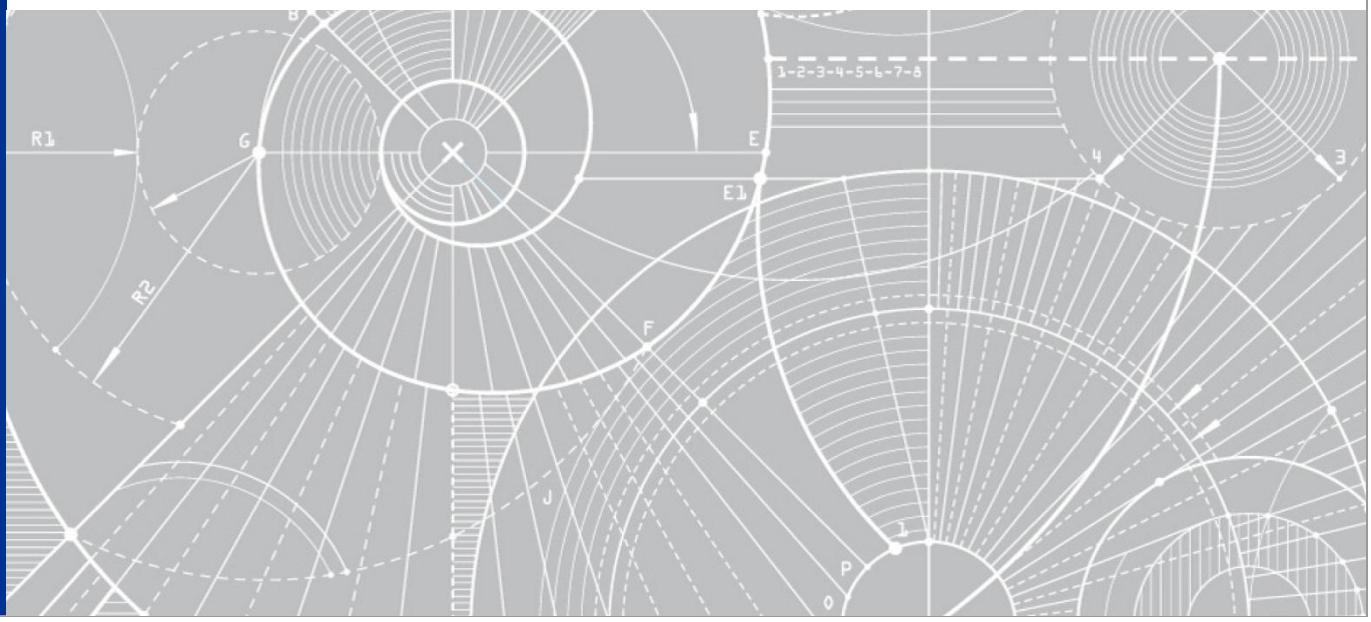
Appraisal Framework Module 4.

Surface Access: Gatwick Airport Second Runway

FINAL FOR CONSULTATION

AIRPORTS COMMISSION

5th November 2014



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Executive Summary

Background

The Airports Commission (AC) was established in 2012 by the UK Government to examine the need for additional UK airport capacity and to recommend how any additional capacity requirements can be met in the short, medium and long term. The Commission is due to submit a Final Report to the UK Government by summer 2015 assessing the environmental, economic and social costs and benefits of various solutions to increase airport capacity, considering operational, commercial and technical viability.

The AC published an Interim Report in December 2013 that short-listed three options to address the UK's long-term aviation connectivity and capacity needs, two focussed on expanding Heathrow Airport and one on expanding Gatwick through the provision of a second runway – the work leading up to the publication of the Interim Report is described as Phase 1. The short-listed options were to be further developed and appraised during Phase 2, with further phases of work programmed in the run-up to the submission of the Final Report in the summer of 2015.

The Phase 2 assessment with respect to surface transport was focussed specifically on three key elements as follows – the identified assessment time period was a busy day peak hour in 2030:

- estimating airport passenger and employee surface transport demand associated with the expansion option in question;
- identifying surface transport measures to meet net airport-related demand (associated with the expansion option in question), accounting for capacity implications related to background growth and non-airport travel demand; and
- assessing the engineering feasibility and high-level cost of the surface transport measures identified to meet forecast travel demand.

The ultimate aim was to provide guidance to the AC on the feasibility of, and likely surface transport issues associated with each short-listed expansion option, with reference to three objectives set out in the AC's Appraisal Framework as follows:

- **Objective 1** – to maximise the number of passengers and workforce accessing the airport via sustainable modes of transport;
- **Objective 2** – to accommodate the needs of other users of transport networks, such as commuters, intercity travellers and freight; and
- **Objective 3** – to enable access to the airport from a wide catchment area.

The impact of freight-related surface access movements was judged likely to be relatively low when compared with air passenger and employee movements during the identified peak hours for all short-listed airport expansion options, and was consequently not assessed. A surface access freight impact assessment is therefore required as part of a future phase of work in order to address the element of **Objective 2** related to freight.

This document constitutes the Appraisal Report for the Phase 2 assessment of a second runway at Gatwick Airport. It should be read alongside the other Phase 2 reports for a full understanding of the approach employed by Jacobs to assess the surface transport implications of a second runway. The full Phase 2 reporting structure published for consultation in October 2014 is as follows:

- the **Methodology Statement** summarises the approach employed by Jacobs to develop surface transport demand forecasts for the second runway – this summary is supported by a Technical Appendix, which includes detailed information about the calibration of models used to generate forecasts and assess the capacity/level of service implications;
- the **Assumptions Log** lists the assumptions used to develop the forecasts and compares them with those contained in the submission received by the AC from Gatwick Airport Ltd (GAL);

- the **Appraisal Report** details the results of the assessment undertaken and draws key conclusions on the impacts of a second runway at Gatwick.

The assessment was undertaken with reference to a Core Transport Baseline and an Extended Transport Baseline, which together listed transport infrastructure and services expected or likely to be in place by 2030 regardless of any airport expansion that may be delivered in the UK. Full details of the schemes included in these baselines are provided in Appendix A – the Core Baseline only included those schemes that were fully committed and funded when the Phase 2 assessment commenced.

The primary focus of all the analysis was on the Extended Baseline as by 2030 it was judged very likely that further enhancements to the UK transport network would have been delivered above and beyond works that were fully committed at the beginning of Phase 2 when the baselines were defined. The Core Baseline was also assessed to highlight the importance of delivering planned but currently uncommitted infrastructure by 2030 to support expected growth in background demand and demand related to a second runway at Gatwick.

The Gatwick Airport Ltd (GAL) submission

The key surface transport-related headlines contained in the GAL submission, received by the AC in May 2014, are as follows:

- if a second runway is delivered, the airport would handle 65 million passengers per annum (mppa) and employ 29,685 staff by 2030, resulting in a ratio of 2,190 annual passengers per employee (the current respective totals are 35mppa and 21,000 staff);
- GAL aspire to a headline mode share target of 50% rail, 10% bus/coach and 40% private vehicle for non-transit air passengers by 2040 – the 2012 headline mode share was 35.7% rail, 7.9% bus/coach and 56.5% private vehicle excluding a small number of trips using other modes;
- the target mode share for employee commuting was defined as 20% rail, 20% bus/coach and 60% private vehicle – the current mode share is 12.9% rail, 11.8% bus/coach and 75.3% private vehicle.

Although not stated in their submission, GAL have also confirmed independently to the AC that their target headline surface access mode share for air passengers in 2030 is 44% rail, 11% bus/coach and 45% private vehicle.

The submission indicates that committed rail infrastructure improvements associated with the post-2018 high-peak Thameslink-Southern-Great Northern (TSGN) franchise timetable together with a number of uncommitted rail schemes included in the Extended Baseline will be sufficient to accommodate growth in rail passenger numbers associated with a second runway. In addition, it is indicated that the strategic road network incorporating committed and planned Highways Agency (HA) schemes will provide sufficient capacity to accommodate airport and background commuter demand in 2040. Finally, the submission proposes a number of road schemes in the vicinity of the airport (including a scheme to increase the capacity of junction 9 on the M23) to mitigate for local demand impacts.

This report details the outputs from an independent analysis undertaken by Jacobs of the likely surface access impacts of a second runway at Gatwick Airport in 2030, and where necessary the assumptions used in the GAL submission and its subsequent conclusions have been challenged by this independent analysis.

Methodology overview

GAL's headline assumptions regarding passengers per annum and on-airport staff in 2030 were fed into a linked trip distribution/logistic regression (logit) mode share model to forecast peak-hour surface access demand to Gatwick from different parts of the UK using different modes of transport. The GAL

numbers indicate that the net surface access impact of a second runway would effectively amount to an additional 17.5mppa in 2030 (a total of 65mppa in the two-runway scenario less 46mppa in the one-runway scenario, assuming that 8% of all passengers in both scenarios are interliners). This compares with two key AC forecasts for the same year as follows:

- a net surface access impact of 3.7mppa in the 'Carbon-Capped Assessment of Need' (CC AON) scenario (45.6mppa with 6.3% interlining with two runways, less 41.1mppa with 5% interlining with one runway); and
- a net impact of 11.1mppa in the 'Carbon-Traded Low Cost is King' (LCK) scenario (72mppa with 26.2% interlining with two runways, less 43.7mppa with 3.7% interlining with one runway).

The GAL forecast therefore indicated a more significant net second runway surface access impact than either of the two described AC forecasts. As with all the short-listed airport expansion options, the initial basis of the analysis for Gatwick was the scheme promoter's own forecasts. Two sensitivity tests were carried out using the passenger numbers from the AC scenarios summarised above, and an additional two tests assessed the impact in turn of higher staff numbers at the airport associated with the AC's 'low productivity' scenario, and the removal of the premium fare for the Gatwick Express (GEX) rail service – the current premium was assumed to remain as at present in the central Jacobs scenario in 2030. Summary results for these four sensitivity tests are provided in Appendix B. A range of other tests were also carried out to validate the model and to assess impacts related to specific changes in travel behaviour, and these are referenced wherever relevant in this report.

The model, which was calibrated using 2012 CAA passenger survey data, accounted for forecast growth in population and jobs in the UK, and Generalised Cost (GC) estimates (accounting for the impact of journey times, wait times, interchange times, assumed public transport fares and car operating costs) were developed for the future transport network. For rail, journey time parameters associated with the post-2018 high-peak TSGN timetable and additional services made feasible through the delivery of the uncommitted schemes in the Extended Baseline were inputted along with other key rail schemes in both baselines likely to influence passenger travel choices, notably Crossrail and HS2 Phase 1 from Manchester and Birmingham.

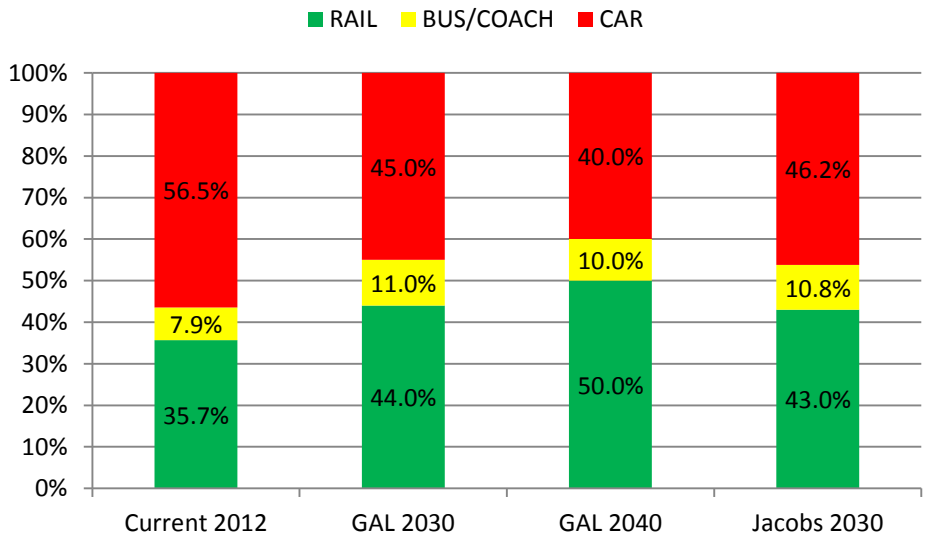
The mode share forecasts were then assigned to road and rail corridors serving the airport and compared with background demand estimates sourced from the Department for Transport (DfT) and Network Rail (NR). Total rail demand was compared with seated and total capacity estimates associated with the current assumed post-2018 TSGN timetable and additional services related to planned but currently uncommitted infrastructure. Total road demand was compared with estimates of capacity on strategic road network links, accounting for the impact of committed and planned HA schemes included in the Core and Extended Baselines.

Forecasts from the strategic road network model were then fed into an independent assessment of road enhancements in the immediate vicinity of the airport. The basis for this was the GAL proposal consisting of the schemes summarised in Figure 9.7 of Appendix A6 of the GAL submission. Notable among these schemes were capacity enhancements at the M23 junction 9; the re-alignment of approximately 8km of the A23 around the new runway; and a new dual carriageway link from junction 9a to the new terminal building.

Objective 1 - maximising the use of sustainable modes of transport

The model produced a headline surface access mode share forecast for air passengers, which is shown alongside the current mode share and the GAL 2030 and 2040 targets in Figure 1. The graph indicates that the proportion of air passengers using public transport is forecast to rise from 44% in 2012 to 54% in 2030 (according to the Jacobs model), with rail mode share increasing from 36% to 43% as a result of anticipated improvements to services.

Figure 1: Headline air passenger surface access mode share



The model also forecast an overall increase in sub-rail mode share for standard rail services, with Gatwick Express (GEX) mode share falling from 35.4% of all air passenger rail trips currently to 29.6% in 2030 as a result of improvements associated with the post-2018 TSGN timetable and the additional services made feasible by Extended Baseline schemes. For employees, Jacobs reviewed the 2040 GAL submission and concluded that the headline mode share target of 60% private vehicle, 20% bus/coach, and 20% rail constituted a reasonable assumption in light of planned improvements to rail and bus/coach services and the potential impact of traffic demand management measures on employee car use at the airport in 2030.

Based on the assumptions described above, the Jacobs model forecasted a net impact of up to 1,200 additional rail trips to the airport in the AM peak hour in 2030 as a result of the second runway, with up to 750 additional rail trips leaving the airport.

Objective 2 – accommodating the needs of other users (rail)

Rail capacity in 2030

The analysis indicated that additional passengers related to the second runway at Gatwick constituted a very low proportion of total forecast volumes on the BML in 2030. On the section between Three Bridges and Redhill where airport passengers are most concentrated, the overall Volume/Capacity Ratio (VCR) increases by less than 2% as a result of the second runway, and on the section between East Croydon and London Bridge the uplift is only 1%. As a result, the rail capacity assessment was largely focussed on the implications for background non-airport passengers using the BML during the identified peak hour in 2030.

The key finding of this assessment was that the network is likely to have sufficient capacity to accommodate total forecast demand including airport passengers on all sections of the BML during the AM peak hour in 2030 if the aforementioned uncommitted rail infrastructure is delivered, which means that from a rail perspective the second runway proposal is likely to deliver **Objective 2** of the AC's Appraisal Framework to a satisfactory degree in 2030.

Airport passengers travelling to London should not have any issues boarding trains at Gatwick during the AM peak-hour – the overall VCR on the section between the airport and Redhill to the north is forecast to reach only 40% in the direction towards London, and when fast line services are considered separately, background VCR only reaches 50%.

The forecast also suggests that across all services on this section, there should be enough spare seats available to accommodate additional second runway passengers travelling north from Gatwick, although the majority of available seats are likely to be on unattractive slow line services – background seated VCR on fast line services is forecast at 98% on this section.

The forecast does indicate that passengers on the BML are likely to experience crowded conditions on services travelling into London Bridge during the peak hour, with the VCR on this branch north of East Croydon station reaching 87% of total capacity by 2030. This means that some passengers will experience heavily crowded conditions due to the uneven loading of carriages and fluctuations in demand across the AM peak hour. It also suggests that during the PM peak, passengers are likely to experience crowded conditions when attempting to board trains on the Thameslink branch in central London, although the PM peak hour has not been modelled as part of this study.

As mentioned above, the provision of adequate capacity to accommodate demand in 2030 is dependent on the delivery of a number of currently uncommitted and unfunded rail schemes, including the following:

- the aforementioned redevelopment of the airport station;
- works in the Windmill Bridge Junction area (including grade-separation, the provision of new track to East Croydon, and the lengthening of the Selhurst Spurs);
- the remodelling of East Croydon station with additional platforms;
- the remodelling of Stoats Nest Junction (including grade-separation);
- the re-designation of Platform 8 at London Victoria (with a new access from the Platform 9 approach);
- alterations in the Clapham Junction area to allow for additional train paths (the benefits and costs of switches and crossings (S&C) alterations and partial track re-modelling are being compared by NR with signalling enhancements associated with implementation of the European Railway Traffic Management System (ERTMS));
- the provision of a third track and/or grade-separation at Keymer Junction;
- works to deliver bi-directional capability on the Up fast line into Victoria;
- works to deliver turn-back capability at Haywards Heath.

