacity of the airport.

5.3 Alpha Box

The existing runway is served by an area of pavement known as the ‘Alpha-Box’ which is to the northeast of the existing runway 26L threshold (see area marked “1” in Figure 5-1 above). This area is used for sequencing of departing aircraft on westerly operations. The Alpha Box protects the runway under CAT II[14] and CAT III[15] conditions by positioning stop-bars so that holding aircraft are located outside the approach surface when landing operations are on runway 26L. Due to this constraint the ‘Alpha Box’ is currently a bottleneck at peak times, particularly under conditions of CAT II and III landings when departing aircraft are held outside the box whilst an aircraft approaches and lands.

The proposed displaced 26L threshold will mean that the existing “Alpha Box” will need to be increased in size and extended further west to correspond with the new threshold location and associated approach surface. This new threshold location will place similar restrictions on the taxiways at Charlie, Charlie Romeo, (Charlie Box) and taxiways Bravo and Bravo Romeo (Bravo Box). The existing Alpha Box will remain in-situ as the clearance provided here to the underside of the approach surface is only in the order of 15m therefore large aircraft would present an obstruction in this area. The south side of the runway will be affected in a similar manner. The extent of the protected areas will require discussion and approval from CAA as part of the design process.

[13] EASA NPA 2014/21.
[14] CAT II is when landing conditions have a Runway Visual Range of no more than 1,200 ft, with a Decision Height of between 200ft and 100ft
[15] CAT III is when landing conditions have a Runway Visual Range of no more than 700 ft (3a), 10 ft (3b) or zero (3c), with a Decision Height of less than 100ft.

The Alpha Box will continue to be a bottleneck at peak times, but the overall impact of the proposed changes to this area will be relatively neutral in terms of safety and capacity.

5.4 Rapid Exit Taxiways

The existing runway is served by several Rapid Exit Taxiways (RETs). It is recognised that these RETs may need to be repositioned for the new landing thresholds. Two additional RETs are proposed in either direction to the south of the runway to facilitate access to the Midfield area.

The proposed RETs would appear to meet safety and security standards and be capable of adequately meeting the proposed capacity of the airport. However, additional RETs could improve the efficiency and resilience across the runway/taxiway network and should be considered during detailed design.

5.5 Runway Crossings

Two runway crossings to link the midfield to the northern terminal area are proposed. Runway crossings are generally not seen to be good practice on safety grounds and because they constrain runway capacity. However, they provide a contingency measure for resilient airport operation should one or both of the EATs be unavailable. The proposed runway crossings would appear to be able to be operated safely, subject to detailed design and the concept of operations.

It could be beneficial to airport efficiency if these taxiways were aligned with the cargo area taxiways in both cases to allow direct taxiing access routes for aircraft, although it is recognised that a staggered runway crossing (as proposed) can mitigate against runway incursions.

Additional runway crossings around the RAT area at the eastern end of the north runway could also improve the efficiency of the airfield, by enabling bypass of EATs at times of congestion, but would also be subject to safety approval.

The proposed runway crossings could add resilience to the airfield system, but would need to be carefully designed and managed to ensure safe operation and to avoid becoming new sites for airfield congestion.

5.6 Parallel Taxiway Network

The scheme includes a dual parallel taxiway network that extends along the full length of both runways, with an apron taxiway along the back of the midfield aprons. This taxiway network is designed for Code E aircraft, with access for Code F stands at the end of the Midfield terminal and satellite only.

Whilst this taxiway network would be safe and compliant for up to Code E aircraft, it could not accommodate Code F aircraft passing one another under current EASA standards, although separation would only have to be increased by 2.5m.

The dual taxiway network includes a pinch point between the Midfield Terminal and satellite (see area marked “4” in Figure 5-1 above). This is likely to be a critical area during times of peak operations during westerlies.

The parallel taxiway network would meet safety and security standards and be capable of adequately meeting the proposed capacity of the airport, but would be restricted in its availability to Code F aircraft, presenting a capacity limitation on the use of such aircraft.

5.7 End Around Taxiways

Single end around taxiways (EATs) are proposed at either end of the northern runway to facilitate movement between the northern terminal area, the midfield and the southern runway.

The EATs have been positioned sufficiently distant from the landing thresholds such that aircraft up to and including Code E would not be an obstacle to landing aircraft. Although the EATs are wide enough to be used by Code F aircraft, the height of Code F aircraft restricts them from using the EATs whilst an aircraft is approaching and would be required to wait for runway crossing clearance. As proposed, the EATs would be safety compliant and adequate for taxiway operation, providing sufficient jet blast mitigation is provided. Further consultation with the CAA will be required prior to the EATs being permitted.

Additional link taxiways serving the EAT around the western end of the northern runway would have added flexibility to the parallel taxiways around the periphery of the ground service equipment storage area. At present there are few taxiway links provided between the EAT and the parallel taxiway system in this area. An additional EAT around the western end of the airfield would enhance the resilience of the network, but this would require significant land acquisition, river diversion and relocation of a noise bund.

The EATs would appear able to meet safety and security standards and be capable of adequately meeting the proposed capacity of the airport.

5.8 Taxiway operations

Taxiway circulation has been assessed to ensure coordination with arrival and departure airspace operations. Indicative flow routes have been identified in order to ascertain whether there are likely to be particular areas of congestion in the future. Independent computer modelling of aircraft has not been undertaken, although it is recognised that further detailed modelling will be required prior to detailed design.

Overall, taxiway circulation appears to be acceptable. However, the areas depicted in Figure 5-1 above are potential bottlenecks that are likely to present some delays at times of peak operation, although these should be able to be mitigated by appropriate operational procedures.

5.9 Appraisal

5.9.1 Safety and Security

The planned taxiway network is consistent with relevant safety standards and recommendations in most cases.

There are some specific issues that will need resolution during the detailed design phase as follows:

- *Code E to Code F taxiway separations are compliant with CAP168, but not current EASA regulations (although proposed amendments to these may mean they would be compliant);*
- *Taxiways around the remote stands to the west of the midfield are not Code F compliant. This may be addressed in detailed design or by restricting Code F operations in this area; and*
- *Proposed runway crossings would need to be approved by CAA and be subject to appropriate management of operations.*

5.9.2 Capacity

The proposed taxiway network should provide adequate capacity to support the efficient operation to the stated runway capacity. However, the taxiway configuration does include a number of bottlenecks that are likely to create some delays at times of peak operation, and its design includes limitations on the extent of the taxiway network available to Code F aircraft.

The congestion "pinch points" under peak operating conditions that could create delays and affect the reliability of airport operations are as follows (and as shown on Figure 5-1 above):

- *The extended Alpha Box is likely to remain a bottleneck for aircraft taxiing to the southern runway for departure from the existing North and South Terminals;*
- *Aircraft waiting for departure may affect access to the EAT at peak times;*
- *Location of the glide path aerial may influence the position of runway links and place restrictions on the use of the parallel taxiway system;*
- *The dual taxiway between the end of the Midfield Terminal pier, and the Midfield Satellite could become a bottleneck when opposing taxiway flows are in operation; and*
- *Conflict of aircraft pushbacks in proximity to aircraft holding for the southern runway departures during westerlies.*

Detailed airfield modelling should help develop operational and design solutions to mitigate these issues. Furthermore, there is scope to expand the taxiway network with additional RETs, runway crossings and another EAT to the west of the airfield.[16] The relative merit and value of such options should be considered during detailed design. It is difficult to assess the likely airfield delays in the absence of airfield modelling, and therefore it is unclear whether congestion at peak times will be an improvement compared to existing conditions, however, congestion is likely to be no worse than currently and the additional infrastructure will improve capacity for many years before throughput reaches the operational capacity.

A wide range of aircraft types will be able to use the entire taxiway network up to Code E. However, some elements of the taxiway network restrict the movement of Code F aircraft, which would necessitate an operational response that would reduce the capacity of the airfield. These include:

- *The dual parallel taxiways do not have sufficient separation;*

[16] Although this would require land to be acquired to expand the airfield.

- *Code F aircraft present an approach surface penetration when using the EATs; and*
- *Midfield western remote stand access to Code F aircraft is restricted.*

5.9.3 Efficiency

The proposed taxiway network should be capable of handling the proposed maximum capacity of the airport. Two aspects of the design are noteworthy.

Firstly, the airport layout with two terminals to the north of the northern runway means that taxiing from those terminals to the southern runway may be subject to delay (e.g. if a runway crossing of a Code F aircraft is required, congestion is encountered around the ends of the northern runway, or an aircraft is held up around the end of the midfield pier). In addition, the proposed Midfield Satellite is relatively long (serving around 16 Code E/F stands in an uninterrupted line) and consequentially will require lengthy taxiing times to cover its full length.

At peak times, it is likely that the capacity bottlenecks shown on Figure 5-1 above will affect the efficiency of the airfield. However, careful design of operational procedures to dynamically respond to congestion, by managing departures and runway and taxiway utilisation may mitigate potential delays.

As also discussed, the taxiway network would support a wide range of future aircraft, but would not support unrestricted use by Code F aircraft.

The taxiway network would be able to adequately support both runways operating in mixed mode, segregated mode and a combination of modes of operation.

5.9.4 Reliability and Resilience

The proposed taxiway network appears to be adequate to enable a reasonable standard of resilience and reliability of operations.

However, the bottlenecks described above are likely to affect reliability and resilience at times of peak demand.

5.9.5 Scalability

While the taxiway network is predominantly planned for Code E aircraft, there is limited capacity for Code F aircraft. The proposed runway separation means that it will not be possible to expand taxiway capacity to enable greater movement of Code F aircraft across the airfield. To do so would require significant changes to the master plan including wider runway separation and consequential increased land take.

However, it would be possible to expand taxiway capacity to enhance reliability and resilience through measures such as additional EATs and a third taxiway link between the Midfield Terminal and the satellite. An additional EAT at the eastern end of the airport would be difficult as there is little space available at the eastern end of the airfield for an additional EAT, and providing one at the west of the airfield would require significant land acquisition, further diversion of the Crawters Brook / River Mole and relocation of the noise bund all by some 150m to the west and northwest of the airport.

6 Stands and Aprons

6.1 Proposed Stands and Aprons

The current stand provision is presented in Table 6-1. A significant increase in stands is proposed. A number of configurations have been proposed providing a range of different sizes of stands to reflect demand based on different aircraft types. However, further to the discussion above (see Section 5), there is reduced scope to accommodate Code F aircraft given the reduced flexibility of the taxiway network.

Aircraft Code	North and South Terminal Current 2014 Provision	Total Airfield Proposed 2040 Provision
C	28	134
D	17	-
E	56	63
F	6	6

Table 6-1 Existing and Proposed Future Stand Provision

Given the flexibility in phased provision of mixes of stands based on demand, adequate provision has been made to provide sufficient stands and apron space to meet the proposed runway capacity in terms of ATMs.

The proposal is for the existing aprons to accommodate around an additional 10mppa over the current 35mppa throughput. The airfield is currently constrained by runway capacity at peak times, therefore it is reasonable to assume that any additional stand capacity would be filled during shoulder and quieter periods of the day. Broadly, the stand provision doubles in order to accommodate the proportionate increase to 95mppa.

The scheme includes a range of alternative scenarios for higher or lower proportions of Code C and Code E stands to reflect forecast future demand. It is recognised that these options provide a sample of possible arrangements and would be subject to further planning and design to determine the optimum layout.

It should be noted that a series of remote stands are located to the south of the Midfield Terminal pier (at the eastern end of the airfield). Access to these stands could impact operation of pier served stands along the terminal at peak times and that pushback onto the parallel taxiway system could compromise efficient flow of aircraft during busy periods (see area marked “5” in Figure 5-1 above).

The stand provision is considered to be acceptable, and could be flexed to accommodate different combinations of aircraft types.

6.2 Appraisal

6.2.1 Safety and Security

The proposed stands and aprons can be safely laid out in accordance with EASA and CAA standards. The proposed stands and aprons would support the continued safe and secure operation of the airport.

6.2.2 Capacity

It appears that there is sufficient capacity in terms of numbers of stands and apron capacity to meet the runway capacity proposed. A wide range of aircraft types will be able to use the airport, but a limited number are able to be Code F given the proposed stand availability, which is itself limited by the taxiway system.

6.2.3 Efficiency

The proposed stands and apron will support the efficient operation of the airport and a range of aircraft types. It would support high proportions of Code C aircraft operations and growth in Code E aircraft compared to current capacity.

The operational efficiency of the Midfield Terminal southern remote stands is likely to be reduced due to interaction with the adjacent taxiway and RATs.

6.2.4 Reliability and Resilience

The proposed stands and aprons would appear to support reliable and resilient operation of the expanded airport. The spread of stands across the airfield should enable adequate provision of capacity at peak times. The linear arrangement allows for relatively straight forward re-allocation of aircraft in the event of stand outages. There is however, a comparative lack of resilience for Code F aircraft, given the relatively low number of stands that could be allocated to them.

6.2.5 Scalability

The linear layout lends itself to phased development according to need up to the capacity of the runway system. However, it will be more challenging to provide stands for significantly higher numbers of Code F aircraft should a different demand scenario eventuate.

7 Ancillary Facilities

7.1 Introduction

A wide range of ancillary facilities are provided at the airport including, but not limited to offices, hotels, catering, power, and fuel farms. Much of the land within the boundary shown in the master plan is already under the control of the airport. The use of the land split between these facilities will be dependent on demand over time. This report does not seek to determine whether the scheme design appropriately reflects future demand for office space or other specific facilities. However, it is recognised that GAL will utilise all land available to the airport, and that additional independent support facilities will inevitably grow in the immediate vicinity of the airport, whether under the direct operation of the airport or otherwise.