If these schemes are not delivered and capacity enhancements are limited to the committed infrastructure associated with the post-2018 TSGN timetable, the analysis indicates that the East Croydon-London Bridge section of line reaches around 95% of total capacity by 2030. This would result in passengers experiencing severe over-crowding on services in the peak hour, with some non-airport passengers on platforms at East Croydon and stations to the north being unable to board services.

The Sussex Route Study currently being developed by NR (the draft for consultation is due to be published in October 2014) is examining the Value for Money (VfM) rating for several infrastructure packages. One package does include all the works identified above but a number of others assume for example that some services will terminate closer to London than the service pattern assumed for the purpose of the rail assessment described in this report. As a result, it is possible that not all the schemes listed above will be progressed further following publication of the Route Study. In addition, the scope of some of the works still needs to be defined, for example the aforementioned re-development of the airport station.

The forecast transfer of demand away from GEX described in the previous section highlights the potential benefit of pricing as a mechanism for maximising the use of available rail capacity. A sensitivity test was undertaken using the Jacobs model to determine the impact of operating GEX without a premium fare in 2030. As indicated in Appendix B of this report, GEX sub-mode share is forecast to rise to 37.9% in this scenario from 29.6% in the central scenario, suggesting that there may be some scope to relieve crowding on standard rail services to a small extent with such an approach.

However, further assessment would be required to determine the impact on non-airport users since evidence suggests that significant numbers currently use GEX services during peak periods and the NR 2030 forecasts indicate an expectation that this is likely to continue in future with a premium fare in place.

Some additional capacity may be provided via installation of the Level 2 ERTMS without line-side signals, and NR are currently examining implementation dates for the BML. The ERTMS will remove some of the constraints of line-side signal block boundaries and establish minimum separation times based on the maximum permitted speed and braking characteristics of rolling stock. However, line capacity will still be limited by other existing constraints and since the committed and planned infrastructure enhancements described previously are already expected to provide up to 32 trains per hour through Gatwick Airport in the AM peak, the capacity benefits associated with the ERTMS may be limited (although it is difficult at the present time to quantify any capacity benefits prior to full system modelling).

In the event that the full package of works in the Extended Baseline is not delivered, further assessment would be required to ascertain the importance of the excluded works for delivering a sufficient rail service to support the delivery of a second runway at Gatwick in 2030, and the extent to which the costs of such works should be included in the cost of a second runway.

The assessment also highlighted that the provision of four tracks between East Croydon and Gatwick and direct connections to two London terminals does provide for a good degree of resilience against service disruptions and station closures. However, it is noted that south of East Croydon, disruptive incidents (for example power supply failures, signalling failures and track trespassing incidents) can lead to a total suspension of services between London and the airport. Performance data provided by NR indicates that 22 ‘four-line block’ incidents requiring the closure of the BML have occurred in the last three years on the section between London and Gatwick, an average of just over 7 per year. Of these events, approximately 70% involved fatalities and it is noted that in these circumstances, NR aim to re-open the line within 90 minutes.

Longer-term capacity enhancement options

The analysis suggests that by the 2040s, additional investment will likely be required to increase capacity beyond the aforementioned measures included in the Extended Baseline. As a result, Jacobs undertook a high-level review of potential long-term capacity enhancement options for the BML, which are summarised below. It should be noted that these options do not constitute an exhaustive list of proposals for increasing rail capacity beyond the schemes listed in the Extended Baseline.

The review suggested that additional capacity could be added on the BML between East Croydon and London Bridge by extending services on the Uckfield and Caterham/Tattenham Corner branch lines to 12-car operation. This would entail electrifying the Uckfield line, ordering new rolling stock to operate services on both lines, and also potentially remodelling a number of stations on both lines, notably Purley. It should be noted that the extension of these services to 10-car is already committed for Control Period 5 (CP5 – NR’s 5-year planning cycle for the period 2014-2019) and is included in the 2030 capacity assumptions for the rail assessment detailed in this report.

Train lengthening beyond 12-car could also provide more capacity although a number of challenges would need to be overcome. Specific train lengthening would likely need to be targeted at express services that do not stop at intermediate stations on the BML, which would reduce the capacity-related benefits and still potentially involve dedicated platform extensions at Victoria, London Bridge, Gatwick and Brighton – services currently using those platforms would need to be re-routed. In contrast, a general extension to 14- or 16-car would involve the remodelling of most major stations on the BML (including London Bridge and Victoria), the potential acquisition of land on the approaches to Victoria and London Bridge, and significant changes to the complex network of junctions north of East Croydon.

Further options would involve a more significant investment in infrastructure. The delivery of a new rail tunnel from the Purley area into (and potentially through) central London incorporating an underground station at Croydon would constitute a major infrastructure project requiring significant national investment. Another infrastructure-led option identified is double-decking, although with limited capacity available in the terminating platforms at London Bridge, this is likely to involve extensive gauge clearance works covering the Thameslink tunnels and routes north of London as well as the widening of the Balcombe and Clayton tunnels south of Gatwick. These schemes would not only be very expensive but also involve extensive disruption to network operations during construction.

Objective 2 – accommodating the needs of other users (roads)

Strategic roads

In terms of road traffic, the Jacobs model forecasted a net impact of up to 1,000 additional car/taxi trips to the airport in the AM peak hour in 2030 as a result of the second runway, with up to 600 additional car/taxi trips leaving the airport.

The strategic highway analysis indicated that if schemes in the baselines (notably the M23 smart motorway between junctions 8 and 10) are included in the analysis, no links on the road network would require capacity enhancements as a result of the second runway in 2030. In effect, this additional capacity means that second runway-related traffic will not significantly affect the needs of other strategic road users and therefore, from a strategic roads perspective the second runway proposal is likely to deliver **Objective 2** of the AC's Appraisal Framework to a satisfactory degree in 2030.

The M23 scheme, which would involve increasing road capacity through hard-shoulder running, was initially included in the Extended Baseline but was moved to the Core Baseline during this study following discussions with the HA, who indicated that the scheme is now considered to be committed for delivery by 2030 regardless of a second runway at Gatwick. The current expectation is that the scheme will operate 24-hours a day with CCTV monitoring in place, pending further assessment to ascertain whether sustained operation will create any resilience issues.

Other key sections of the strategic network serving Gatwick, notably southern sections of the M25, were highlighted as issues related to background demand but forecast additional traffic flows associated with the second runway did not significantly increase overall traffic volumes on these links and they were not identified as second runway-related issues as a result. It should be noted that these M25 capacity issues, if not addressed, will be highly detrimental to all the short-listed airport expansion options currently being assessed by the AC.

Discussions with the HA indicated that there is a particular concern over the heavy reliance of Gatwick on the stretch of the M23 between junctions 8 and 9 for strategic road connectivity. In the event of a major incident it is likely that the link would be closed for a period of time, and this issue needs to be taken into consideration when assessing the merits of the proposal for a second runway at the airport.

Roads in the vicinity of the airport

The analysis undertaken by Jacobs indicated that forecast flows were within assumed link capacities associated with the road network in the vicinity of Gatwick. VCRs reached a maximum of 70% on the A23 northbound between the off- and on-slips at the North Terminal but links around the South Terminal and the New Terminal typically had VCRs of less than 30%.

The overall conclusion therefore was that the proposed road network in the vicinity of the airport included in the GAL submission would provide sufficient link capacity to accommodate forecast flows including non-airport traffic, which means that from this perspective the second runway proposal is likely to deliver **Objective 2** of the AC's Appraisal Framework to a satisfactory degree in 2030. However, it was noted that the limiting capacity on any road network typically occurs at the junctions,

where the capacity for turning movements is almost always lower than the link capacity. If any network capacity issues do arise in the Gatwick area, they will be due to junctions rather than links and it is recommended that more detailed modelling is undertaken to assess the impact of forecast flows on key junctions.

Objective 3 – enabling access to the airport from a wide catchment area

Rail journey cost and time

In addition to addressing capacity issues, our rail analysis also suggested that overall rail GC and journey times to Gatwick are likely to reduce slightly between now and 2030 as a result of improvements to standard rail services associated with the post-2018 TSGN timetable and the additional services made feasible by the Extended Baseline schemes. The overall demand-weighted average GC of a rail trip to Gatwick (taking into account journey duration, wait times and interchanges required, and the monetary cost related to Value of Time) is forecast to fall from 151 minutes to 139 minutes in 2030, although this includes an assumption that real Values of Time and rail fares do not change between now and then but that a higher proportion of airport passengers are travelling for business purposes and consequently have a higher Value of Time.

When the components of GC related to fares and wait/interchange penalties were removed, the model indicated a reduction in demand-weighted average standard rail journey time from 72 minutes at present to 63 minutes by 2030, driven by more direct connections via the Thameslink core and increased service frequency on the BML. This journey time benefit is partially off-set when GEX services are included in the calculation, primarily because of the skewed distribution of GEX trips in 2012. The CAA data indicates that over 60% of all GEX trips originated in three London Boroughs with lower-than-average GEX travel times. The expected improvement in standard rail journey time from these boroughs in 2030 therefore effectively results in the transfer to standard rail of a large number of GEX trips with lower-than-average 2012 journey times. This results in an increase in average GEX travel time in 2030 when weighted by demand from different districts, although in many cases the actual GEX travel time between the airport and individual districts does not change.

The forecast change in demand-weighted rail journey times coupled with consideration of the new direct connections to Gatwick provided by the post-2018 TSGN timetable (which will encourage a mode shift to rail for longer distance journeys) suggest that the overall rail catchment of the airport will be significantly larger in 2030 than it is today.

Public Transport isochrones analysis

Both the current and the Extended Baseline public transport service routes were coded in accessibility software to ascertain the changes in travel times by public transport to Gatwick as a result of schemes in the Extended Baseline. This isochrones analysis indicated that significant areas of the UK are expected to become accessible by public transport to Gatwick as a result of committed and planned service enhancements. In particular, benefits for air passengers from the north-west of England were immediately evident, in addition to a number of other areas across the Midlands, East Anglia and the South West that also benefit from improved connections.

According to this analysis, the improvements to services associated with the Extended Baseline account for a 36% increase in the UK population within 3 hours public transport travel time of Gatwick, suggesting that the proposal for a second runway performs well against **Objective 3** in the AC's Appraisal Framework.

Scheme costs

This study has not assigned any rail-related infrastructure costs directly to the delivery of a second runway at Gatwick as the analysis indicated that the additional rail trips generated constituted a very low proportion of total forecast volumes on the BML in 2030. However, the analysis did indicate that

funding will need to be secured for the aforementioned uncommitted BML rail infrastructure to provide sufficient capacity to accommodate background demand in 2030.

In addition, NR and GAL are investigating whether the scheme currently being developed to enhance the airport station would have sufficient capacity to accommodate passengers associated with a second runway. The analysis undertaken as part of this study is not detailed enough to assess individual station capacity impacts and further assessment is required to determine whether some station re-development costs should be assigned to the cost of delivering an additional runway at Gatwick. It is noted that GAL have allocated £50m in their second runway cost plan for enhancements to the airport station if additional works are required.

This study also did not assign any strategic road network capacity enhancement costs to the delivery of a second runway. This was as a result of the M23 smart motorway scheme being moved from the Extended Baseline to the Core Baseline following feedback from the HA, who now consider the scheme to be committed for delivery regardless of the second runway.

The schemes associated with the GAL road proposal in the vicinity of the airport were priced independently by Jacobs based on a QS assessment and out-turn costs from comparable recently-completed schemes, and an initial estimate of **£510m** was derived for all the identified schemes, as indicated in the breakdown provided in Table 1. This included pure engineering costs, land costs, environmental mitigation costs and the consequential costs of the schemes themselves. This estimate rises to **£734m** with the inclusion of optimism bias.

Asset replacement and operational expenditure (OPEX) were not considered during this study, but analysis of these costs was undertaken as part of a separate work stream and is detailed in a report entitled '*Deliverable 13.2: Cost calculations*'.

Table 1: Summary of Gatwick second runway capital costs for roads in the vicinity of the airport

Location	Requirement	Length (km - both dir)	Unit cost (£ per km for links)	Estimated Cost (£)
M23 Junction 9	Slip road widening	1	£42.5m	£42.5m
	Grade-separated flyover for southbound slip	1	£35m	£35m
M23 J9 to 9a road widening	Widening of existing D2 to 4 lanes EB and 5 lanes WB	0.75	£30m	£22.5m
Airport Way	Widening of existing D2 to 4 lanes in each direction	1.25	£30m	£37.5m
A23 re-alignment	Provision of new section of A23 to D2 standard	5.5	£25m	£137.5m
	Grade-separated section of A23 re-alignment	1.75	£35m	£61.3m
Long-term parking	New high capacity roundabout and approaches	~	£5m	£5m
Industrial zone	New roundabout and approaches	~	£5m	£5m
North Terminal access	New high capacity roundabout and approaches	~	£5m	£5m
	A23 to Airport Way grade-separated flyover	0.6	£35m	£21m
New Terminal access	Provision of new D2 connecting M23 to new terminal	1.3	£25m	£32.5m
	Grade-separated section of new D2 access to new terminal	1.3	£35m	£45.5m
South Terminal access	New high capacity roundabout and approaches		£5m	£5m
Longbridge Roundabout	Capacity enhancements		£1m	£1m
Gatwick Road	New roundabout and approaches		£5m	£5m
Balcombe Road	Re-provision of existing road (standard 7.5m width 1 lane in either direction)	3.25	£15m	£48.8m
			TOTAL	**£510m**
			Risk	*0%*
			Optimism bias	*44%*
			TOTAL (including risk and optimism bias)	**£734m**

1. Introduction

1.1 Background

1.1.1 The Airports Commission (AC) was established in 2012 by the UK Government to examine the need for additional UK airport capacity and to recommend how any additional capacity requirements can be met in the short, medium and long term. The Commission is due to submit a Final Report to the UK Government by summer 2015 assessing the environmental, economic and social costs and benefits of various solutions to increase airport capacity, considering operational, commercial and technical viability.

1.1.2 A key milestone in the AC's operational life was the delivery in December 2013 of an Interim Report. Following a general call for evidence, the Interim Report detailed the results of analysis of the capacity implications of forecast growth in UK aviation demand and a preliminary appraisal on a long-list of proposals put forward by scheme promoters to address the UK's long-term aviation connectivity and capacity needs – this work is described as Phase 1. The associated appraisal process identified three short-listed options, two focussed on expanding Heathrow Airport and one on expanding Gatwick through the provision of a second runway. These short-listed options were to be further developed and appraised during Phase 2, with further phases of work programmed in the run-up to the submission of the Final Report in the summer of 2015.

1.1.3 Shortly after its inception, the AC issued tenders for support contracts to engage independent technical advice on a range of aspects of the Commission's work. Jacobs together with sub-consultants Leigh Fisher and Bickerdike Allen Partners were appointed as the sole supplier on the Airport Operations, Logistics and Engineering Support Contract (ref: RM1082), which runs throughout the AC's lifespan up until the summer of 2015.

1.2 Study scope

1.2.1 Under the terms of the RM1082 support contract, Jacobs were commissioned to develop the aforementioned Phase 2 assessment with respect to surface transport for a potential second runway at Gatwick. This assessment focussed specifically on three key elements as follows:

- estimating the net airport passenger and employee surface transport demand associated with a second runway, accounting for expected growth in demand to and from the airport in its current form;
- identifying surface transport measures to meet net airport-related demand associated with a second runway, accounting for capacity implications related to background growth and non-airport travel demand; and
- assessing the engineering feasibility and high-level cost of the surface transport measures identified to meet forecast travel demand.

1.2.2 The ultimate aim of the study was to provide guidance to the AC on the feasibility of, and likely surface transport issues associated with delivering a second runway at Gatwick, with specific reference to three objectives set out in the AC's Appraisal Framework:

- **Objective 1** – to maximise the number of passengers and workforce accessing the airport via sustainable modes of transport;
- **Objective 2** – to accommodate the needs of other users of transport networks, such as commuters, intercity travellers and freight; and
- **Objective 3** – to enable access to the airport from a wide catchment area.

1.2.3 The terms of reference covered an assessment of forecast demand during a peak hour in 2030. In the case of Gatwick, this peak hour was identified as 0800-0900, when the highest proportion of daily

surface access trips made by air passengers typically occurs at present. The impact of freight-related surface access movements during this peak hour was judged likely to be relatively low when compared with air passenger and employee movements and was consequently not assessed as part of this study – this was also the case with the parallel assessments of the other short-listed airport expansion options. A surface access freight impact assessment is therefore required for all the short-listed options as part of a future phase of work in order to address the element of **Objective 2** related to freight.

1.2.4 Reporting for the Phase 2 surface transport assessment published for consultation in October 2014 was defined as follows:

- the **Methodology Statement** summarises the approach employed by Jacobs to develop surface transport demand forecasts for the second runway – this summary is supported by a Technical Appendix, which includes detailed information about the calibration of models used to generate forecasts and assess capacity/level of service implications;
- the **Assumptions Log** lists the assumptions used to develop the forecasts and compares them with those contained in the submission received by the AC from Gatwick Airport Ltd (GAL);
- the **Appraisal Report** details the results of the assessment undertaken and draws key conclusions on the impacts of a second runway at Gatwick.

1.2.5 This report is the Appraisal Report in the structure defined above, and should be read alongside the other reports for a full understanding of the approach employed by Jacobs to deliver the Phase 2 Gatwick surface transport assessment. The surface access environmental impacts resulting from a second runway at Gatwick are considered as part of a separate work stream.

1.3 Methodology overview

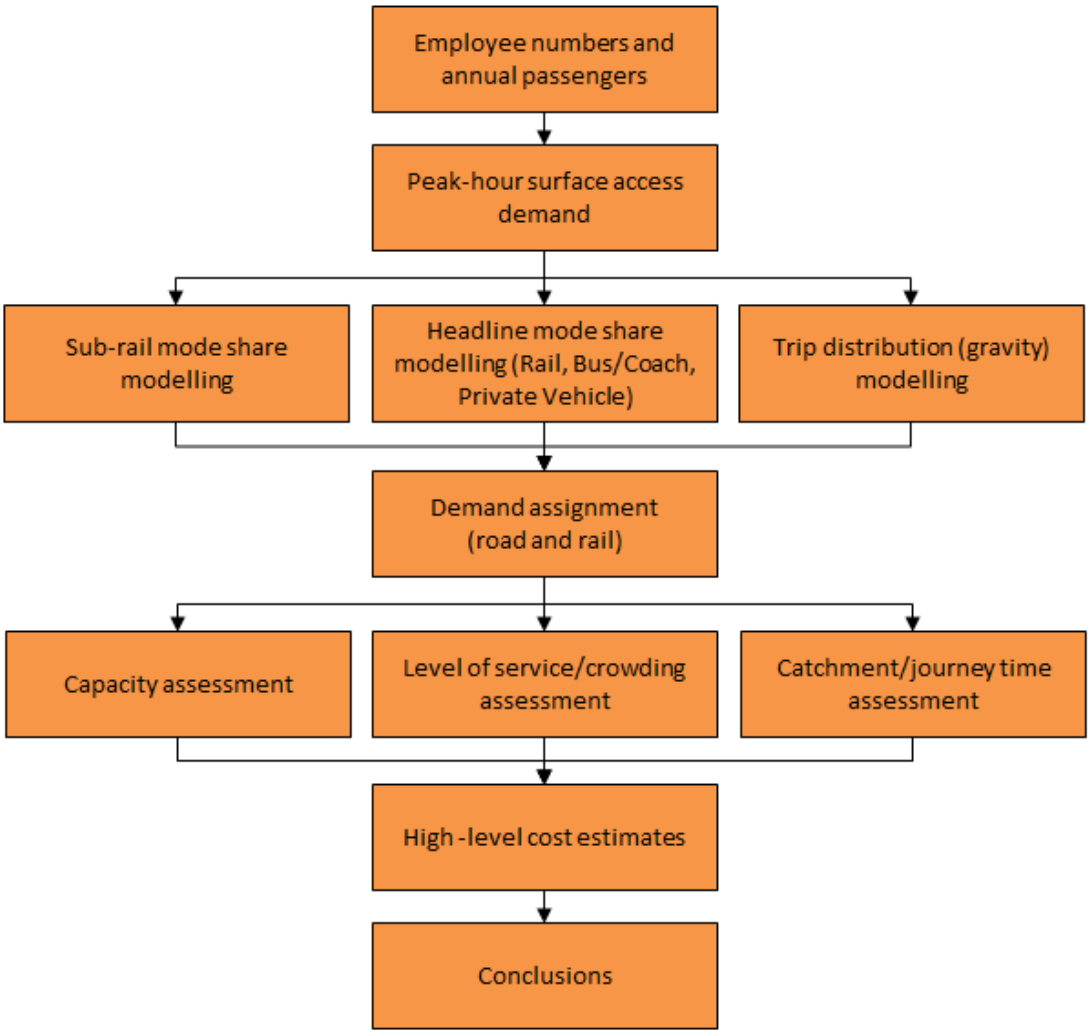
1.3.1 The methodology employed by Jacobs to forecast passenger and staff travel demand associated with a second runway at Gatwick is summarised in more detail in the Methodology Statement and its supporting Technical Appendix. The process is summarised here in Figure 2.

1.3.2 The analysis carried out to generate the forecasts discussed in this report was based on two models: a nested logit model forecasting both headline mode share and sub-rail mode share, and a trip distribution model based on changes in the Generalised Cost (GC) of travel between the airport and UK districts associated with proposed surface access enhancements. The approach used to forecast rail demand is consistent with the principles set out in the latest version of the Passenger Demand Forecasting Handbook (PDFH), released in 2013.

1.3.3 The assessment was undertaken with reference to a Core and an Extended Transport Baseline, which together listed transport infrastructure and services expected or likely to be in place by 2030 regardless of any airport expansion that may be delivered in the UK. Full details of the schemes included in these baselines are provided in Appendix A – the Core Baseline only included those schemes that were fully committed and funded when the Phase 2 assessment commenced.

1.3.4 In general terms, the primary focus of all the analysis was on the Extended Baseline as by 2030 it was judged very likely that further enhancements to the UK transport network would have been delivered above and beyond the works that were fully committed at the beginning of Phase 2. The Core Baseline was also assessed to highlight the importance of delivering planned but currently uncommitted infrastructure by 2030 to support expected growth in background demand and demand related to a second runway at Gatwick. In addition, the two road schemes listed in the Extended Baseline (a smart motorway scheme on the M4 and the Lower Thames Crossing east of Dartford) were judged unlikely to have a significant impact on road access to Gatwick and as a result, the quantitative analysis undertaken for the roads assessment focussed on the Core Baseline.

Figure 2: Phase 2 Gatwick – methodology overview



1.3.5 Constructing an appropriate Extended Baseline for a 2030 assessment involved making significant assumptions about the likely state of the transport network by that time, and this was a central factor in the decision not to extend the scope of the surface access assessment to include later years. There is currently a high degree of uncertainty surrounding some of the included schemes, not just in terms of their delivery but also their final form and characteristics, which in some cases are continually evolving as development work is progressed. The assessment detailed in this report was based on the best assumptions on the state of the 2030 transport network at the time of writing, but it is recommended that the baselines continue to be refined and developed in liaison with the AC's stakeholders as part of any further assessment of surface access impacts.

1.4 Gatwick submission

1.4.1 The GAL submission for a second runway at Gatwick was received by the AC in May 2014 and includes a detailed assessment of surface transport demand and the capacity implications.

1.4.2 The assumptions used in the submission are summarised in more detail and compared with the Jacobs assumptions used during this study in the separate Assumptions Log. The key headlines are as follows:

- in 2012 Gatwick handled 35 million passengers per annum (mppa) and employed 21,000 on-airport staff – a ratio of 1,667 annual passengers per employee;

- the airport would handle 46mppa and employ 24,430 staff in 2030 if a second runway is not delivered (referred to as Option 0) – this amounts to a ratio of 1,883 annual passengers per employee;
- if a second runway is delivered, the airport would handle 65mppa and employ 29,685 staff (referred to as Option 3), assuming some efficiencies in airport staffing could be achieved with a second runway when compared with Option 0, resulting in a ratio of 2,190 annual passengers per employee;
- 8% of passengers at the airport in both Option 0 and Option 3 would be interliners (transit passengers) and would not use surface access – this is similar to the current proportion of interlining passengers at the airport;
- a headline mode share target of 50% rail, 10% bus/coach and 40% private vehicle for non-transit air passengers in 2040 was used to test the impact on the rail network in both options, while the current private vehicle mode share (approximately 57%) was used to test the impact on the road network – the 2012 headline mode share at Gatwick for passengers according to the CAA passenger survey data (excluding Olympic-related trips) was 35.7% rail, 7.9% bus/coach and 56.5% private vehicle – this excluded a small number of trips using other modes, including walk and cycle;
- headline employee commuting mode share was assumed to be 20% rail, 20% bus/coach and 60% private vehicle in both options – the current Gatwick headline mode share for employees is 12.9% rail, 11.8% bus/coach and 75.3% private vehicle.

1.4.3 Although not stated in their submission, GAL have also confirmed independently to the AC that their target headline surface access mode share for air passengers in 2030 is 44% rail, 11% bus/coach and 45% private vehicle.

1.4.4 The Gatwick submission indicates that planned rail infrastructure improvements associated with the post-2018 high-peak Thameslink-Southern-Great Northern (TSGN) franchise timetable and additional services made feasible through the delivery of a number of currently uncommitted rail schemes included in the Extended Baseline will be sufficient to accommodate growth in rail passenger numbers associated with a second runway.

1.4.5 In terms of road enhancements, the submission indicates that "*there is enough running lane capacity in 2040 on the M23 with committed schemes to accommodate both future growth at Gatwick and background commuter growth. With the M23 Managed Motorway J8-10 (hard shoulder running), northbound and southbound capacity will be in the region of 8,000 vehicles per hour on the running lanes*".

1.4.6 The submission also indicates that "*a combination of committed strategic highway improvements and local mitigation is capable of meeting 2040 demand and allows further growth at the airport to 2050. Local mitigation around the airport includes upgrading M23 Junction 9, with plans to double its capacity through a new grade separated junction to handle the on/off traffic to the M23. Gatwick is meeting 100% of the cost of this*".

1.4.7 This report details the outputs from an independent analysis undertaken by Jacobs of the likely surface access impacts of a second runway at Gatwick Airport in 2030, and where necessary the assumptions used in the GAL submission and its subsequent conclusions have been challenged by this independent analysis.

1.5 Report structure

1.5.1 The remainder of this report is structured as follows:

- Chapter 2 summarises the headline and sub-rail mode share forecasts from the logit modelling;
- Chapter 3 summarises the rail capacity and level-of-service assessments based on forecast rail passenger trips to and from the airport;

- Chapter 4 summarises the road capacity assessment based on forecast car trips to and from the airport;
- Chapter 5 summarises the public transport catchment analysis undertaken, including an assessment of UK population within travel time bands to Gatwick;
- Chapter 6 draws out and summarises the key conclusions arising from the study.

2. Headline forecasts

2.1 Methodology

2.1.1 As mentioned in Chapter 1, two key models were developed by Jacobs to assess the impact of a second runway at Gatwick Airport – a nested logit model forecasting sub-rail and headline mode share, and a trip distribution model forecasting surface access trip origins and destinations. The models were linked as the shortest calculated Generalised Cost (GC) between each district in the UK and the airport was used as a key parameter in the distribution model. As a result, districts with relatively improved transport connections to the airport in 2030 were allocated an increased proportion of total airport demand, reflecting the assumption that improved transport connections would induce demand between these areas and Gatwick. This change in distribution was then fed back into the logit model to forecast the modes of transport that would be used by these trips.

2.1.2 The remainder of this chapter describes the headline and sub-rail mode share forecasts arising from the 2030 nested logit model developed for Gatwick. These forecasts provided the basis for the assessment of the second runway proposal against **Objective 1** in the AC's Appraisal Framework, which is 'to maximise the number of passengers and workforce accessing the airport via sustainable modes of transport'.

2.1.3 The sub-car mode share (i.e. the split between taxi, kiss-and-fly, short-term parking and long-term parking demand) from the 2012 CAA Gatwick passenger survey data was used to estimate a composite GC for car between each district and the airport in the base model. The complexities involved with forecasting sub-car mode share in 2030 (which would involve assumptions related to car ownership levels, background traffic congestion, availability of short- and long-term parking at the airport, average parking tariffs and dwell times, kiss-and-fly arrangements etc.) would be significant, and the decision was taken to apply the 2012 sub-car mode share by district in the 2030 model to calculate future composite car GCs.

2.1.4 It should be noted that the GCs developed for the logit modelling are fixed costs and do not account for the variable impact of congestion or crowding on journey time/experience. This approach is consistent with the subsequent road and rail assessments undertaken, which are described in the following chapters in this report – both these assessments were based on a static analysis of forecast demand compared with, but not constrained by, network capacity.

2.1.5 In addition, the trip distribution model developed for this study accounts for the GC of travel to and from the airport as well as forecast changes in Gatwick passenger characteristics and population/employment at a district level across the UK in 2030. However, the model does not account for associated changes in passenger characteristics at other airports in the UK and Europe, in particular with regard to interlining, which may have a significant impact on the surface access catchment of Gatwick in future. Further assessment is therefore required to determine the most appropriate passenger catchment as the basis for analysing surface access impacts in the event of a second runway being delivered.

2.2 Sensitivity tests

2.2.1 As with all the short-listed airport expansion options, the initial basis of the analysis for Gatwick was the scheme promoter's own forecasts. The headline numbers from the GAL submission described in section 1.4 are summarised in Table 2 alongside the AC's 'Carbon-Capped Assessment of Need' (CC AoN) and 'Carbon-Traded Low Cost is King' (CT LCK) scenarios. The table indicates that the GAL submission figures provide for a more conservative assessment of potential second runway surface access impacts than either of the AC scenarios.

Table 2: Gatwick Airport 2030 air passenger growth forecasts

Scenario	*One runway*			*Two runways*			Net annual surface access pax growth
	Total annual pax	Interlining %	Annual surface access pax	Total annual pax	Interlining %	Annual surface access pax	
Jacobs model (GAL submission)	46.0m	8.0%	42.3m	65.0m	8.0%	59.8m	17.5m
Carbon-Capped Assessment of Need	41.1m	5.0%	39.0m	45.6m	6.3%	42.7m	3.7m
Carbon-Traded Low Cost is King	43.7m	3.7%	42.1m	72.0m	26.2%	53.2m	11.1m

Sources: GAL submission for Jacobs 2030 model scenario; AC for CC AoN and CT LCK scenarios

2.2.2 Sensitivity tests were undertaken on the AC passenger scenarios summarised in the table above, and summary results of these tests are provided in Appendix B alongside the results of two additional tests as follows:

- High staff forecast – as noted in the previous chapter, GAL envisage significant efficiency savings in terms of staff numbers by 2030 with an assumed ratio of just under 2,200 annual passengers per employee in their two-runway scenario – in contrast, the AC have produced a 'high productivity' employee scenario that assumes an equivalent ratio of 2,095 and a 'low productivity' scenario with a ratio of 1,509 – the latter figure has been applied to the GAL 65m passenger forecast to calculate an estimate of just over 43,000 employees at the airport in the two-runway scenario for this test, which contrasts with GAL's estimate of 29,685;
- Removal of the premium fare for GEX – the calculation of GC applied in the central Jacobs scenario described in this report assumes that the current premium fare for GEX services between the airport and London is retained in future (further details on this assumption can be found in section 2.5) – as a result, a test was undertaken to understand the impact of removing this premium and pricing GEX in the same way as other standard rail services as a means of better utilising available rail capacity serving the airport in 2030.

2.2.3 In addition to the four sensitivity tests described above, a range of other sensitivity tests were undertaken to validate the models and to assess the impact of specific changes in the travel behaviour of airport passengers. These tests are referenced in the relevant sections of this report.

2.3 Comparison of Jacobs and GAL peak hour surface access trips

2.3.1 As mentioned in Chapter 1, the assumptions used to convert annual passenger trips and employee numbers into peak-hour (0800-0900) surface access trips are covered in more detail in the Assumptions Log. In summary, the GAL headline operation figures listed in Chapter 1 produced the peak-hour surface access estimates shown in Table 3 to Table 5.

2.3.2 The tables indicate that the net peak-hour impact of the second runway in Option 3 on surface access, accounting for growth in activity at the airport without a second runway (Option 0), was estimated at an extra 2,878 trips to the airport and 1,710 trips from the airport. The trip totals included forecast rail meet and greet trips – it was not considered necessary to include these for vehicular modes based on the assumption that meet and greet trips would be sharing vehicles already used by passengers to travel to and from the airport.