Particular comment has been given to the provision of cargo, fuel and de-icing facilities.

7.2 Cargo Facilities

The proposal's predicted throughput of cargo, including both dedicated and belly-hold cargo, is that it could reach 1,070,000 tonnes in 2050. This is around a threefold increase over that seen in the peak of 2000. It appears that this ratio has been used in the master plan as the basis for extending the current cargo building footprint proportionally. As such, the proposed design is able to accommodate an increase that goes beyond the proportionate increase in passenger traffic capacity that is planned. At this stage of master planning there would appear to be an adequate facility provision for such an increase in cargo with further scope to expand this area if required, or slower provision of capacity depending upon experienced demand.

Historic Throughput (tonnes)	**2012**: 97,567 **2000**: 320,000
Forecast Throughput (tonnes)	**2050**: 1,070,000
Current Footprint (m^2)	27,085 (of which 60% is occupied in 2014)
Proposed 2050 Footprint (m^2)	92,500

Table 7-1 Proposed Cargo Area

7.3 Fuel storage

The airport is not responsible for the fuel infrastructure. The scheme contains no short term requirement to increase fuel provision. However it is proposed that 3 extra 10,000 litre tanks be built by 2050, increasing the five that exist today to eight. There is also sufficient space to expand this further or to develop another site, if additional provision were to be required.

7.4 De-icing Facilities

Three potential zones for de-icing have been identified:

- *Both ends of the midfield satellite building facilitating de-icing of wide bodied aircraft, and*

- *Closer to the midfield terminal suitable for narrow bodied aircraft.*

This allows for multiple aircraft to be de-iced simultaneously at either end of the airfield depending on weather conditions. Implementation of de-icing zones as indicated would be an improvement on the current situation in terms of reliability and resilience, and there is sufficient area to expand this further if required.

7.5 Appraisal

7.5.1 Safety and Security

The cargo, fuel and de-icing infrastructure can reasonably be expected to be built to the prevailing safety and security standards at the time and so are likely to have no net effect on safety and security at the airport.

7.5.2 Capacity

Providing a trebling of air cargo area capacity when the airport forecasts around a doubling of total ATMs appears to be a reasonable response to possible future demand for air cargo. Given the flexibility available to develop this according to demand, it is unlikely that cargo capacity will be a major issue for the airport.

While some provision has been made for expansion of fuel storage, this is likely to be scalable and so will not be a restriction on the utilisation of the airport's capacity.

The proposed scope for de-icing facilities is an increase on the current provision. As de-icing facilities, by the nature of their operations, tend to be subject to demand peaks when required, it is likely that when required, the need for de-icing will constrain the airport's capacity. However, it is the prevailing climate conditions, not the lack of de-icing facilities, which creates this constraint, as de-icing adds time to the departure process. It would appear likely that if demand increase for such facilities, that there will be scope for additional de-icing facilities to be offered.

7.5.3 Efficiency

The proposed expansion of cargo, fuel storage and de-icing facilities are all likely to add to the overall incremental efficiency of the airport.

7.5.4 Reliability and Resilience

Provision of additional fuel storage and de-icing facilities are likely to enhance the resilience of the airport in the event of disruption of fuel supplies and severe weather respectively.

7.5.5 Scalability

The proposed expanded cargo, fuel storage and de-icing facilities are all able to be expanded further within the boundaries of the airport, according to demand.

8 Terminals

8.1 Concept of Operations

The scheme includes a phased set of improvements to terminal capacity as follows:

- *Upgrades to the existing North and South Terminals;*
- *A new Midfield Terminal between the runways with a main pier; and*
- *A satellite building to the west of the new Midfield Terminal.*

These are intended to enable the airport to progressively move from its current maximum capacity to forecast capacity through a modular design.

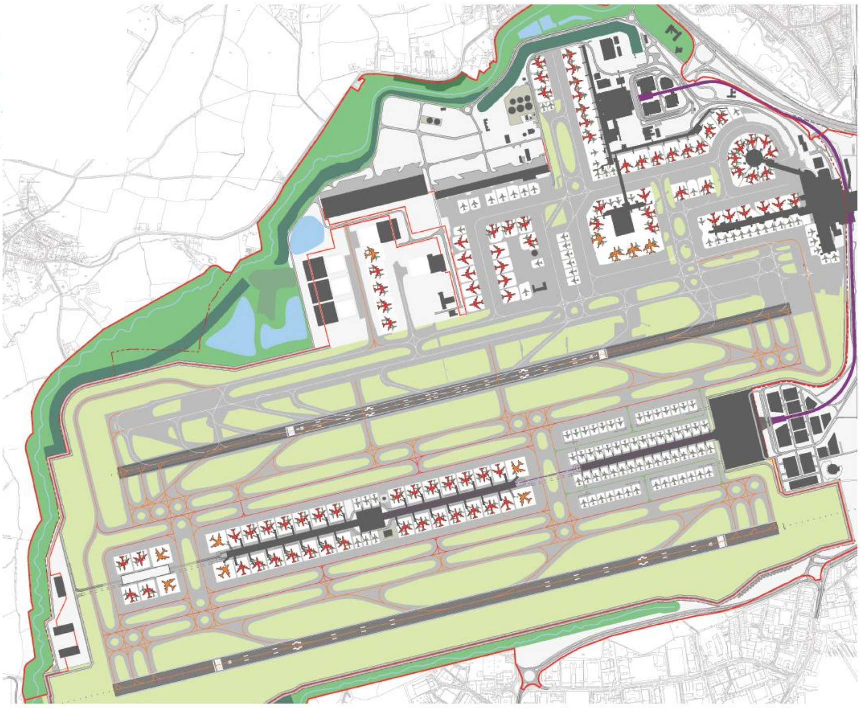

Figure 8-1: New Midfield Terminal and Satellite Building

The proposed Midfield Terminal, as shown in Figure 8-1, centralises most departure and arrival passenger processes under one roof and serves as a single landside connection point. This centralisation would appear able to permit an efficient operation.

Landside access to the Midfield Terminal is proposed either from the access road to the forecourt or by the automated people mover (APM) to the Gatwick Airport Gateway (railway station) complex, similar to the current connection between the South and North Terminal. Careful design of the forecourt will be required to minimise bottlenecks at times of peak demand.

Movement of passengers between the Midfield Terminal and its Satellite is proposed via an underground APM. This is a capital intensive solution that would provide relatively fast travel times and a superior passenger experience compared to lower cost solutions such as airfield buses.

The proposed use of a pier and satellite with aircraft stands on both sides maximises the use of the space inside the building. However, the length of the satellite building (1,478m) could be perceived by some passengers as generating long walking times (with similar issues for taxiing aircraft as discussed previously).

The land area allocated for the Midfield Terminal complex appears to have been primarily driven by the requirements of the airfield. As such, the width of the satellite and pier are largely driven by the separation distances of the runways, the associated taxiway network and the required aircraft stands. Changes in any of these three domains are likely to result in changes to the others.

8.2 Phasing

The proposed phasing of development consists of four major steps, as shown in Figure 8-2. Note that the opening of the runway and associated airside facilities is driven by aircraft movements, irrespective of passenger forecasts.[17]

- *Improvements to existing North and South terminals – capacity of 45 mppa;*
- *Phase 1 of the Midfield Terminal complex – capacity of 60 mppa;*
- *Phase 2 of the Midfield Terminal complex – capacity of 75 mppa; and*
- *Phase 3 of the Midfield Terminal complex – capacity of 95 mppa.*

Figure 8-2 Proposed Terminal Phasing

[17] For the purpose of this assessment, it has been assumed that the second runway opens when 280,000 ATMs is reached. However, due to the time needed for planning and regulatory approval, 2025 is considered to be the earliest that a new runway would open.

8.2.1 North and South Terminals

Prior to the development of new infrastructure, it is proposed to progressively expand the capacity of the existing North and South terminals. These, predominantly internal improvements, would provide a marginal increase of today's terminal capacity, 21 mppa, to 22.5 mppa per terminal, with the North and South terminal likely to be operated at high utilisation levels. It is likely that queuing at such levels of utilisation would exceed current levels at peak times, but would be manageable off-peak.

8.2.2 Midfield Terminal

The Midfield Terminal delivers passenger processing capacity capable of handling the forecast increase in demand significantly beyond the capacity of the improved North and South Terminals. The first phase comprises the partial construction of the main terminal together with its pier, but with a further limited fit-out of both. With the required airside infrastructure the airport would be able to handle 60 mppa during the first phase. In the second phase the earlier built parts of the terminal and its pier are fully fit-out and an element of the satellite is opened. This increases the airport's capacity to 75 mppa. The third phase sees completion of the satellite and main terminal building resulting in a capacity of 50 mppa for the new terminal and a total airport capacity of 95 mppa.

8.3 Sizing

Following the approach set out in Section 2.7, the passenger service standard implicit in the space allocation per design hour passenger was assessed for each development phase. Table 8-1 below presents a summary of that analysis.

Phase	GFA (m^2)	Capacity (mppa)	DHP	Space Planning Factor (m^2/DHP)
Existing	344,900	42	11,550	30
Improvements	370,834	45	12,375	30
Phase 1	487,094	60	16,500	30
Phase 2	598,234	75	20,625	29
Phase 3	768,234	95	26,125	29

Table 8-1 Proposed Terminal Sizing and Space Allocation

Given that the GFA is a difficult number to pinpoint exactly, for reference a 5% increase or decrease in floor area would correspondingly increase or decrease the space planning factor by 1.5m^2/DHP.

With reference to Section 2.7, Table 8-1 and Figure 8-3 demonstrate that the airport, at its current capacity, can operate at a reasonable level of space allocation given the nature of its operation and predominant types of airlines. During the full build-out of the Midfield Terminal the space allocation per passenger would be similar to the existing terminals today. However, as the airport grows and expands, the space allocation per passenger remains at the average, but towards the low end provision in the context of international "gateway airports" of comparable size. The scheme could, therefore, be seen as optimised to accommodate primarily short-haul, point-to-point passengers, who might be likely to spend less time in terminals, and fewer transfer passengers.

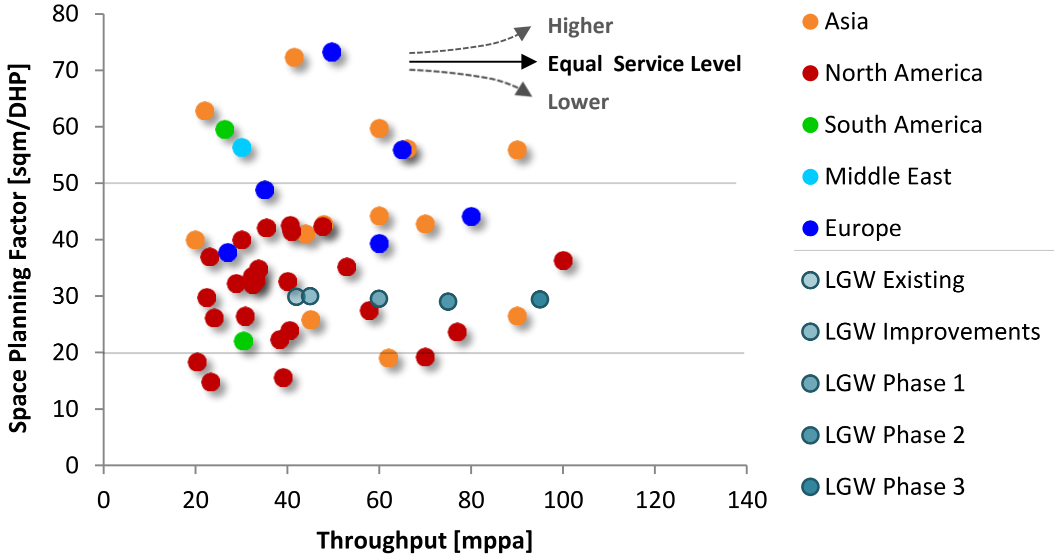

Figure 8-3 Space Planning Factor for Airports with more than 20 mppa, Showing All Phases of the Proposed Scheme

It should be noted that this benchmark serves as an indication of space provision. Two factors can have an impact on the level of space provision and level of service experienced in two airports close to each other in the benchmark: the number of international and, to a lesser extent, transfer passengers. As the former require separate facilities as opposed to domestic passengers (immigration for example) and their dwell times are often longer, more space ought to be provided within the terminal building. Similarly transfer passengers require separate facilities and longer dwell times can be observed to increase the space requirement of the terminal. The scheme is, therefore, seen as providing a reasonable space allocation within the wider industry benchmark, but towards the lower end for international "gateways".

8.4 Departures

Although a detailed analysis has not been undertaken there is no reason to assume that the departures capacity of the Midfield Terminal would not be acceptable. Four areas or processes are discussed in more detail below.

8.4.1 Check-In

Over the past 10 years, the check-in process has changed significantly, mainly driven by technology enhancements such as ease of internet access and smartphones. Given these developments (e.g. self-service check-in, bag drop, bag tagging at home, remote check-in, permanent bag tags, etc.) it is likely that the current requirements for the design of the check-in area and the hall as a whole will change.

It is likely that less space will be required for a passenger to check-in hold baggage. Given that assumption, it is likely that different functions may be provided instead. It is therefore important that this area remains flexible in terms of its design. Within the new terminal footprint, it appears that there is sufficient space for a check-in hall that would meet the proposed capacity of the airport.

8.4.2 Security

Similarly security regulations have changed significantly over recent years. These changes have significantly influenced process and space requirements for security at terminals. As it is likely that change will continue, it is similarly important that this area be designed to be as flexible as possible. It would appear that the proposed new Midfield Terminal would be able to accommodate sufficient security checkpoints under current conditions to meet the proposed capacity of the airport. The detailed design phase will need to take particular care to ensure that flexibility in design can be achieved.