Table 3: Total 2030 peak-hour Gatwick surface access trips (Option 0)

Headline mode	Passengers		Employees		TOTAL	
	TO airport	FROM airport	TO airport	FROM airport	TO airport	FROM airport
Car/taxi	2,327	1,728	1,253	84	3,580	1,812
Bus/coach	551	410	418	28	969	437
Rail	2,142	1,591	418	28	2,560	1,619
TOTAL	**5,021**	**3,729**	**2,089**	**139**	**7,110**	**3,868**

Source: Jacobs 2030 model – rail passenger trips include forecast meet and greet demand

Table 4: Total 2030 peak-hour Gatwick surface access trips (Option 3)

Headline mode	Passengers		Employees		TOTAL	
	TO airport	FROM airport	TO airport	FROM airport	TO airport	FROM airport
Car/taxi	3,438	2,497	1,523	102	4,961	2,598
Bus/coach	802	582	508	34	1,310	616
Rail	3,209	2,330	508	34	3,716	2,364
TOTAL	**7,449**	**5,409**	**2,538**	**169**	**9,987**	**5,578**

Source: Jacobs 2030 model – rail passenger trips include forecast meet and greet demand

Table 5: Total 2030 peak-hour Gatwick surface access trips (Option 3 – Option 0)

Headline mode	Passengers		Employees		TOTAL	
	TO airport	FROM airport	TO airport	FROM airport	TO airport	FROM airport
Car/taxi	1,111	768	270	18	1,381	786
Bus/coach	251	173	90	6	341	179
Rail	1,066	739	90	6	1,156	745
TOTAL	**2,428**	**1,680**	**449**	**30**	**2,878**	**1,710**

Source: Jacobs 2030 model – rail passenger trips include forecast meet and greet demand

2.3.3 The GAL submission does not explicitly state the number of peak hour trips to and from the airport in 2030, but an estimate can be derived for 2040 passengers using Table 5.2 on page 48 in Appendix A6 on Surface Access – this table provides an hourly profile of passengers arriving and departing the airport by air in the two options based on flight profile estimates. Two key assumptions are needed to convert these estimates into a peak-hour surface access forecast, as follows:

- the proportion of interliners remains at 8% in 2040 (it is stated in the text that it is expected to remain at less than 10%);
- lag times are 1 hour after landing for passengers leaving the airport using surface transport and 2 hours before take-off for passengers arriving at the airport using surface transport.

2.3.4 Applying the two assumptions described above to Table 5.2 results in a peak-hour forecast of 4,916 trips to the airport in Option 0 rising to 8,849 trips to the airport in Option 3 in 2040. These figures compare with the Jacobs estimates of 5,021 passengers to the airport in Option 0 rising to 7,449 in Option 3 in 2030.

2.3.5 The difference between the figures can be explained in part by the annual passenger forecasts. In Option 0 the GAL and Jacobs forecasts are very similar due to the limited growth expected at the airport between 2030 and 2040, with total passenger numbers expected to rise from 46mppa to

47mppa. If this increase of 2.2% in total passenger numbers is applied to the Jacobs 2030 estimate, a forecast of 5,130 peak-hour passenger trips to the airport is derived for 2040 – this is 4.4% higher than the GAL estimate for 2040.

2.3.6 In Option 3, passenger numbers are expected to rise more dramatically between 2030 and 2040, from 65mppa to 83mppa – this is an increase of just under 28%. If this uplift is applied to the Jacobs 2030 Option 3 estimate, a forecast of 9,512 passengers travelling to the airport in the peak hour is derived for 2040 – this is some 650 more trips, or 7.5% higher, than estimated by GAL in 2040.

2.3.7 It is clear then that there are some differences in the assumptions used by GAL and Jacobs to estimate peak-hour trips travelling to and from the airport – a key difference appears to be that rail meet and greet trips were not added to passenger/employee demand forecasts in the GAL submission as they were in the Jacobs forecast. However, the figures compared above suggest a reasonably similar order of magnitude applied in both this study and the GAL submission in terms of demand to and from the airport in the peak hour.

2.3.8 Average vehicle occupancy figures for passengers and employees were used to convert the car/taxi trip forecasts into numbers of vehicles travelling to and from the airport. These vehicle trip estimates are summarised in Table 6 and Table 7. All kiss and fly trips to and from the airport are assumed to involve an empty vehicle trip in the other direction during the peak-hour, while a proportion of taxi trips were also assumed to travel empty in one direction – further details on the methodology applied to generate car trip totals can be found in the Methodology Statement.

Table 6: Total 2030 peak-hour Gatwick private vehicle (car/taxi) trips (Option 0)

Trip type	TO airport	FROM airport
Passengers	1,364	1,012
Employees	1,044	70
Total	**2,409**	**1,082**

Source: Jacobs 2030 model

Table 7: Total 2030 peak-hour Gatwick private vehicle (car/taxi) trips (Option 3)

Trip type	TO airport	FROM airport
Passengers	2,111	1,582
Employees	1,269	85
Total gross trips	**3,380**	**1,667**
Total net trips	**971**	**585**

Source: Jacobs 2030 model

2.3.9 The tables indicate that the net impact of the second runway (Option 3 less Option 0) is expected to amount to an additional 971 car trips to the airport in the peak-hour and 585 trips away from the airport.

2.3.10 In the GAL submission, Table 8.3 on page 123 of Appendix A6 highlights the AM peak road traffic movements associated with passengers and employees that have been used to test the road network for the two options in a number of forecast years. Interpolating between the 2025 and 2040 forecasts using the mppa figures provided in Table 5.1 of the same document produces a 2030 estimate of 3,562 car trips to the airport in Option 0 rising to 4,868 in Option 3. This compares reasonably closely with the car trip forecasts to the airport used in the Jacobs model for the two options shown in Table 3 and Table 4. The submission indicates that the GAL forecasts are based on the current mode share of

just under 60% using private vehicles (which is significantly higher than the Jacobs 2030 central forecast, as described in more detail in the following section of this report) but does not indicate what vehicle occupancy figures were applied to calculate total vehicle trips.

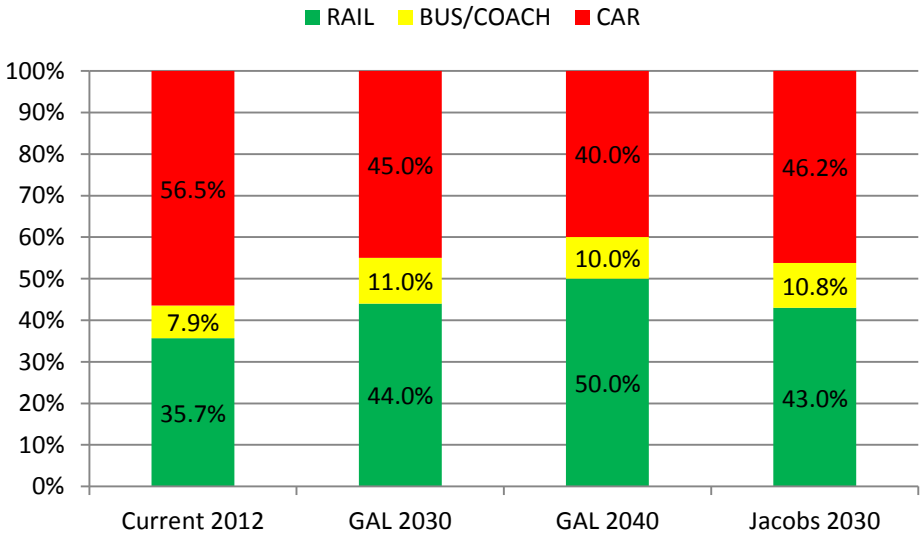
2.3.11 The CAA 2012 survey data suggests that passenger vehicle occupancy, particularly for leisure passengers, is currently high for trips to Gatwick with an average of around 2.1 calculated. This results in a significantly lower forecast for actual vehicle trips used in the Jacobs 2030 model as shown in Table 6 and Table 7.

2.4 Main mode share

2.4.1 The graph in Figure 3 indicates the headline passenger mode share forecast arising from the Jacobs 2030 Gatwick model, which predicts that 43% of airport passengers would use rail to reach the airport in 2030 with a second runway in place, increasing from the current passenger rail mode share of 35.7%. Total bus/coach mode share is also forecast to rise, from 7.9% in 2012 to 10.8% in the 2030 Jacobs forecast. This uplift in overall public transport mode share from 2012, derived from the CAA passenger survey data, reflects the rail service improvements associated with the post-2018 TSGN timetable and additional uncommitted services, and new direct coach services to a number of areas including parts of South London, Kent and Essex. The graph indicates that the mode share forecast from the Jacobs 2030 model is very similar to the GAL figures for 2030, which were not reported in their submission but were provided independently by GAL. The 2040 figures in the submission represent an aspirational target public transport mode share, which GAL has used to assess rail capacity.

2.4.2 In the central Jacobs 2030 forecast, general levels of traffic congestion on the strategic road network were assumed to rise in line with the latest forecasts derived from the Department for Transport's (DfT's) National Transport Model (NTM). Since potential real increases in Value of Time (VoT) and travel-related costs were not considered in this central forecast, car GCs in the 2030 model increased slightly from those used in the 2012 model. Two sensitivity tests were carried out for different headline mode share scenarios, which were both developed by changing the central scenario congestion assumptions. The results of these tests are summarised later in this report.

Figure 3: Headline mode share forecasts for passengers

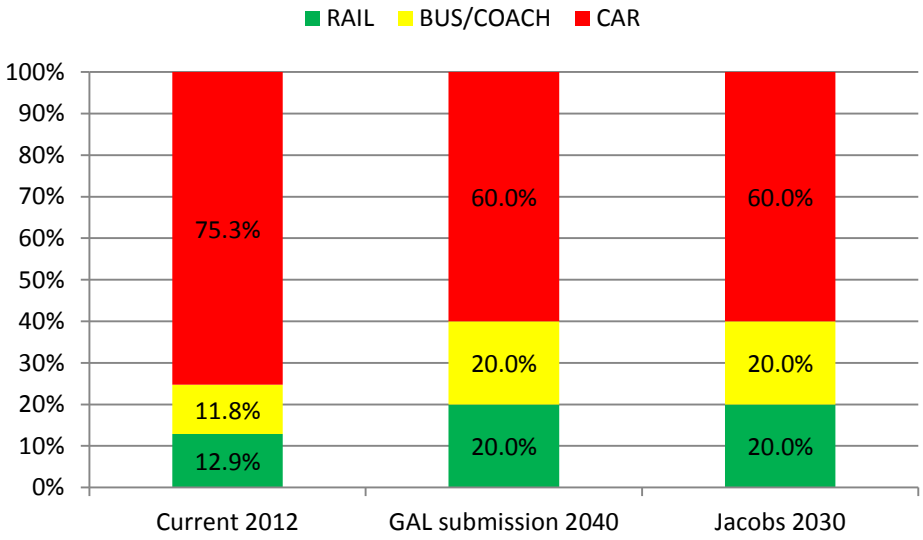


Sources: Current 2012 mode share from CAA 2012 Gatwick passenger survey (excluding other modes, including Walk and Cycle). The GAL submission 2040 figures represent a public transport target used for rail capacity testing purposes – road capacity has been tested using current mode share assumptions.

2.4.3 A further point to note is that the Jacobs 2030 forecast shown in the graph reflects the forecast derived for the submission Option 3, which is the airport with a second runway in place. A forecast for Option 0 (without the second runway) was also derived from the model, which differs slightly due to the different mix of business and leisure passengers assumed in each option. The mix was assumed to remain constant from the current observed split of 15% business-85% leisure in Option 0, but in Option 3, the proportion of business passengers was assumed to rise to 23%, in line with the figure provided in the GAL submission. This resulted in a headline mode share for Option 0 of 46.4% car, 11.0% bus/coach and 42.6% rail.

2.4.4 The graph in Figure 4 indicates the headline mode share for employees travelling to the airport in 2012, compared with the assumptions made in the 2040 GAL submission and in the 2030 Jacobs model. The GAL submission did not indicate a target employee mode share for 2030.

Figure 4: Headline mode share forecasts for employees



Sources: Current 2012 mode share from GAL (Gatwick Employment Survey) (excluding other modes, including Walk and Cycle).

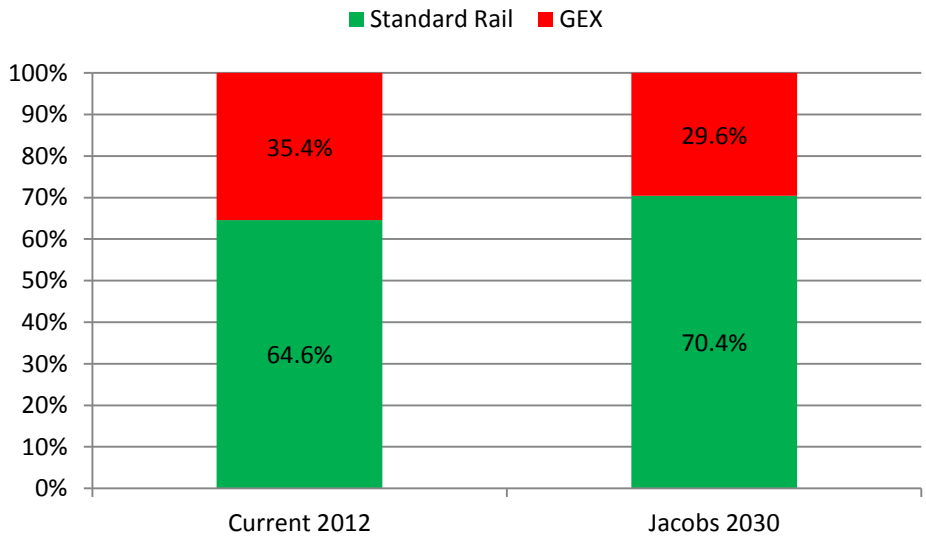
2.4.5 Given the clustering of employee home locations in districts in the vicinity of the airport (with 35% of employees in the 2012 Employment Survey recorded as living in Crawley), it was felt that the headline mode share model developed by Jacobs to forecast passenger trips to the airport was not detailed enough to assess employee mode share, and so the headline figure indicated in the graph was applied across the board.

2.4.6 The graph indicates that Jacobs used the 2040 GAL submission headline mode share for employees for testing purposes as part of this study, as the forecast increase in rail and bus mode share from the 2012 observed data seemed a reasonable assumption in light of planned improvements in rail and bus/coach services and the impact of traffic demand management measures on employee car use at the airport.

2.5 Sub-rail mode share

2.5.1 The sub-rail element of the headline mode share model described above was also used to forecast the sub-rail mode share split between Gatwick Express (GEX) and standard rail services in 2030. The output from the model is shown in Figure 5 alongside the current split derived from the CAA 2012 passenger survey data.

Figure 5: Sub-rail mode share forecast for passengers



Current sub-rail mode share derived from CAA 2012 passenger survey data, excluding trips with an Olympic journey purpose.

2.5.2 For the sub-rail analysis undertaken as part of this study, it was assumed that GEX services are retained in 2030 in their current form, consisting of 4 train paths per hour direct between the airport and Victoria station during off-peak periods, with the paths extended between Victoria and Brighton at peak times. The post-2018 TSGN high-peak timetable provided by Network Rail (NR) and described in more detail in the following chapter of this report indicates the four GEX services operating between Victoria and Brighton. A premium fare is currently only levied on the section of the route between the airport and Victoria with standard fares applicable for the peak services between the airport and Brighton. This fare structure is assumed to be retained in 2030 and has been incorporated in the assessment by assuming that the 4 peak GEX train paths between the airport and Brighton are standard rail services. As a result, the 2012 and 2030 GEX mode shares indicated in the graph above refer only to those passengers using the premium-fare section of the route between the airport and Victoria.

2.5.3 The graph shows a forecast reduction in GEX sub-rail mode share in 2030 when compared with the observed 2012 data, based on the assumptions described above. This can be attributed to the fact that while GEX has been assumed to operate a similar service pattern to that currently in operation, the post-2018 TSGN timetable involves significant improvements to standard rail services including increased service frequencies from stations on the BML and direct connections to more stations via the Thameslink Core. These improvements are enhanced further through the provision of additional rail services on the BML that are made feasible by currently uncommitted schemes included in the Extended Baseline.

2.5.4 The GAL submission does not explicitly state a forecast mode share split between GEX and standard rail services as the assessment of rail impacts was forecast using the PLANET South model. This model does not include rail fare as a factor when allocating forecast demand to rail services and as a result, capacity impacts on standard rail services may be underestimated on rail corridors with premium services such as the BML. The model is likely to allocate a higher proportion of demand to such dedicated services when in reality, some of those trips will be more sensitive to price and will choose to use standard rail services instead.

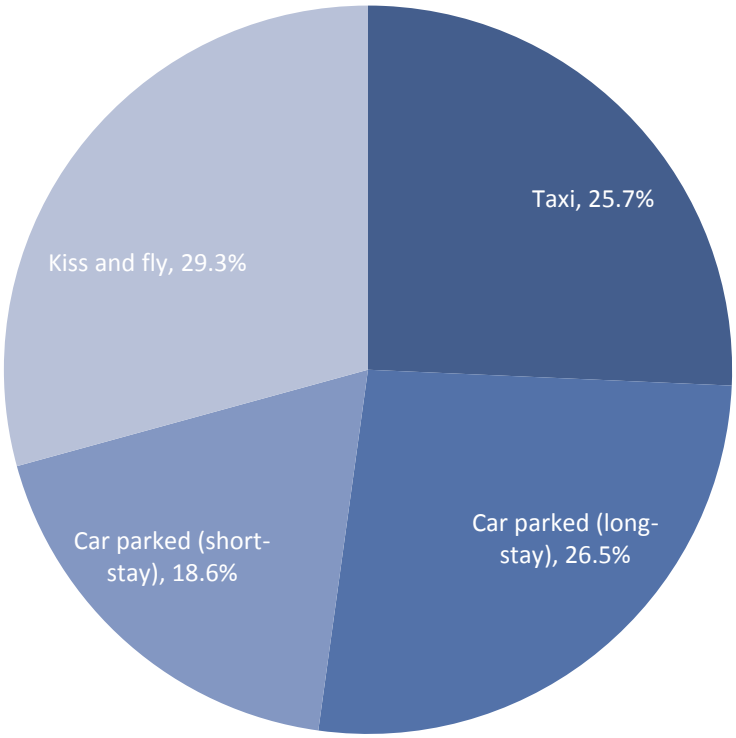
2.5.5 It was assumed for the purposes of this analysis that all employee rail trips to Gatwick are made using standard rail services in 2030 – no current sub-rail mode share data was available for employees and a high proportion of employee home locations are expected to remain clustered around the airport as they are at present. A small number of Gatwick staff may travel to work in the AM peak hour using

GEX in 2030 but available evidence suggests these trips are not likely to be significant in terms of volume.

2.6 Sub-car mode share

2.6.1 As mentioned above, the observed 2012 sub-car mode share derived from the CAA passenger survey data was applied for air passengers in the 2030 model. Forecasting sub-car mode share is a highly complex process based on a wide range of variables, and it was deemed unnecessary for this study as the GAL submission did not highlight any proposals that were considered likely to impact significantly on sub-car mode share at Gatwick in future. The 2012 sub-car mode split is shown in Figure 6.

Figure 6: Current sub-car mode share for air passengers at Gatwick



Source: CAA 2012 passenger survey data

2.6.2 The graph indicates that kiss and fly was the most popular car-based mode among passengers at the airport. It should be noted that when interrogating the CAA data, a number of minor car-based categories had to be allocated to one of the four grouped categories indicated above based on assumptions about the nature of the activity being undertaken. These assumptions are summarised in the Methodology Statement.

3. Rail assessment

3.1 Overview

3.1.1 The peak-hour demand forecasts and trip distribution/mode share analysis developed to assess the impact of a second runway at Gatwick in 2030, described in more detail in the Methodology Statement, were used to assess the provision of future rail services to the airport.

3.1.2 The GAL submission indicated that committed rail infrastructure enhancements associated with NR's post-2018 TSGN timetable, plus additional services made feasible by a number of currently uncommitted schemes included in the Extended Baseline, would be sufficient to accommodate the increase in rail passenger trips to and from the airport with a second runway in place. The uncommitted schemes listed in the Extended Baseline include the following:

- Gatwick Airport Station redevelopment, which was recommended as part of the AC's Interim Report – discussions are currently underway between the government, NR and GAL regarding the nature and scale of the redevelopment; and
- proposed capacity enhancements to the BML, which are currently under development and may potentially be identified for funding in Control Period 6 (CP6 – NR's 5-year planning cycle for the period between 2019 and 2024) – components include:
  - Windmill Bridge Junction area re-modelling including new grade-separation for the Up London Bridge fast line and the Down London Bridge fast line over the Wallington and Victoria slow lines, reusing the current fly-under for realigned Up London Bridge slow services, providing a new sixth track between East Croydon and Windmill Bridge, and lengthening Selhurst Spurs to provide 12-car signal standing;
  - remodelling East Croydon Station with additional platforms;
  - Stoats Nest Junction remodelling, including the provision of a flyover for Up Redhill services to join the Up fast line;
  - re-designation of Platform 8 at London Victoria, and new access from Platform 9 approach;
  - Clapham Junction area alterations to allow for additional train paths (no feasibility work yet undertaken);
  - provision of a third track at Keymer Junction to enable Up Lewes services to join the BML while an Up service is passing and enabling the BML to remain open when the junction is unusable.

3.1.3 NR indicated that the benefits and costs of switches and crossings (S&C) alterations and partial track re-modelling in the Clapham Junction area are being weighed up against signalling enhancements that could be delivered through implementation of the European Railway Traffic Management System (ERTMS). A range of other options are also being investigated alongside the aforementioned Extended Baseline schemes, including the requirement for grade separation at Keymer Junction, works needed to deliver bi-directional capability on the Up fast line into Victoria, and works needed to deliver turn-back capability at Haywards Heath.

3.1.4 Jacobs consulted with NR to establish peak hour background demand and capacity estimates associated with the post-2018 TSGN timetable and the additional but currently uncommitted train paths as the basis for assessing the impact of net rail demand associated with a second runway.

3.1.5 During discussions, NR stressed that the infrastructure outlined for CP6 and CP7 (2024-2029) is currently at a very early stage of development. Following publication of the Sussex Route Study draft for consultation in October 2014, which aims to identify spending priorities beyond committed enhancements included in CP5 (2014-2019), NR will begin to take selected infrastructure schemes through the early GRIP project development stages. Typically, detailed cost estimates would not be submitted to funders until 2017/18 and at this early stage, infrastructure scope and resultant rail

capacity outputs are subject to change. Indicative pre-GRIP cost estimates will be included in the Route Study.

3.1.6 Several infrastructure packages are being assessed and while the enhancements listed above would be required to meet the 2030 service specification defined in the Jacobs assessment, other packages assume for example that a higher number of services would terminate further north on the BML, meaning that some interventions would not be required. The Route Study will assess the Value for Money (VfM) rating for each infrastructure package, and some interventions may not be delivered as a result while the scope of others may change significantly.

3.1.7 NR and GAL are also investigating whether the aforementioned scheme to enhance the airport station would be able to accommodate additional passengers associated with a second runway at the airport. Depending on the scheme taken forward, further alterations at the airport station may be required to accommodate this additional demand. It is noted that GAL have allocated £50m in their second runway cost plan for enhancements to the airport station if additional works are required.

3.1.8 Airport-related demand on each rail service was forecast using the parameters derived from the calibrated base 2012 Gatwick mode choice logit model, based on assumptions regarding the GC of trips to the airport in the future years and accounting for proposed changes associated with the TSGN timetable and schemes in the Core and Extended Baselines.

3.1.9 The aim of the analysis was to determine the likely location and scale of rail capacity issues and to draw preliminary conclusions regarding the level of service that would be experienced by rail passengers based on forecast crowding on services. In addition, rail journey times were analysed for each option and compared with current journey times to Gatwick to assess the overall change in rail accessibility forecast in 2030.

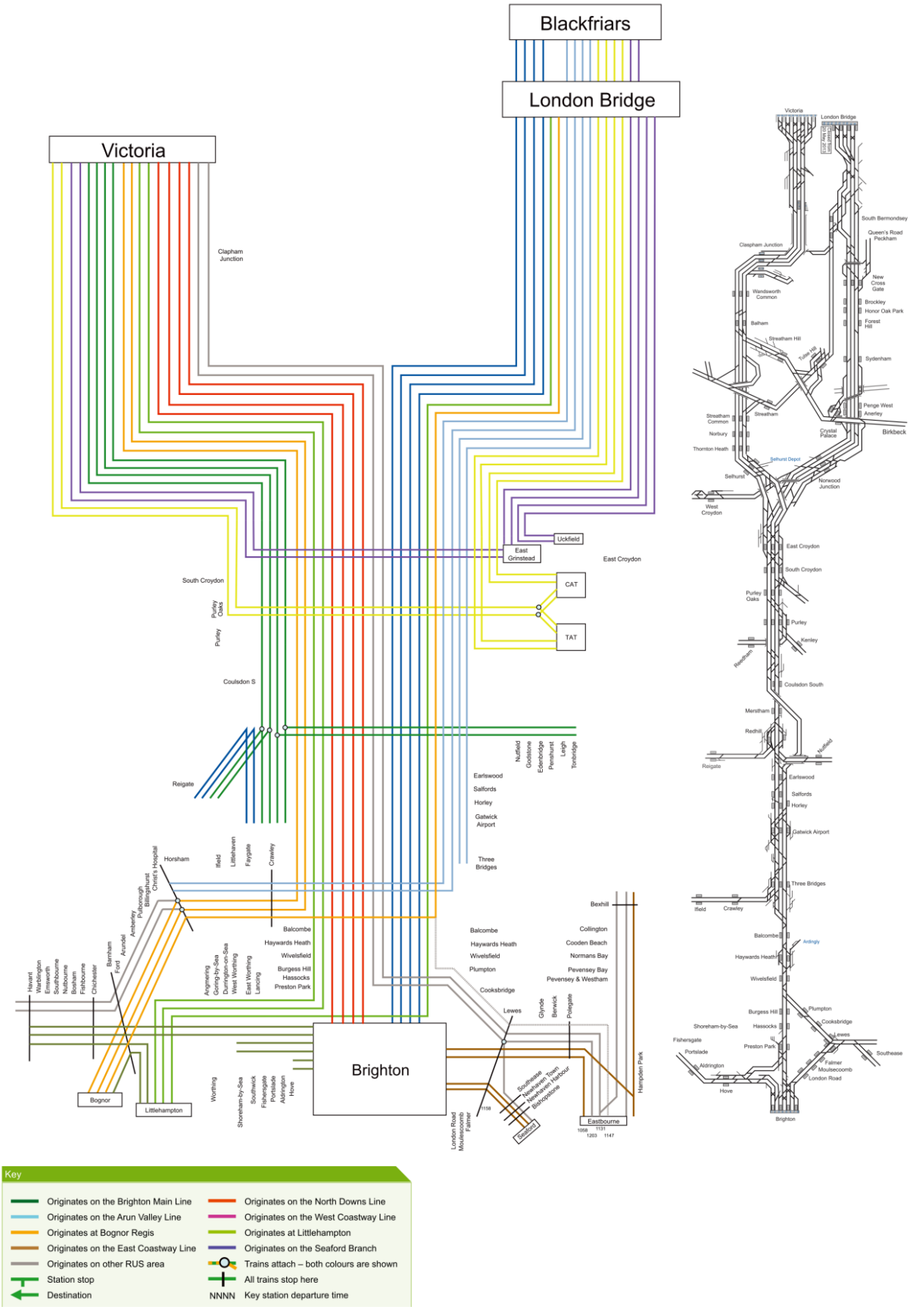
3.1.10 As mentioned in Chapter 2, this assessment constitutes a static analysis of forecast rail demand compared with but unconstrained by expected available network capacity in 2030. Further assessment is therefore required using a strategic dynamic modelling approach to better understand the impacts of forecast demand on rail network performance and passenger journey time/experience, including:

- the extent to which rail passengers (including those not related to the airport) change their route to avoid over-crowded services, and the associated knock-on impacts on other services;
- the extent to which new rail services related to currently uncommitted infrastructure may induce an increase in background demand;
- the wider impacts of crowding on the rail network providing secondary connections to BML services, notably the London Underground.

3.2 The 2030 rail network serving Gatwick

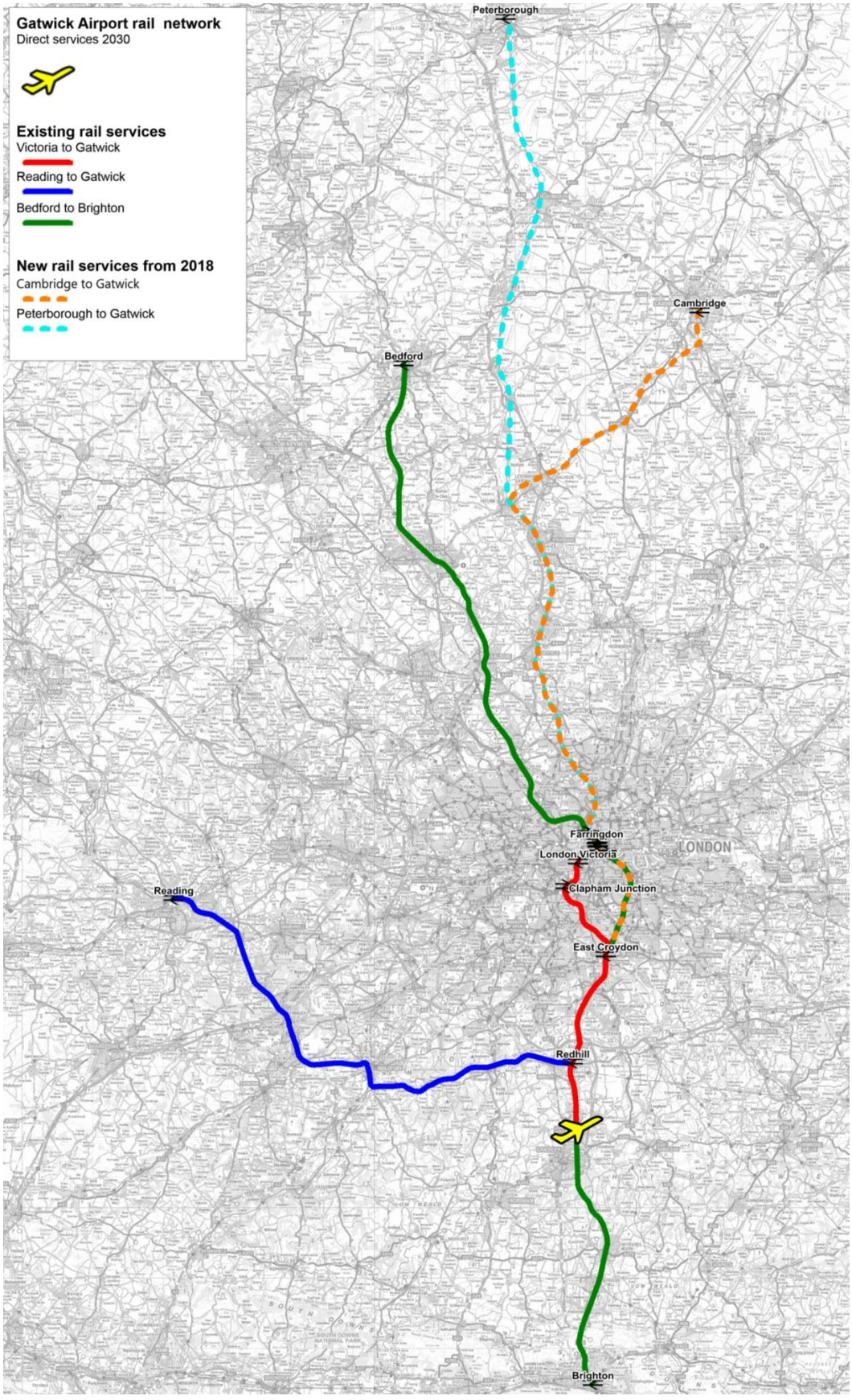
3.2.1 The latest post-2018 high-peak TSGN timetable assumed by NR is shown in Figure 7. The diagram indicates that following the delivery of committed rail infrastructure, 22 standard and 4 Gatwick Express (GEX) train paths (shown in red) are expected to pass through Gatwick Airport station, including 8 paths through the Thameslink Core via London Bridge. The provision of direct links between the airport and key stations to the north of London via the Thameslink Core is summarised in Figure 8. It should be noted that the TSGN franchise holder will have some scope to determine the actual timetable that is operated on the BML and that at the time of writing the 2018 timetable and track access rights had not been finalised. However, NR indicated that it was unlikely to be significantly different to their current assumptions, which have been used as the basis of assessment in this study.

Figure 7: Indicative post-2018 high peak TSGN timetable



Source: Network Rail

Figure 8: New direct rail connections to Gatwick in 2030



Contains Ordnance Survey data © Crown copyright and database right 2014

3.2.2 In addition to the TSGN services summarised in Figure 7, the uncommitted works listed earlier in this chapter and currently earmarked for CP6 onwards could allow an additional 4 train paths to Victoria and 2 to London Bridge. NR's current proposal is that 3 of these services would terminate at Haywards Heath or Wivelsfield, with 2 terminating at Hove and 1 at Eastbourne (although these are preliminary proposals and are subject to change). All are expected to operate in 12-car formation utilising Class 377 rolling stock.

3.2.3 These additional services could increase the total train paths through Gatwick in the high peak hour from 26 to 32. Discussions with NR indicated that at the time of writing, there was some uncertainty regarding the number of services that would actually stop at the airport although it was agreed that a reasonable working assumption for the purpose of this analysis was that most services would stop.

3.2.4 GC assumptions for rail trips in 2030 were also developed with reference to other schemes included in the Core and Extended Baselines provided by the AC, which are detailed in Appendix A. Following a review of the rail schemes included in both baselines, it was decided that only two were likely to have a significant impact on rail mode choice to Gatwick as secondary connecting rail modes - Crossrail and HS2 (excluding the HS1-HS2 spur following the Government's decision to remove this from the core HS2 scheme). GC estimates accounted for the likely impact of these two schemes on rail frequencies, journey times and the number of interchanges required to reach Gatwick.

3.2.5 All other baseline schemes affecting the network were judged unlikely to have a significant impact on final rail mode choice to Gatwick. These schemes included a number of London rail schemes listed in the Extended Baseline including Crossrail 2, the Bakerloo line southern extension, Overground Gospel Oak to Barking Riverside, DLR extensions to Catford and Bromley, and the Northern Line extension to Nine Elms and Battersea. It was assumed that these schemes would only impact on some local mode choices and would not make a significant difference to the overall mode share calculations, and so they were not referenced in GC calculations.