8.4.3 Gates and Retail

It is proposed to construct gates that would correspond to the stand numbers outlined in Section 6. The airport currently operates a closed gate system: passengers enter a closed room located at their gate of departure well before boarding time. This helps ensure that passengers are grouped and can be boarded relatively quickly. However, it requires separate, closed rooms at each gate decentralising the seating capacity.

Closed gates tend to be favoured by airlines as they assist reliability by ensuring passengers arrive at the gate early and are ready for efficient boarding. However, they tend to be less attractive to airports as it reduces the likely exposure of passengers to retail facilities (as passengers in closed gates are restricted from leaving them), and they reduce gate flexibility because seating for lightly loaded flights or flights using smaller aircraft is not available for nearby heavily loaded flights. Passengers are more likely to prefer open gates given the increased freedom of movement available.

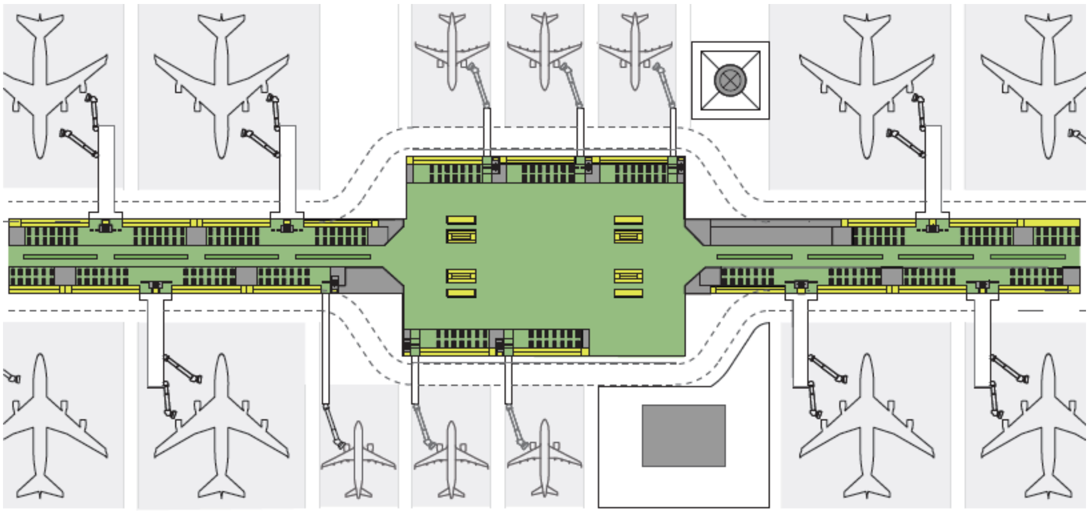

Figure 8-4 Proposed Satellite and Pier Gate Configuration

The size of a gate room has a significant impact on the size of the pier and satellite. Therefore these were assessed to determine whether the proposed Midfield Terminal pier and satellite could readily accommodate the required capacity.

These calculations indicate that the Midfield Terminal pier and its satellite will require a width of 28m and 30m respectively, excluding any retail or food and beverage facilities. This assumes all space inside the pier/satellite in front of a stand is used as closed gate room and 10m is provided for circulation in the centre of the pier/satellite.[18]

A satellite with a width of 33m is proposed, which aligns with the proposed pier width of 33m. This width appears to be the maximum limit within the airfield configuration when allowing Code C stands (as is the case at the pier) or Code F stands (as is the case at the ends of the satellite). Where Code E stands are provided, it appears there is flexibility to allow further overhang of the terminal building to increase its width and gate rooms' sizes.

Given the proposed 33m width for both the satellite and pier, only 3m is available for commercial offerings to passengers inside each side of the satellite and 5m inside the pier. Noting that two Code F gates are located at the ends of the satellite building, it can be concluded that the service level for passengers at gates will be at the lower end of industry standards for terminal space. Careful consideration will need to be made in the detailed design phase to optimise the use of this space, given that, if several flights are departing simultaneously at neighbouring stands, the potential for local congestion appears to be significant.

8.5 Arrivals

The most important arrivals processes are immigration and baggage reclaim. The former is managed by UK Border Agency and is largely outside of the airport's control. Baggage reclaim is largely dependent on the number of checked-in bags. The proposed reclaim belts appear to be in line with the provided aircraft stands and types as these tend to arrive in bulk. There is no reason to assume that the proposed new terminal complex would not be able to manage the capacity stated for arrivals.

8.6 Transfers

It is proposed to facilitate transfers at the Midfield Terminal by a dedicated transfer facility at the centre of the Midfield satellite and at the terminal itself. Shuttle buses are proposed to facilitate airside transfers between the Midfield Terminal and the North and South Terminals. However, no dedicated baggage transfer facility for transfer passengers is envisaged.

An assessment of minimum connection times (MCTs) has been undertaken to determine the reliability of the proposed transfer times. IATA Resolution 765 defines the MCT Interval as the shortest time interval required to transfer a passenger and luggage from one flight to a connecting flight, in a specific location or metropolitan area.[19] This time interval should allow for a reasonable amount of queuing at the processes encountered by the transfer passenger.

The MCT is of commercial importance as it determines the lower limit of time between flight pairs that may be sold by airlines in a single ticket. These MCTs have to be agreed by a working group (the Local Minimum Connecting Time Group or LMCTG).

[18] As suggested by GAL in its submission on pages 67 and 70 of Appendix A5 showing detailed design of the pier/satellite.
[19] Source: IATA Passenger Services Conference Resolutions Manual 30th edition, June 2010.

An analysis of each step a transfer passenger would take for the longest conceivable transfer (international flight between the Midfield satellite and the North Terminal) is summarised in Table 8-2.

Process Element	Analysis (minutes)
Disembarkation	15.0
Walk to transfer facility	6.0
Transfer connection desk	3.0 to 6.0
Boarding pass check	0.2 to 1.0
Transfer security	0.5 to 5.5
Walk to bus stand	1.0
Waiting for bus	0.0 to 5.0
Transfer bus to North Terminal	9.0 to 11.0
Walk to gate	2.0
Arrival at gate pre-closure	5.0
Total	**41.7 to 57.5**

Table 8-2 Transfer Process Elements and Times

Excluding any form of queuing and assuming no dwelling by these passengers, the MCT could be 41.7 minutes. A more conservative assessment, allowing for queuing and waiting times at various steps, could mean a MCT of 57.5 minutes. Additional queuing or unforeseen situations that occur on day-to-day operations are not included in this time.

8.6.1 Baggage Handling for Transfers

The baggage MCTs were estimated as total MCTs require baggage as well as passengers to be transferred in a timely manner to reach the connecting flight.

Whilst optimal MCTs would mean that transfer bags are the first offloaded from aircraft, this element is outside the control of the baggage handling agents at the airport, as it is dependent upon loading at the origin of the flight. Given that such optimal loading may not be the case, it is likely that the baggage handling time would be around 11 to 16 minutes.

In conclusion, it would appear to be likely that the MCTs would be around 55 to 60 minutes.

8.6.2 Self- Connecting Passengers

Traditionally, passengers who have booked a journey with separate tickets are not considered to be transfer passengers. In such cases airlines have no responsibility for ensuring baggage is transferred between flights, nor are they responsible if their own delays mean a passenger has missed the connecting flight. These “self-connecting” passengers transfer at their own risk. However, such transfers are appearing to grow in numbers for passenger using low-cost airlines wishing to feed into services of other carriers through major airports. As many airports have limited or no service from full service carriers that tend to offer traditional transfer based tickets, “self-connecting” is the only option for such passengers wishing to fly to locations not served directly from those airports. The airport already makes provision for assisting the facilitation of such passengers.

Such passengers (connecting between international flights) have to proceed through immigration, reclaim and customs before checking in once more, adding considerable time to the transfer process. It is estimated that this could add another 30 minutes to transfer times. With the enlarged airport, such passengers would need to connect landside between terminals (or within the terminal itself by walking from arrivals to departures). The existing APM between the North and South Terminal and the proposed APM from South Terminal to the Midfield Terminal will facilitate landside inter-terminal transfers with luggage. The capacity to support this traffic will be related to the overall capacity of the system to support arriving and departing passengers, and does not appear to create any significant issues.

8.7 Track Transit Systems

It is proposed to utilise and expand the existing landside APM to connect the North, South and Midfield Terminals and to provide a new APM airside to facilitate transfers between the Midfield Terminal and its satellite.

8.7.1 Landside APM

It is proposed to extend the current landside APM connecting the North and South Terminal to include the Midfield Terminal and link all three to the Gatwick Gateway station. The number of people that will take this landside APM will be largely driven by the modal share of passengers.

Given the apparent flexibility of the location and the rolling stock that could be selected, it would appear possible to reconfigure the landside APM to meet future demand. However, it will be important to build in sufficient capacity to the system to meet likely future needs, given the inherent higher cost in subsequent up-scaling of such systems.

8.7.2 Airside APM

A separate APM system is proposed to connect the Midfield Terminal to its satellite. This system should be designed to be flexible and expandable as it will experience a gradual increase in demand as the terminal is expanded. It appears possible to design the airside APM or TTS to deliver the required capacity.

8.8 Appraisal

8.8.1 Safety and Security

The proposed designs for the terminals appear consistent at this stage with the construction of safe and secure terminals. It is reasonable to assume that at the detailed design phase, the latest standards for construction, fire and other hazard safety and security will be incorporated in the design.

8.8.2 Capacity

It is proposed as a first stage, to enhance the capacity of the North and South Terminals. This enables a modest increase in capacity and is in line with what could reasonably be expected if a second runway is not built.

The proposed Midfield Terminal and Satellite would provide adequate terminal capacity to service the proposed runway capacity and to deliver an average passenger experience (based on floor space per passenger) similar to that experienced at the airport today, but towards the low end for an international "gateway" airport. However, whilst the space provision in aggregate appears reasonable, the relatively narrow piers may generate constraints and a potentially sub-standard passenger experience. Operational procedures may be required to mitigate this risk.

8.8.3 Efficiency

The proposed new Midfield Terminal would be able to provide an efficient operation. However, given the width of the piers and the constrained areas at the terminal end gates (which are proposed to service Code F aircraft), it may be more challenging to provide an acceptable passenger service experience for larger (Code E and above) aircraft compared to that for Code C and smaller aircraft. As such, the expanded airport may be seen by airlines as better suited to a high proportion of Code C and smaller aircraft, rather than a high proportion of Code E and larger aircraft.

8.8.4 Reliability and Resilience

The proposed Midfield Terminal should be capable of providing similar or better levels of reliability and resilience than at present.

It is estimated that the MCT is likely to be around 55 to 60 minutes. As no provision has been made for a dedicated baggage transfer facility between terminals or high capacity airside passenger transfer system between terminals, it is unlikely that Gatwick could support significant growth in transfer traffic between terminals without additional infrastructure.

8.8.5 Scalability

The Midfield Terminal is proposed to be constructed in three phases. Within each phase, the opportunity would exist to scale stands and passenger processing facilities to meet different mixes of aircraft types, and to match terminal gate design to match aircraft demand. However, the location of the runways and the associated taxiways are such that there is limited scope to increase the width of the proposed Midfield Terminal satellite and piers. Therefore, as discussed, terminal processes will require careful management to ensure they could adequately cope with the forecast volumes of passengers, particularly at gates serving Code E or larger aircraft.

The provision of transfer facilities is relatively unsophisticated, but more substantial or automated facilities could be provided subsequently if required.

Beyond the proposed Midfield Terminal, there is more limited scope to add new terminal capacity. This would likely require reallocation of existing airfield space or the acquisition of additional land adjacent to the airfield.

9 Comparison with Demand Scenarios

The Airports Commission has developed a range of demand scenarios that consider a range of forecast drivers and their impact upon demand at Gatwick Airport. Additional airport infrastructure would be required at different points in time depending on the particular demand scenarios. The runway and associated airfield infrastructure is dependent on the forecast ATMs whereas the terminal development depends on forecast passengers. The date of opening of the second runway and associated infrastructure is further dependent upon the relevant regulatory and planning processes.

As described in Section 8.2, the terminal development is designed to be modular so it allows building the infrastructure when it is required by the forecast. The scheme provides each phase of additional capacity in line with demand such that the passenger service standard is maintained as set out in Figure 8-3.

The scenarios show significant variation in forecast demand. Two scenarios, the "Assessment of Need Carbon Capped" and "Global Fragmentation Carbon Capped", forecast passenger throughput increasing to 69 and 63 mppa respectively, which, with reference to Section 8.2, do not require the provision of Phase 3 by 2050. The "Assessment of Need Carbon Traded", "Low Cost is King Carbon Traded" and a scenario considering the above phasing applied to GAL's traffic forecast, "Rebased Adopting GAL Traffic", do require provision of Phase 3 by 2050. The "Low Cost is King Carbon Traded" scenario predicts 96 mppa by 2050 resulting in a marginal additional 1 mppa above design capacity.