Deployment of the European Railway Traffic Management System (ERTMS)

3.2.6 Some additional capacity may be provided by 2030 via the ERTMS Level 2 without line-side signals, which is being progressively deployed in the UK – NR are currently examining implementation dates for the BML. ERTMS will remove some of the constraints of line-side signal block boundaries and establish minimum separation times based on the maximum permitted speed and braking characteristics of rolling stock. This headway reduction theoretically increases line capacity.

3.2.7 There are other constraints however in exploiting ERTMS capacity benefits, which include the ability to terminate and despatch trains from terminal locations, general terminal capabilities, capacity constraints at junctions and differing train speeds. In general the BML is currently recognised as an intensive urban service which is efficiently timetabled and operated. It is difficult at the present time therefore to quantify the capacity benefits ERTMS may be able to offer prior to full system modelling and for this reason, the impact of ERTMS on capacity has not been accounted for in this assessment.

3.3 2030 rail capacity analysis

3.3.1 The rail demand forecasts derived from the mode shares summarised in Chapter 2 for the rail option summarised above were allocated to rail corridors based on information about the components of the rail journeys used to calculate GC in the model. Airport-related rail demand by corridor was then compared with estimates of rail capacity and background demand to identify potential issues. Table 8 summarises the results of this process, which provided the basis for the assessment (from a rail perspective) of the second runway proposal against **Objective 2** in the AC's Appraisal Framework, which is 'to accommodate the needs of other users of transport networks, such as commuters, intercity travellers and freight'.

3.3.2 NR provided figures for seated and total capacity and 2023 background demand in the Up direction towards London by line section based on their modelling of the post-2018 TSGN timetable. Total capacity on the Class 700 Thameslink rolling stock expected to be used on services through London

Bridge was based on an assumed upper threshold of 0.25m^2 per standing passenger, which is in line with assumptions used in the assessment of capacity on Crossrail and the Piccadilly Line undertaken for the Heathrow expansion options. In contrast, an upper limit of 0.45m^2 per standing passenger was applied to the Class 377 rolling stock expected to be used on services to Victoria and those terminating at London Bridge. This latter threshold was based on research undertaken by NR, which indicated that due to the configuration of seats it is not possible to load standard commuter trains to the same extent as new metro-style rolling stock.

3.3.3 The 2023 background demand was factored up by 7.8% to estimate 2030 demand – this factor was derived from forecasts for total high-peak demand for Sussex fast services to London, which is expected to increase from 38,400 passengers in 2023 to 47,600 passengers in 2043[1]. NR do not undertake any demand modelling for services in the Down direction away from London but advised that applying a factor of 0.5 to the equivalent Up direction forecasts would be a reasonable approach to allocating demand to Down direction services – the resultant Down direction background demand estimates are highlighted in red in the table.

3.3.4 The background demand estimates provided by NR were based on the assumption that Gatwick Airport remains in its current form with a single runway in place in 2030. As a result, it was necessary to deduct the Option 0 (single runway) airport rail forecast from the background demand before adding the Option 3 (two runways) forecast. This meant that the net impact of the second runway could be assessed without double-counting any rail trips to and from the airport. This net impact amounted to up to 1,200 additional rail trips to the airport in the 2030 AM peak-hour with up to 750 additional trips leaving the airport in the same time period.

3.3.5 The table indicates that the background demand estimates provided by NR for GEX in 2030 are higher than the forecasts for Option 0 and Option 3 arising from the Jacobs model. The Jacobs forecasts only include air passengers and airport staff using rail services, while NR indicated that a significant proportion of the current demand for GEX during peak periods is not related to the airport, consisting of commuters taking advantage of the fast connection to Victoria (including those traveling from areas south of the airport as a result of the extension of the 4 GEX paths to Brighton during peak periods). The NR forecasts for 2030 assume that this practice will continue, explaining the difference in the numbers. As a result, Jacobs has applied the same approach to assessing capacity on GEX as that applied to standard rail services, adding the net impact of the second runway (Option 3 less Option 0) to the NR background forecast.

3.3.6 It was noted that in the GAL submission the rail network was tested based on an aspirational headline mode share target of 50% of air passengers travelling to and from the airport by rail. This target is higher than the forecast of 43% passenger rail mode share arising from the Jacobs 2030 model and as a result, a sensitivity test was run with a 50% rail mode share assumption for passengers included for Option 3 with the second runway in place. The results of this sensitivity test are summarised in Table 9, which indicates that the net impact of the second runway in this scenario amounts to up to 1,700 additional rail trips to the airport as a result of the second runway in the peak hour in 2030 and just over 1,100 additional rail trips leaving the airport in the same time period.

3.3.7 A key point to note is that the analysis detailed in this report does not account for any additional journeys made on the rail network as a result of local indirect or induced employment or wider area catalytic growth arising from a second runway at Gatwick. Such demand may increase background rail demand in the vicinity of the airport.

3.3.8 The initial conclusions arising from the capacity analysis described above are as follows:

- in the central scenario, the net impact of the second runway at Gatwick in terms of rail passenger volumes is likely to constitute a very low proportion of total demand on the BML in 2030 – even on the section of line where airport passengers are most concentrated (between Three Bridges and Redhill), overall VCR as a result of the second runway increases by less than 2%;

[1] Source: LSE Market Study (2013), 'London Bridge and Victoria fast critical loads in high peak'

- airport passengers travelling into central London during the AM peak hour should not have any issues boarding trains at the airport station as overall forecast total VCR on the section of line between the airport and Redhill is at 40% including second runway-related passengers – it should be noted that this includes BML services on both slow and fast lines – when the fast line is considered separately, overall background VCR rises to 50%;
- the overall seated VCR is forecast at 82% including second runway passengers on the same section between the airport and Redhill, which suggests that across all services there will be a sufficient number of seats to accommodate airport passengers leaving Gatwick and travelling towards London – however, when the fast line services are considered separated, background seated VCR increases to 98% on this section, suggesting that spare seats available in the AM peak hour will predominantly be available on slow line services that will be unattractive to airport passengers seeking to travel into central London;
- on all sections of line, the network is likely to have sufficient capacity to accommodate forecast demand in 2030 including airport passengers associated with the second runway, although passengers are likely to experience crowded conditions on the approach to London Bridge – the section of this branch north of East Croydon has an overall VCR of 87% with the additional airport passengers – accounting for demand fluctuations across the peak hour and the uneven loading of carriages suggests that some passengers may experience very crowded conditions on certain services into London Bridge in the AM peak – it should however be noted that this issue is not caused by the second runway as the forecast VCR based purely on background demand on this section of line is already at 86%;
- the AM peak crowding on the East Croydon to London Bridge section suggests that during the PM peak, airport passengers are likely to experience crowded conditions when attempting to board trains on the Thameslink branch in central London to access the airport, although it should be noted that the PM peak hour has not been modelled as part of this study;
- the very low proportion of passengers on the BML during the forecast AM peak hour in 2030 who are air travellers or airport employees means that the sensitivity test with a 50% rail mode share for rail passengers does not change the conclusions associated with the central scenario, as summarised above.

3.3.9 Although not an issue that can be attributed to the second runway, NR's growth forecasts for the BML suggest that the East Croydon to London Bridge section of line will be at 100% of total capacity due to background demand by the mid-2040s even if all the infrastructure in the Extended Baseline is delivered. Given Gatwick's current reliance on the BML for rail connections to London and much of the rest of the UK, we feel that this represents a potential long-term risk to airport expansion plans. Further consideration of the infrastructure issues associated with increasing capacity on the BML is provided later on in this chapter.

3.3.10 It should also be noted that providing sufficient capacity to accommodate demand on the network in 2030 is dependent on the delivery of the identified and currently uncommitted schemes included in the Extended Baseline, as described in the first section of this chapter. If these schemes are not delivered and capacity enhancements are limited to the committed infrastructure associated with the post-2018 TSGN timetable, the East Croydon-London Bridge section of line reaches around 95% of total capacity by 2030, resulting in airport passengers experiencing severe over-crowding on services in the peak hour and some non-airport passengers unable to board services from platforms at East Croydon and stations to the north.

Table 8: 2030 rail capacity analyses

Line	Section (between)	Direction (related to Gatwick)	Direction (related to London)	*2030 capacity + background demand*							*Gatwick Airport rail forecast flows*		*Gatwick + background rail forecast V/C*	
				Gatwick train paths (NR info)	Total train paths (NR info)	Hourly capacity (seated)	Hourly capacity (total)[2]	2030 background passengers	2030 background V/C (seated)	2030 background V/C (total)	Option 3 (Gatwick submission)	Option 0 (one runway)	Option 3 (2nd runway) NET - seated	Option 3 (2nd runway) NET - total
GEX	Victoria-Airport	To	Down	4	4	2,880	4,752	1,730	60%	36%	949	621	71%	43%
GEX	Airport-Victoria	From	Up	4	4	2,880	4,752	3,460	120%	73%	689	461	128%	78%
Brighton Main Line (South)	Brighton-Burgess Hill	To	Up	13	13	9,060	18,384	6,202	68%	34%	222	155	69%	34%
Brighton Main Line (South)	Burgess Hill-Three Bridges	To	Up	19	19	13,320	26,100	11,581	87%	44%	330	234	88%	45%
Brighton Main Line (South)	Three Bridges-Airport	To	Up	28	28	19,080	38,352	14,651	77%	38%	648	479	78%	39%
Brighton Main Line (North)	London Bridge-East Croydon	To	Down	12	20	12,460	29,288	12,585	101%	43%	792	533	103%	44%
Brighton Main Line (North)	Victoria-Clapham Junction	To	Down	14	18	12,720	20,988	6,036	47%	29%	649	460	49%	30%
Brighton Main Line (North)	Clapham Junction-East Croydon	To	Down	14	18	12,720	20,988	6,036	47%	29%	1,043	724	50%	30%
Brighton Main Line (North)	East Croydon-Redhill	To	Down	26	26	18,120	36,768	9,149	50%	25%	1,953	1,340	54%	27%
Brighton Main Line (North)	Redhill-Airport	To	Down	28	28	17,520	35,778	6,990	40%	20%	2,119	1,460	44%	21%
Brighton Main Line (South)	Airport-Three Bridges	From	Down	28	28	19,080	38,352	7,325	38%	19%	277	193	39%	19%
Brighton Main Line (South)	Three Bridges-Burgess Hill	From	Down	19	19	13,320	26,100	5,790	43%	22%	187	129	44%	22%
Brighton Main Line (South)	Burgess Hill-Brighton	From	Down	13	13	9,060	18,384	3,101	34%	17%	136	94	35%	17%
Brighton Main Line (North)	Airport-Redhill	From	Up	28	28	17,520	35,778	13,979	80%	39%	1,398	965	82%	40%
Brighton Main Line (North)	Redhill-East Croydon	From	Up	26	26	18,120	36,768	18,298	101%	50%	1,321	913	103%	51%
Brighton Main Line (North)	East Croydon-Clapham Junction	From	Up	14	18	12,720	20,988	12,071	95%	58%	709	498	97%	59%
Brighton Main Line (North)	Clapham Junction-Victoria	From	Up	14	18	12,720	20,988	12,071	95%	58%	449	323	96%	58%
Brighton Main Line (North)	East Croydon-London Bridge	From	Up	12	20	12,460	29,288	25,171	202%	86%	543	369	203%	87%
North Downs (Reading) Line	Guildford (Dorking)-Redhill	To	~	2	2	360	594	87	24%	15%	121	87	34%	21%
North Downs (Reading) Line	Redhill-Guildford (Dorking)	From	~	2	2	360	594	175	49%	29%	57	38	54%	33%
Tonbridge Main Line	Tonbridge-Redhill	To	Up	0	2	960	1,584	299	31%	19%	7	5	31%	19%
Tonbridge Main Line	Redhill-Tonbridge	From	Down	0	2	960	1,584	149	16%	9%	5	3	16%	10%
Horsham Branch Line	Horsham-Three Bridges	To	Up	5	5	3,480	7,116	2,352	68%	33%	132	94	69%	34%
Horsham Branch Line	Three Bridges-Horsham	From	Down	5	5	3,480	7,116	1,176	34%	17%	70	48	34%	17%
										TOTAL (to)	3,716	2,560		
										TOTAL (from)	2,364	1,619		

[2] NR capacity and background demand estimates include all services operating on each line section. South of Gatwick, all available rail capacity is assumed to be standard rail services including the 4 GEX train paths between the airport and Brighton, as explained in Section 2.4. North of Gatwick the 4 GEX paths are assumed to be premium services and have been separated out in the analysis from standard services. As a result, standard rail capacity quoted on the section of the BML between Redhill and the airport to the north is lower than on the section between Three Bridges and the airport to the south.

Table 9: Rail capacity sensitivity test – Option 3 forecast with 50% rail mode share

Line	Section (between)	Direction (related to Gatwick)	Direction (related to London)	*2030 capacity + background demand*							*Gatwick Airport rail forecast flows*		*Gatwick + background rail forecast V/C*	
				Gatwick train paths (NR info)	Total train paths (NR info)	Total hourly capacity (seated)	Total hourly capacity (total)	2030 background passengers	2030 background V/C (seated)	2030 background V/C (total)	Option 3 (Gatwick submission)	Option 0 (one runway)	Option 3 (2nd runway) NET - seated	Option 3 (2nd runway) NET - total
GEX	Victoria-Airport	To	Down	4	4	2,880	4,752	1,730	60%	36%	1,067	621	76%	46%
GEX	Airport-Victoria	From	Up	4	4	2,880	4,752	3,460	120%	73%	775	461	131%	79%
Brighton Main Line (South)	Brighton-Burgess Hill	To	Up	13	13	9,060	18,384	6,202	68%	34%	231	155	69%	34%
Brighton Main Line (South)	Burgess Hill-Three Bridges	To	Up	19	19	13,320	26,100	11,581	87%	44%	343	234	88%	45%
Brighton Main Line (South)	Three Bridges-Airport	To	Up	28	28	19,080	38,352	14,651	77%	38%	691	479	78%	39%
Brighton Main Line (North)	London Bridge-East Croydon	To	Down	12	20	12,460	29,288	12,585	101%	43%	979	533	105%	44%
Brighton Main Line (North)	Victoria-Clapham Junction	To	Down	14	18	12,720	20,988	6,036	47%	29%	711	460	49%	30%
Brighton Main Line (North)	Clapham Junction-East Croydon	To	Down	14	18	12,720	20,988	6,036	47%	29%	1,183	724	51%	31%
Brighton Main Line (North)	East Croydon-Redhill	To	Down	26	26	18,120	36,768	9,149	50%	25%	2,290	1,340	56%	27%
Brighton Main Line (North)	Redhill-Airport	To	Down	28	28	17,520	35,778	6,990	40%	20%	2,480	1,460	46%	22%
Brighton Main Line (South)	Airport-Three Bridges	From	Down	28	28	19,080	38,352	7,325	38%	19%	308	193	39%	19%
Brighton Main Line (South)	Three Bridges-Burgess Hill	From	Down	19	19	13,320	26,100	5,790	43%	22%	196	129	44%	22%
Brighton Main Line (South)	Burgess Hill-Brighton	From	Down	13	13	9,060	18,384	3,101	34%	17%	143	94	35%	17%
Brighton Main Line (North)	Airport-Redhill	From	Up	28	28	17,520	35,778	13,979	80%	39%	1,660	965	84%	41%
Brighton Main Line (North)	Redhill-East Croydon	From	Up	26	26	18,120	36,768	18,298	101%	50%	1,566	913	105%	52%
Brighton Main Line (North)	East Croydon-Clapham Junction	From	Up	14	18	12,720	20,988	12,071	95%	58%	811	498	97%	59%
Brighton Main Line (North)	Clapham Junction-Victoria	From	Up	14	18	12,720	20,988	12,071	95%	58%	494	323	96%	58%
Brighton Main Line (North)	East Croydon-London Bridge	From	Up	12	20	12,460	29,288	25,171	202%	86%	679	369	205%	87%
North Downs (Reading) Line	Guildford (Dorking)-Redhill	To	~	2	2	360	594	87	24%	15%	143	87	40%	24%
North Downs (Reading) Line	Redhill-Guildford (Dorking)	From	~	2	2	360	594	175	49%	29%	72	38	58%	35%
Tonbridge Main Line	Tonbridge-Redhill	To	Up	0	2	960	1,584	299	31%	19%	8	5	31%	19%
Tonbridge Main Line	Redhill-Tonbridge	From	Down	0	2	960	1,584	149	16%	9%	6	3	16%	10%
Horsham Branch Line	Horsham-Three Bridges	To	Up	5	5	3,480	7,116	2,352	68%	33%	161	94	70%	34%
Horsham Branch Line	Three Bridges-Horsham	From	Down	5	5	3,480	7,116	1,176	34%	17%	91	48	35%	17%
										TOTAL (to)	4,238	2,560		
										TOTAL (from)	2,743	1,619		

3.4 Crowding on rail services

3.4.1 The forecast VCRs on key sections of the rail network with background plus airport demand, calculated and described above, were used to estimate the average level of crowding experienced by rail passengers travelling to and from Gatwick in 2030.

3.4.2 For the purposes of this analysis, the overall level of crowding experienced by passengers was assumed to equate to the worst level of crowding they experienced on the last leg of their rail journey to Gatwick, excluding any crowding issues on connecting modes (analysis of which was not within the scope of this study).

3.4.3 In the case of standard rail services on the BML, the worst level of crowding experienced was related to where passengers were assumed to board services. For example when travelling to the airport, those boarding at Victoria experience worse levels of crowding than those boarding at East Croydon.

3.4.4 Summary crowding levels are shown for 2030 in Table 10. It should be noted that the passenger numbers quoted are sourced from the rail capacity tables provided above but represent non-cumulative totals on each section of line – in effect those passengers who start their journey, or join from a branch line, on that particular section.

Table 10: Average crowding weighted by demand on Gatwick services in 2030

Line	Section (between)	Direction (related to Gatwick)	VCR (background + airport)	Passenger forecast (non-cumulative)
GEX	Victoria-Airport	To	43%	949
GEX	Airport-Victoria	From	78%	689
Brighton Main Line (South)	Brighton-Burgess Hill	To	34%	222
Brighton Main Line (South)	Burgess Hill-Three Bridges	To	45%	108
Brighton Main Line (South)	Three Bridges-Airport	To	39%	318
Brighton Main Line (North)	London Bridge-East Croydon	To	44%	792
Brighton Main Line (North)	Victoria-Clapham Junction	To	30%	649
Brighton Main Line (North)	Clapham Junction-East Croydon	To	30%	394
Brighton Main Line (North)	East Croydon-Redhill	To	27%	119
Brighton Main Line (North)	Redhill-Airport	To	21%	166
Brighton Main Line (South)	Airport-Three Bridges	From	19%	90
Brighton Main Line (South)	Three Bridges-Burgess Hill	From	22%	51
Brighton Main Line (South)	Burgess Hill-Brighton	From	17%	136
Brighton Main Line (North)	Airport-Redhill	From	40%	77
Brighton Main Line (North)	Redhill-East Croydon	From	51%	69
Brighton Main Line (North)	East Croydon-Clapham Junction	From	59%	260
Brighton Main Line (North)	Clapham Junction-Victoria	From	58%	449
Brighton Main Line (North)	East Croydon-London Bridge	From	87%	543
Total AM Peak hour rail passengers			**TO**	**3,716**
			FROM	**2,364**
Average VCR (weighted by forecast demand)			**TO**	**38%**
			FROM	**65%**

3.5 Infrastructure capacity issues

3.5.1 As summarised earlier in this chapter, the rail capacity assessment undertaken based on outputs from the Jacobs model indicated that while no serious capacity issues are evident in 2030, current NR growth forecasts suggest that issues are likely to emerge on rail services towards London Bridge in the AM peak hour by the mid-2040s. As a result, Jacobs has undertaken a high-level review of the implications of increasing capacity on the BML beyond the committed measures associated with the post-2018 TSGN timetable and the uncommitted schemes in the Extended Baseline that may be delivered in CP6 or beyond. It should be noted that the options discussed below do not constitute an exhaustive list of proposals for increasing rail capacity beyond the schemes listed in the Extended Baseline.

3.5.2 The BML in its current form between East Croydon and Redhill is the result of competition between railway companies in the Victorian era. The original line through Merstham was built by the London and Brighton Railway but was part-funded by the South Eastern Railway who shared running rights from East Croydon to Redhill. The line through the North Downs required long deep cuttings and a tunnel of more than a mile in length. At the time, much of the route was sparsely populated but it has since been extensively developed as the London suburbs expanded.

3.5.3 Following disputes between the two companies, the London, Brighton and South Coast Railway (the successor to the London and Brighton Railway) built its own line between Coulsdon North and Earlswood, bypassing the South Eastern stations. The new line, known as the Quarry Line today provides the route for fast services between London and Brighton while stopping services continue to travel via Redhill. As with the Merstham Line, the Quarry Line was also a major infrastructure project including a cutting 100ft deep and the 1.2 mile Quarry Tunnel.

3.5.4 This historical rivalry provides almost two separate railways from London to Redhill, with four tracks continuing south from the junction at Earlswood to Gatwick Airport. The two lines have provided resilience when one has had to be closed for maintenance but because of the deep cuttings, they are still vulnerable to flooding, although the Quarry Line has received some major investment from NR to improve drainage.

3.5.5 There has been much recent investment and more is planned by NR for the pinch points on the route, but the analysis undertaken as part of this study suggests that further investment will be needed beyond that planned for CP6 and CP7 to accommodate demand in the 2040s. A number of options have been considered and are discussed in more detail in the remainder of this section.

Lengthening proposed services to 12-car

3.5.6 NR's capacity assumptions for the post-2018 TSGN timetable indicate that 196 carriages will be provided between East Croydon and London Bridge across 18 train services during the high peak hour, suggesting that further capacity could be delivered by extending all services operating on the link to 12-car formation. Two service groups on the link are currently proposed to operate with formations of less than 12 cars: the Uckfield service and the Caterham/Tattenham Corner services.

3.5.7 The Uckfield service currently operates in 8-car formation and is proposed to be operated by 10-car Class 171 diesel trains with a stated capacity of 1,020 passengers per train post 2018, indicating that this line is not expected to be electrified post 2018. With electrification and the extension of platforms for 12-car services, another 4 carriages per hour could be added to the East Croydon-London Bridge section, amounting to space for 1,512 additional passengers across the two peak hour services if Class 700 trains were used.

3.5.8 The Caterham and Tattenham Corner services are proposed to be operated by 10-car Class 377 units to Victoria and 8-car Class 700 units to London Bridge. The London Bridge services could be lengthened in a number of ways to provide greater capacity north of East Croydon. The 10-car Victoria services are formed of 2 x 5 car units attaching and detaching at Purley, which means that 10-car services could operate to London Bridge in the same way if additional Class 700 (or similar) rolling

stock was acquired in 5 car units. An alternative would be to remodel Purley station for 12-car operation, since the 10-car operational limit on Caterham/Tattenham Corner services has historically been as a result of insufficient infrastructure at Purley to attach and detach 12-car sets. Resolving this limitation would allow the operation of 12-car services attaching and detaching at Purley into 2 x 6-car sets.

3.5.9 Both of the Caterham/Tattenham options described above would involve overcoming challenges. Operating 2 x 5-car or 2 x 6-car sets would have to be carefully managed and could possibly be captive to these services since the current Class 700 Thameslink order does not include 5 or 6-car sets. In addition, remodelling Purley station for 12-car operation would involve resolving track alignments and platform footprint issues.

3.5.10 An alternative and simpler option may be to remodel the track to Caterham/Tattenham Corner for 12-car operation but utilise Selective Door Opening at stations with short platforms, as currently happens on many 12-car London services that extend into rural areas. This would allow 12-car operation during peak periods, reverting to 8-car operation off-peak. However, it is still likely that additional rolling stock would be required to deliver this increased service provision.

3.5.11 Based on the crush capacity threshold of 0.25m^2 per standing passenger applied by NR to Class 700 rolling stock, the enhancements described above to Uckfield and Caterham/Tattenham Corner services could potentially provide space for up to 2,960 additional peak-hour trips between East Croydon and London Bridge. If this capacity was provided on top of that associated with the additional uncommitted infrastructure earmarked for CP6 and beyond, NR background demand forecasts would hit 100% of capacity on this link in the 2050s.

3.5.12 At this point it is likely that further significant investment will be required to enhance capacity between Gatwick and London, and 3 additional options have been considered in order of increasing levels of intervention as follows.

Specific train lengthening to 14- or 16-car lengths

3.5.13 This idea has provenance with both the Eurostar service from Waterloo to the Channel Tunnel and also the White Rose service, utilising Eurostar North of London sets between Kings Cross and York. The most obvious candidate for consideration would be the Gatwick Express service from Victoria to Gatwick, although it could be argued that this would require some dedicated platform extensions at Victoria, Gatwick and probably Brighton. Platforms would be extended at East Croydon and Haywards Heath if possible but it may be feasible to use Selective Door Opening instead.

3.5.14 It is unlikely however that a lengthened service could be accommodated on the East Croydon-London Bridge route due to the intensive cross-London Thameslink service. Two dedicated platforms would have to be considered at London Bridge Low Level (the terminating platforms) for the use of a dedicated London Bridge-Gatwick Express, probably also calling at East Croydon, Haywards Heath and Brighton. Services currently using those platforms would have to be re-routed to either Blackfriars or through the Thameslink tunnels.

3.5.15 While not ideal, this option may offer a solution providing additional capacity between East Croydon and London Bridge, especially for BML users who will benefit from Thameslink services.

General extension of train lengths to 14- or 16-car lengths

3.5.16 Although NR has just completed a programme of extending platforms on the suburban routes to London Bridge to 12-car, a further major extension programme would be both expensive and disruptive. London Bridge and Victoria stations would need major remodelling to extend their platforms and the restrictions in the station throat area might require additional land. An extension at East Croydon would impact on the complex junctions north of the station while most other major stations on

the BML, including Brighton, Haywards Heath, Three Bridges and Gatwick Airport itself would require significant remodelling.

Re-opening of the Uckfield-Lewes branch line

3.5.17 It has been suggested in some quarters that if the Uckfield-Lewes branch line was reopened, some peak time services could be diverted releasing additional capacity on the BML. While this may be feasible, it is Jacobs' view that it would provide minimal benefits for Gatwick services for the following reasons:

- the route would be longer and would likely operate at slower speeds than the BML – while it may be possible to build a case for diverting some Eastbourne services this way, it would be significantly more difficult for core services to Brighton;
- there is likely to be little demand for more services via Uckfield due to the distance from the main towns on the BML and the Coastway routes;
- the diverted services would still need to be accommodated north of East Croydon where the greatest pressure on capacity has been identified.

Double-decking

3.5.18 While common-place overseas where line capacity is limited, double-decking in the UK has to-date only had one long but unsuccessful trial on services from Charing Cross to Dartford between 1949 and 1971. The primary reason for this is because of the restricted loading gauge in the UK compared with other countries whose railways were developed at a later date.

3.5.19 Double-decking is currently being considered for some routes although the East Croydon-London Bridge route is not among them due to modifications for Thameslink services with an increase in the number of through-services running direct into the Thameslink tunnels and a reduction in services terminating at London Bridge. With limited capacity in the terminating platforms at London Bridge, it is likely that any gauge works would also have to include the Thameslink tunnels and routes north of London.

3.5.20 While technically possible, gauge clearance on this scale could be considered on a par with the challenges facing the original railway construction engineers and as well as being expensive, would be extremely disruptive. It would also be likely that enlarging of the Balcombe and Clayton Tunnels south of Gatwick would require a long closure without an alternative route to maintain services.

3.5.21 One benefit of the BML would be that while either Merstham or the Quarry Tunnels are closed for enlarging, a limited service could operate on the alternative route, although it should be recognised that this method of operation would probably be unsustainable for more than a limited number of weeks.

Provision of a new tunnel

3.5.22 It is likely that the optimum means of running more services between Gatwick and London beyond 2050 would be to construct a major new tunnel providing new capacity into (and through) central London. Any such tunnel would probably have to start around Purley or further south, a distance of some 12 miles from London Bridge, and an underground station at Croydon would probably be required to meet future demand. Such a proposal would obviously incur significant expense.

3.6 Resilience issues

3.6.1 As mentioned in the previous section, the railway from London to Gatwick Airport is predominantly two originally separate railways built by competing companies during the Victorian era. This provided eight

tracks from Victoria and London Bridge to East Croydon and four tracks from East Croydon to Gatwick Airport.

3.6.2 During normal operation, this allows some resilience as even with two tracks closed, services can continue on the other two tracks – an approach that is usually exploited during planned engineering works. A second benefit of the Gatwick services is having more than one London terminal to operate between, which is important for passengers when one of the main London stations is closed by, for example, a security alert or a fire evacuation.

3.6.3 It has also been suggested that if the Uckfield-Lewes line was reopened, some Brighton and East Coastway services could be diverted via this new route (with West Coastway services diverted via Horsham and the Arun Valley), releasing some limited capacity for airport services if the line between East Croydon and Gatwick Airport was partially blocked. It should be noted that this benefit could only be realised if two tracks were available between East Croydon and Gatwick Airport.

3.6.4 Therefore, while north of East Croydon, disruptive incidents (or example power supply failures, signalling failures and track trespassing incidents) leave a second alternative route, depending on the exact location, these events between East Croydon and Gatwick Airport (particularly south of Redhill) can lead to a total suspension of services.

3.6.5 Performance data provided by NR indicates that 22 'four-line block' incidents requiring the closure of the BML have occurred in the last three years on the section between London and Gatwick, an average of just over 7 per year. Of these events, approximately 70% involved fatalities and it is noted that in these circumstances, NR aim to re-open the line within 90 minutes. NR has indicated that further analysis is required to investigate the challenges and opportunities regarding contingency planning on the BML in future.

3.7 Level of service analysis

3.7.1 In addition to rail capacity, the 2030 Jacobs model was also used to assess the impact of proposed enhancements to rail services to and from Gatwick on passenger journey time and cost. Overall demand-weighted averages were calculated from model outputs and then compared with averages derived from the calibrated base model. The results of this process are summarised in this section, and contributed to the assessment of the second runway proposal against **Objective 3** in the AC's Appraisal Framework, which is 'to enable access to the airport from a wide catchment area'.

Generalised Costs (GCs)

3.7.2 GC provides a measure that takes into account not only the total journey duration but also impacts related to journey comfort, wait times and interchanges required (in the case of public transport), and the monetary cost of the journey (covering public transport fares and car operating costs). As explained in the Methodology Statement, estimates of GC for car, bus/coach and rail trips between Gatwick and districts in the UK were the primary input to the Jacobs 2030 logit mode share model, which was developed to forecast demand to and from the airport.

3.7.3 Based on the assumptions used to develop the central scenario, the 2030 Jacobs model indicated that the overall demand-weighted average GC of a rail journey to Gatwick would be **139 minutes**. This compares with a 2012 value of **151 minutes** derived from the base model, and suggests that the overall cost of a rail journey (related to journey time, number of interchanges and overall fare) to Gatwick is expected to reduce by 2030.

3.7.4 However, a key point to note is that the above estimates of average GC for 2012 and 2030 both include an assumed Value of Time (VoT) of 27p per minute for leisure passengers and 69p for business passengers, and the 2030 model assumes no real increase in public transport fares by 2030. As explained in the Methodology Statement, DfT forecasts suggest that VoT is likely to increase significantly by 2030 but if the current government's cap on rail fare increases of Retail Price Index (RPI) + 1 point is maintained between now and then, real increases in rail fares are likely to largely

cancel out the rise in VoT for rail trips. If the previous government's cap of RPI + 3 points was reintroduced, rail trips would be significantly more expensive in real terms by 2030.

3.7.5 As a result of the uncertainties surrounding future changes in rail fares, the central scenario in the Jacobs 2030 model assumed no changes in real values between now and 2030. The central scenario did however assume an increase in the proportion of airport passengers travelling for business purposes in 2030 with a second runway in place. The higher VoT associated with business travel may in part explain the average rail GC saving identified above.

Journey times

3.7.6 In order to provide more clarity on rail service improvements, the components of GC related to fares and penalties applied for wait and interchange times were removed – the remaining components effectively comprised a real clock time estimate for rail trips between Gatwick and each district. This real clock time consisted of total in-vehicle time (including connecting taxi trip time where this was a secondary mode for GEX services), wait time (based on service frequency) and interchange time. It should be noted that the clock times reported in this section do not include first and last leg walk times for any journey.

3.7.7 Clock time estimates were weighted by forecast demand based on the mode shares described earlier to calculate an overall average time to reach Gatwick by rail in 2012 and in 2030, summarised in Table 11 – these averages were based on the same methodology used to calculate the overall average GC described above. If employees are included in the demand-weighted average calculation this reduces the average clock time, reflecting the fact that employees tend to be clustered close to the airport.

Table 11: Demand-weighted average rail journey times for airport passengers (minutes)

Year	Standard rail	GEX (all)	All rail
2012	72	58	67
2030	63	65	64

3.7.8 The overall average clock time for rail journeys is expected to reduce by 3 minutes in 2030 when compared with 2012. Average clock time by standard rail decreases substantially from 72 minutes to 63 minutes, driven by improvements to standard rail services (more direct connections via the Thameslink core and increased service frequency on the BML). However, the demand-weighted average rail journey time by GEX is longer in 2030, primarily because of the skewed distribution of GEX trips in 2012.

3.7.9 For example, the table indicates that the demand-weighted average GEX clock time was 58 minutes in 2012, but the CAA data indicates that over 60% of all GEX trips originated in three London Boroughs (Westminster, Kensington & Chelsea, and Camden) with GEX clock times lower than this average. The expected improvement in standard rail clock times from these boroughs in 2030 therefore effectively results in the transfer to standard rail of a large number of GEX trips with lower-than-average 2012 clock times. This results in an increase in average GEX travel time in 2030 when weighted by demand from different districts, although in many cases the actual GEX travel time between the airport and individual districts does not change.