Appendix A Glossary

A-CDM	Airport collaborative decision making
ADRM	Airport Development Reference Manual, IATA
APM	Automated people mover
ASDA	Accelerate-stop distance available
ATM	Air transport movement
CAA	UK Civil Aviation Authority
CAT II	ICAO ILS category with a Runway Visual Range of at least 1,200 feet, and Decision Height of between 200ft and 100ft
CAT III	ICAO ILS category with a Runway Visual Range of 700 ft, 150ft or zero respectively (for CAT III a, b or c), and Decision Height of less than 100ft.
DHP	Design hour passenger(s)
EAT	End around taxiway
EASA	European Aviation Safety Agency
GAL	Gatwick Airport Ltd
GFA	Gross floor area
IATA	International Air Transport Association
ICAO	International Civil Aviation Organisation
ILS	Instrument landing system
LDA	Landing distance available
MARS	Multi-aircraft ramp system
MCT	Minimum connection time
mppa	million passengers per annum
NATS	UK National Air Traffic Services
OFZ	Obstacle free zone
OLS	Obstacle limitation surface(s)
PSZ	Public Safety Zone
RAT	Runway/rapid access taxiway
RESA	Runway end safety area
RET	Rapid exit taxiway
SID	Standard instrument departure route
STAR	Standard arrival route
TOCS	Take-off climb surface
TODA	Take off distance available
TORA	Take off run available

Appendix B Scheme Changes Compared to the Gatwick Airport Ltd Proposal

The following two sections briefly describe the key differences between the scheme as assessed, and the proposal submitted by GAL. Section B.1 discusses the implications of GAL's proposed phasing, whilst Section B.2 discusses the resulting space planning factor. Reference is made to original and subsequent material provided by GAL to the Airports Commission.

B.1 Phasing

GAL proposes to open part of the remote satellite with the 2nd runway in 2025, which would function as a remote departure lounge. GAL estimates that this Intermediate Phase would enable the airport to handle up to 63 mppa by 2029: 26 mppa would be served in the North terminal, the remaining 37 mppa in the South terminal and the new remote pier. The proposed passenger throughput in 2029 would result in the North and South terminals operating at 115% and 164% of their improved capacity of 45 mppa. Operating at these levels may result in delays throughout the terminal buildings and cause difficulties across the year and the day. These delays would be expected to have knock-on effects affecting resilience and reliability.

As only 15,000 m^2 additional floor area is provided during the Intermediate Phase[20], the space planning factor would reduce from today's circa 30 to around 22 m^2/DHP, or a decrease of a quarter, as shown by the "LGW Intermediate" data point in Figure B-1 below.

Note that, regardless of the absolute value of the gross floor area or the passenger design hour factor being applied the space planning factor reduces by around a quarter between today's standard and that which would be achieved at the end of the Intermediate Phase.

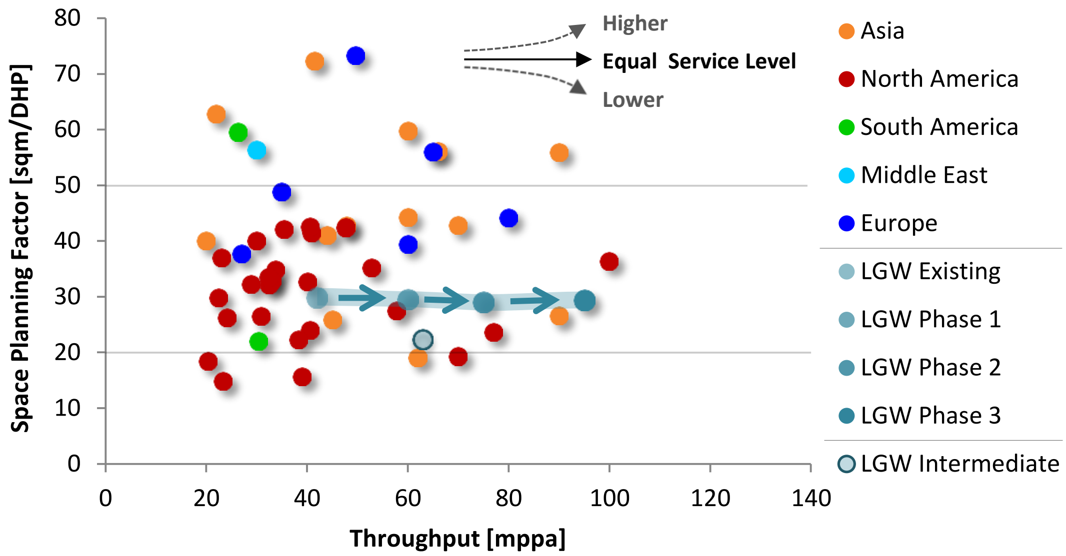

Figure B-1 Space Planning Factor for Airports with more than 20 mppa, Showing Three Phases of the Proposed Scheme and the Intermediate Phase

[20] Further information provided by GAL suggested that this could be up to 22,000 m^2.

Given that all processing facilities for the remote pier would be located in the South Terminal (with the exception of one domestic reclaim belt), these facilities would require major expansion to be able to accommodate the 164% of traffic against a capacity of 22.5 mppa at every stage of the departing, arriving or transferring journey. GAL stated a number of improvements to processing facilities, such as check-in, security, immigration and reclaim that could increase capacity and throughput rates.

It would appear that the Intermediate Phase may increase the capacity of the existing terminals by perhaps 5%, whilst retaining acceptable service standards, albeit lower than today's standards. Moreover, unless all additional demand is displaced outside current peak periods, the likely queues at check-in, security, immigration and reclaim within the current terminals and current processing areas are likely to exceed the available space and hinder other operations. This may have knock-on effects throughout the terminal, creating delay and affecting overall reliability and resilience.

Whilst recognising the limitations of the space planning factor, it is also reasonable to observe that there is an established relationship between space provision and passenger experience. The analysis suggests that GAL's proposed phasing may reduce the space available per design hour passenger, at its lowest point, by around a quarter of what it is today. GAL proposes to mitigate this through suggested process improvements and changes in customer behaviour, which compensate for this loss of space to enable continuing performance against the Airports Commission's objective of improving the passenger experience. Adopting a risk based approach, the Airports Commission has assessed a phasing which broadly maintains the same space available per passenger throughout the lifetime of the scheme, ensuring that the passenger experience is less reliant on the realisation of these proposed improvements and would enhance the passenger experience, relative to today, should these benefits come to pass in future years. Furthermore, certain factors are not in the hands of the airport operator and the opening of a 2nd runway is likely to disproportionately increase the peak hours rather than off-peak hours, as this would be determined by the airlines, further increasing passenger demand at peak times, which may reduce service standards to a level that may not be acceptable to the airlines or the CAA. We note, however, that the construction and phasing of terminal and passenger processing infrastructure would ultimately be a commercial decision for the airport operator.

B.2 Space Planning Factor

GAL set out its view of the space planning factor calculations; GAL's analysis is presented in Table B-1:[21]

[21] Note that this table is taken from GAL's submission and makes reference to earlier terminology of a "Temporary" phase, which equates to GAL's proposed "Transitional" phase as referenced throughout this report.

Terminal	GFA (m^2)	Capacity (mppa)	DHP	Space Planning Factor (m^2/DHP)
Existing (2014)	344,900	42	9,100	38
Improvements (2024)	386,400	45	11,300	34
Temporary (2029)	408,400	63	14,701	28
Phase 1 (2034)	524,700	73	15,823	33
Phase 2 (2039)	635,800	82	16,785	38
Phase 3 (2050)	791,200	95	18,081	44

Table B-1 GAL's Assessment of the Space Planning Factor

It is noted that GAL envisages a level of service decrease of 26% between today's existing standard and the level achieved at the end of the Intermediate ("Temporary") Phase.

Two factors drive the analysis as discussed in each section below.

B.2.1 Passenger Design Hour Factor

It is noted that GAL has used lower design hour factors based on its view of today's operation. Two reasons might explain why the design hour adopted by GAL is lower than this benchmark set as follows, with comments against each:

- *The design hour is not the 30th busiest hour of the year, but an hour that will be exceeded more often with the implication that a greater number of hours are above the capacity analysed which would result in more delays and a reduced passenger experience.*
- *The airport could be less peaky than the benchmark. On opening of the second runway, it is probable that the additional movements would be demanded when airlines favour them, i.e. in the peak times. Therefore, over the period when Gatwick grows from 45 to 60 mppa, it is more likely to be considered relatively peaky than relatively flat.*

As there is no guarantee that today's design hour factors would apply to future operations a consistent methodology has been applied across all three schemes based on the industry benchmark.

B.2.2 Gross Floor Area

The second factor determining the space planning factor is the gross floor area. GAL provided a range of GFAs. Recognising the uncertainty of a precise value for the GFA, the spread of the space planning factor resulting from a 5% sensitivity in the GFA has been determined as shown in Section 8.3 and Figure 8-3.

B.2.3 Influence of International Passengers on Facilities Required

It is noted that the number of international passengers has an impact on the space and facilities required at an airport or terminal as discussed in Section 8.3. Figure B-2, shows that airports that tend to treat fewer international passengers can be found at the lower end of the space provision benchmark (below circa 35 m^2 per DHP). It is noted that GAL's proposed scheme could be regarded as towards the lower end of provision for an airport serving a large proportion of international passengers.

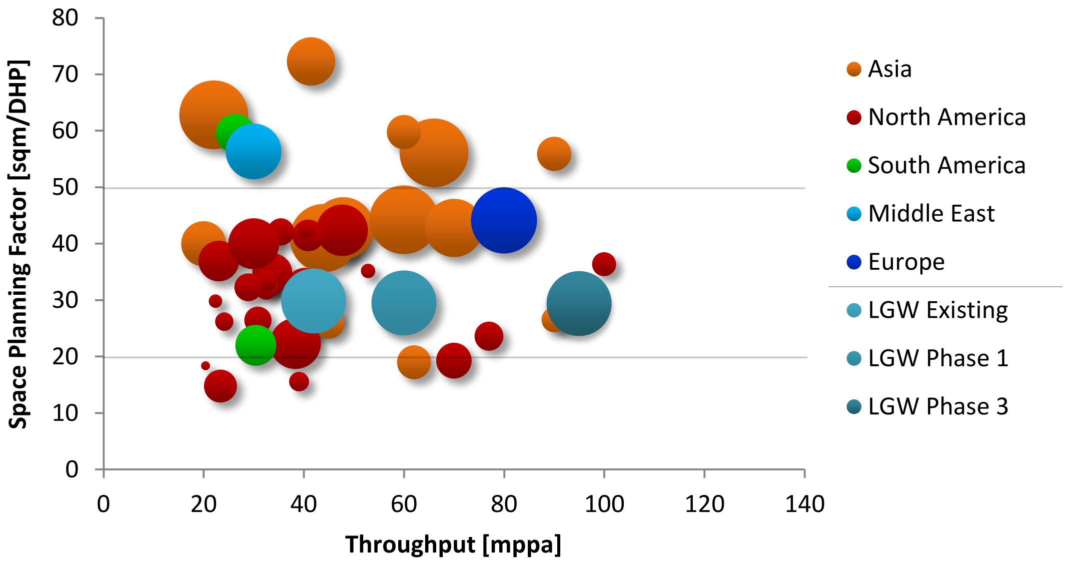

Figure B-2 Space Planning Factor for Airports with more than 20 mppa, Showing Two Proposed Phases, with the Size of the Marker Indicating the Percentage of International Seats[22]

We note GAL's view, as set out in Table B-1, is of a larger GFA than has been assessed, but this fits within the range of uncertainty accounted for by the 5% upper and lower bandwidth as detailed in Section 8.3.

[22]Based on OAG Analyser Ltd data expressed in domestic and international seats flown to/from a particular airport in 2014. Note that the European airports have been excluded as the domestic and international split would not be representative of a driver for space provision since passengers are treated based on the Schengen / non-Schengen division.

Appendix C Appraisal Summary

Element	Safety and Security	Capacity	Efficiency	Reliability and Resilience	Scalability	Comment
Proposed runway					• Runway extensions would require additional land to the west, additional runways likely to the northwest.	
Proposed runway RESA						
Existing runway/s amended					• Runway extensions would require additional land to the west, additional runways likely to the northwest.	
Existing runway RESA						
Runway Approach Lighting						
Public Safety Zones						
Aerodrome Safeguarding System – Protect surfaces	• Approach surface amendments will require operational procedures to ensure aircraft can be held safely.					
ATC and Navigational Systems	• Safeguarded areas for ILS glide path aerials to be identified at detailed design phase.				• Expansion would involve iteration with designs for taxiways.	
Taxiways	• Code E to Code F separations are CAP 168 compliant, but not EASA compliant. • Taxiways around western remote stands are not Code F compliant. • Runway crossings would need regulatory approval.	• Detailed airfield modelling could help mitigate potential pinch points in the taxiway network.	• Restrictions on the use of Code F aircraft on parallel taxiway network. Difficult to resolve without redesign of terminals and runways.		• Additional EATs and runway crossings are possible to increase capacity and resilience, but difficult to address limitations on Code F aircraft without increasing land acquisition.	Amendments to EASA requirements on taxiway separations are proposed, and if adopted would mean that the taxiway clearances requirements would be less onerous than at present.
Stands and Aprons		• Adequate for all aircraft types except Code F for which stand provision is constrained. • Difficult to resolve without redesign of terminals and taxiways.	• Adequate for all aircraft types except Code F for which stand provision is constrained. • Difficult to resolve without redesign of terminals and taxiways.	• Adequate for all aircraft types except Code F for which stand provision is constrained. • Difficult to resolve without redesign of terminals and taxiways.	• Scope to vary stands between Code C and Code E, but scalability for Code F is constrained by taxiway design.	
Cargo facilities						
Fuel storage						
De-Icing Facility						
Bird Hazard Management						
Existing terminals					• Limited scope to expand.	
New Midfield Terminal					• Design is intended to be scalable, but limitations on size.	Scalable in development, but not beyond what is proposed.
Transfer facilities		• Capacity for transfers limited.	• Unlikely to support significant increases in transfers.	• Transfer reliability likely to be challenged if significant increases in transfer traffic.		

(grey)	Not applicable
(red)	Significant issues with no identified resolution or mitigation.
(amber)	Significant issues, options to address are difficult/complex
(yellow)	Minor issues, but could reasonably be addressed during detailed design phase, by dispensations or specific operational procedures.
(green)	No significant issues/limitations, subject to finalisation at detailed design phase