3.7.10 Figure 9 and Figure 10 show the current and 2030 forecast distributions of rail clock times to Gatwick weighted by passenger demand. Journey times are shown in 5-minute increments with the upper limit indicated – the first graph indicates for example that in 2012 approximately 29% of all passengers spent between 45 and 50 minutes travelling to the airport by rail based on the calibrated Jacobs 2012 model.

Figure 9: Gatwick 2012 rail clock times by passenger demand

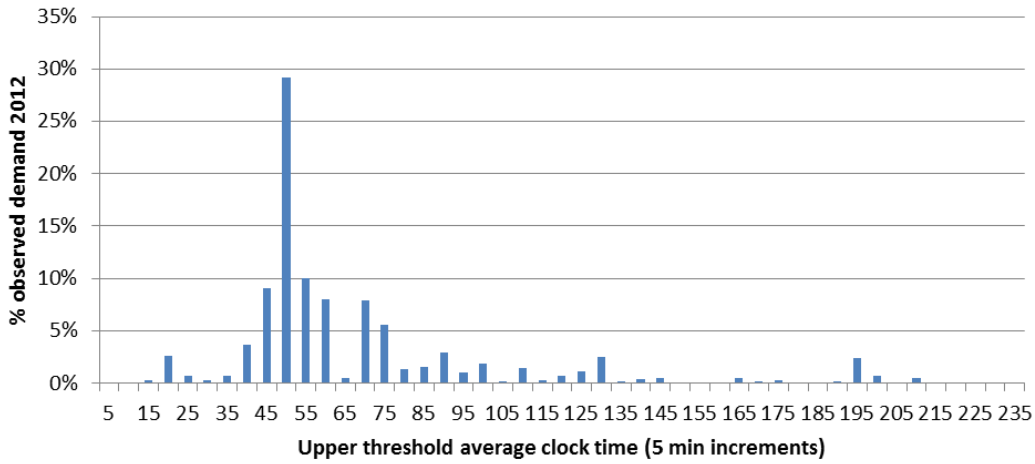


Figure 10: Gatwick 2030 rail clock times by passenger demand

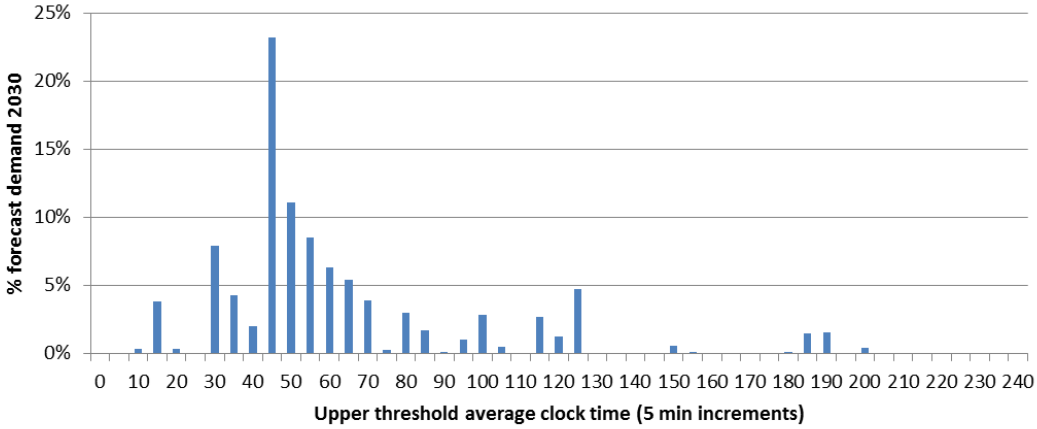
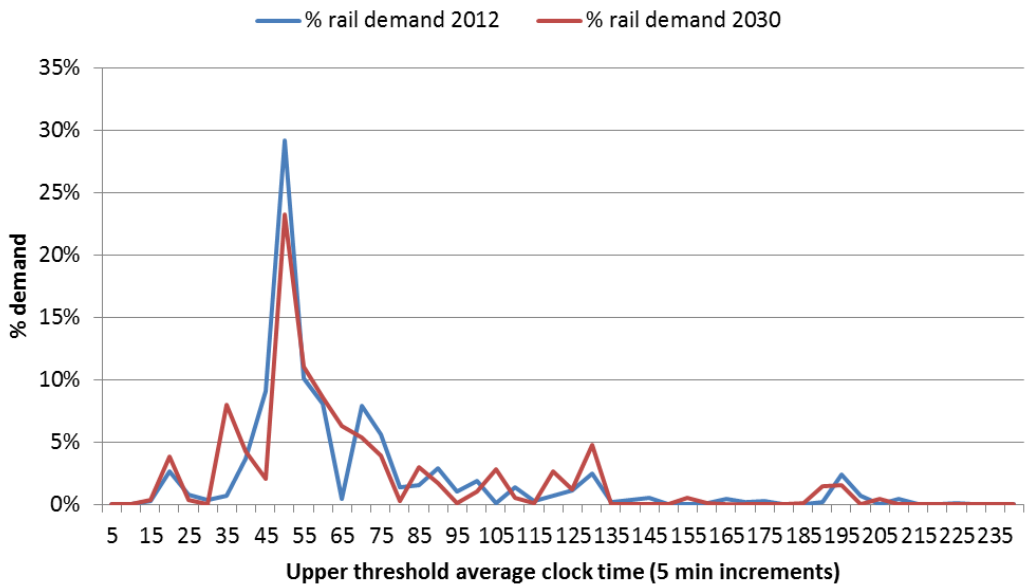


Figure 11: Rail clock time analysis – Gatwick 2012 v 2030



3.7.11 Figure 11 compares the average rail clock time demand profiles for 2012 and 2030 as illustrated and described above. This indicates that overall, the distribution of rail times to the airport changes very little between the two years – an increase in the proportion of rail trips taking 35 minutes or less is evident from the graph in 2030 when compared with 2012, which explains the slight reduction in the overall mean average rail clock time to the airport.

3.7.12 Table 12 shows the rail clock times for identified representative trips between Gatwick and districts that currently produce a high proportion of rail demand in the 2012 and 2030 Jacobs models, by both standard rail and GEX – in this instance only GEX trips with a secondary public transport connection were included. The table shows all 33 London Boroughs and the top ten districts outside London ranked according to the number of annual rail trips generated to Gatwick according to the 2012 CAA data.

3.7.13 The table highlights the reductions in standard rail journey times from London boroughs, which are mainly due to reduced waiting time arising from the increase in service frequencies on the BML.

Interchanges

3.7.14 Table 13 compares the number of interchanges that would need to be made by rail passengers making the same identified representative trips between Gatwick and the key trip generating districts in the Jacobs 2012 and 2030 models. It indicates that the number of interchanges from all the key districts does not change, although there are some districts where the number of interchanges will decrease, for example Cambridge which will have direct services to Gatwick via Thameslink.

3.7.15 The representative rail trip identified by Jacobs between Gatwick and each district for the purpose of developing a logit model was based on a qualitative assessment of the shortest GC route choice for each sub-rail mode. It should be noted that this identified shortest GC trip did not necessarily involve the shortest possible in-train time or the minimum number of interchanges feasible between Gatwick and each district as other factors, including service frequency and fare, had to be taken into account when identifying an appropriate route choice for each sub-rail mode.

Table 12: Comparison of rail clock times for representative trips from key districts to Gatwick in 2012 and 2030

District	Representative station	Gatwick 2012		Gatwick 2030		Difference	
		Standard rail	GEX	Standard rail	GEX	Standard rail	GEX
All 33 London boroughs (ranked by total rail passenger trips to Gatwick in 2012)							
Westminster	Oxford Circus	47	47	42	47	-5	0
Kensington and Chelsea	South Kensington	48	48	43	48	-5	0
Camden	Kings Cross St. Pancras	52	52	49	52	-3	0
Southwark	London Bridge	36	58	31	58	-5	0
Lambeth	Clapham High Street	43	57	38	57	-5	0
Wandsworth	Clapham Junction	33	54	28	54	-5	0
Tower Hamlets	Canary Wharf	48	64	43	64	-5	0
Islington	Highbury & Islington	56	56	51	56	-5	0
Croydon	East Croydon	19	68	17	68	-2	0
Hammersmith and Fulham	Hammersmith	58	58	53	58	-5	0
Hackney	Hackney Central	72	71	67	71	-5	0
Bromley	Bromley South BR	69	69	64	69	-5	0
Lewisham	New Cross	52	74	47	74	-5	0
Richmond upon Thames	Richmond	52	74	47	74	-5	0
Greenwich	Greenwich	54	85	49	85	-5	0
Ealing	Acton Town	69	69	64	69	-5	0
Brent	Wembley Park	70	74	65	74	-5	0
Merton	Wimbledon	50	72	45	72	-5	0
Haringey	Wood Green	70	70	66	70	-5	0
Hillingdon	Hatton Cross	91	91	87	91	-5	0
Kingston upon Thames	Surbiton	59	75	54	75	-5	0
Barnet	Finchley Central	75	76	70	76	-5	0
Hounslow	Hounslow Central	86	86	82	86	-5	0
Waltham Forest	Walthamstow Central	68	68	63	68	-5	0
Newham	Stratford	60	72	55	72	-5	0
Enfield	Cockfosters	86	86	82	86	-5	0
Sutton	Sutton Common	65	98	60	98	-5	0
City of London	Moorgate	50	64	45	64	-5	0
Redbridge	Redbridge	76	83	72	83	-5	0
Bexley	Bexley BR	70	N/A	65	N/A	-5	N/A
Havering	Upminster	78	N/A	73	N/A	-5	N/A
Harrow	South Harrow	88	88	84	88	-5	0
Barking and Dagenham	Barking	85	84	76	84	-9	0
Top 10 districts outside London (ranked by total rail passenger trips to Gatwick in 2012)							
Brighton and Hove	Brighton	41	122	32	122	-9	0
Eastbourne	Eastbourne	72	N/A	72	N/A	0	N/A
Portsmouth	Portsmouth Harbour	97	189	97	189	0	0
Reading	Reading	86	105	86	105	0	0
Mid Sussex	Haywards Heath	17	N/A	17	N/A	0	N/A
Southampton	Southampton	128	157	128	157	0	0
Arun	Littlehampton	81	N/A	81	N/A	0	N/A
Bristol, City of	Bristol Temple Meads	195	179	195	179	0	0
Guildford	Guildford	50	N/A	50	N/A	0	N/A
Horsham	Horsham	31	N/A	31	N/A	0	N/A

Notes: The definition of a 'GEX trip' in this instance refers to a rail journey that includes a premium fare component between London Victoria and Gatwick (non-premium fare trips utilising extended GEX train paths between Brighton and Gatwick during peak-hours are counted as standard rail); GEX clock times are listed for identified representative GEX trips involving a secondary public transport connection – in some cases the GC of a GEX trip involving a secondary taxi connection was lower; 'N/A' denotes districts where no GEX trips were recorded in 2012 during the CAA passenger survey – it has been assumed in the modelling that no GEX trips are made from these districts in 2030.

Table 13: Comparison of rail interchanges for representative trips from key districts to Gatwick in 2012 and 2030

District	Representative station	Gatwick 2012		Gatwick 2030		Difference	
		Standard rail	GEX	Standard rail	GEX	Standard rail	GEX
All 33 London boroughs (ranked by total rail passenger trips to Gatwick in 2012)							
Westminster	Oxford Circus	1	1	1	1	0	0
Kensington and Chelsea	South Kensington	1	1	1	1	0	0
Camden	Kings Cross St. Pancras	1	1	1	1	0	0
Southwark	London Bridge	0	2	0	2	0	0
Lambeth	Clapham High Street	1	2	1	2	0	0
Wandsworth	Clapham Junction	0	1	0	1	0	0
Tower Hamlets	Canary Wharf	1	2	1	2	0	0
Islington	Highbury & Islington	1	1	1	1	0	0
Croydon	East Croydon	0	1	0	1	0	0
Hammersmith and Fulham	Hammersmith	1	1	1	1	0	0
Hackney	Hackney Central	2	2	2	2	0	0
Bromley	Bromley South BR	1	1	1	1	0	0
Lewisham	New Cross	1	3	1	3	0	0
Richmond upon Thames	Richmond	1	2	1	2	0	0
Greenwich	Greenwich	1	2	1	2	0	0
Ealing	Acton Town	1	1	1	1	0	0
Brent	Wembley Park	1	2	1	2	0	0
Merton	Wimbledon	1	1	1	1	0	0
Haringey	Wood Green	2	2	2	2	0	0
Hillingdon	Hatton Cross	2	2	2	2	0	0
Kingston upon Thames	Surbiton	1	2	1	2	0	0
Barnet	Finchley Central	1	2	1	2	0	0
Hounslow	Hounslow Central	2	2	2	2	0	0
Waltham Forest	Walthamstow Central	1	1	1	1	0	0
Newham	Stratford	1	2	1	2	0	0
Enfield	Cockfosters	2	2	2	2	0	0
Sutton	Sutton Common	1	2	1	2	0	0
City of London	Moorgate	2	2	2	2	0	0
Redbridge	Redbridge	2	2	2	2	0	0
Bexley	Bexley BR	1	N/A	1	N/A	0	N/A
Havering	Upminster	2	N/A	2	N/A	0	N/A
Harrow	South Harrow	2	2	2	2	0	0
Barking and Dagenham	Barking	2	2	2	2	0	0
Top 10 districts outside London (ranked by total rail passenger trips to Gatwick in 2012)							
Brighton and Hove	Brighton	0	1	0	1	0	0
Eastbourne	Eastbourne	0	N/A	0	N/A	0	N/A
Portsmouth	Portsmouth Harbour	0	3	0	3	0	0
Reading	Reading	0	3	0	3	0	0
Mid Sussex	Haywards Heath	0	N/A	0	N/A	0	N/A
Southampton	Southampton	0	3	0	3	0	0
Arun	Littlehampton	0	N/A	0	N/A	0	N/A
Bristol, City of	Bristol Temple Meads	1	2	1	2	0	0
Guildford	Guildford	0	N/A	0	N/A	0	N/A
Horsham	Horsham	0	N/A	0	N/A	0	N/A

Notes: The definition of a 'GEX trip' in this instance refers to a rail journey that includes a premium fare component between London Victoria and Gatwick (non-premium fare trips utilising extended GEX train paths between Brighton and Gatwick during peak-hours are counted as standard rail); GEX interchanges are listed for identified representative GEX trips involving a secondary public transport connection – in some cases the GC of a GEX trip involving a secondary taxi connection was lower; 'N/A' denotes districts where no GEX trips were recorded in 2012 during the CAA passenger survey – it has been assumed in the modelling that no GEX trips are made from these districts in 2030.

4. Roads assessment

4.1 Introduction

4.1.1 The methodology for assessing the impact of the second runway at Gatwick on road capacity is described in the Methodology Statement. As indicated in that report, a key aim was to establish the capacity enhancements that would likely be required in 2030 as a result of DfT forecast increases in background traffic volumes (including the airport in its current form), as distinct from the enhancements that would be required specifically as a result of the net impact of airport-related traffic associated with a second runway. This provided the basis for the assessment (from a roads perspective) of the second runway proposal against **Objective 2** in the AC's Appraisal Framework, which is 'to accommodate the needs of other users of transport networks, such as commuters, intercity travellers and freight'.

4.1.2 The analysis of airport-related traffic assumed a headline mode share for private vehicles of 46.2% for passengers and 60% for employees with the second runway in place, with the passenger mode share forecast based on outputs from the headline mode share logit model. For the purposes of this analysis, all private vehicles were assumed to be cars with an average vehicle occupancy of 2.1 for passengers and 1.2 for employees.

4.1.3 The assessment was split into two stages, with an initial focus on the strategic road network in the south-east of England. The outputs from this first stage were then fed into a more detailed analysis of roads in the vicinity of the airport. Two scenarios were tested to draw conclusions with regard to the net impact of airport-related traffic associated with the second runway on road capacity, as follows:

- Background traffic (Core Baseline enhancements);
- Background + airport traffic (Core Baseline enhancements).

4.1.4 A smart motorway scheme for the M23 (which would increase road capacity between junctions 8 and 10 through hard-shoulder running) was included in the Extended Baseline when this study began but was later moved to the Core Baseline following discussions with the HA, who indicated that the scheme is now considered to be committed for delivery by 2030 regardless of a second runway at Gatwick. The remaining strategic road schemes in the Extended Baseline, consisting of the M4 junction 3-12 smart motorway and the Lower Thames Crossing (LTC), are both relatively remote from the airport and unlikely to be significantly affected by second runway-related traffic. Furthermore, no forecasts of traffic redistribution as a result of the LTC were available for assessment during this study. The strategic road network assessment undertaken for this study did not therefore include an Extended Baseline test.

4.1.5 As with the rail assessment described in the previous chapter, the roads analysis constitutes a static assessment of forecast demand compared with, but unconstrained by, expected available capacity in 2030. Further assessment is therefore required using a dynamic modelling approach to better understand the impacts of forecast demand on road network performance and road user journey time/experience, including:

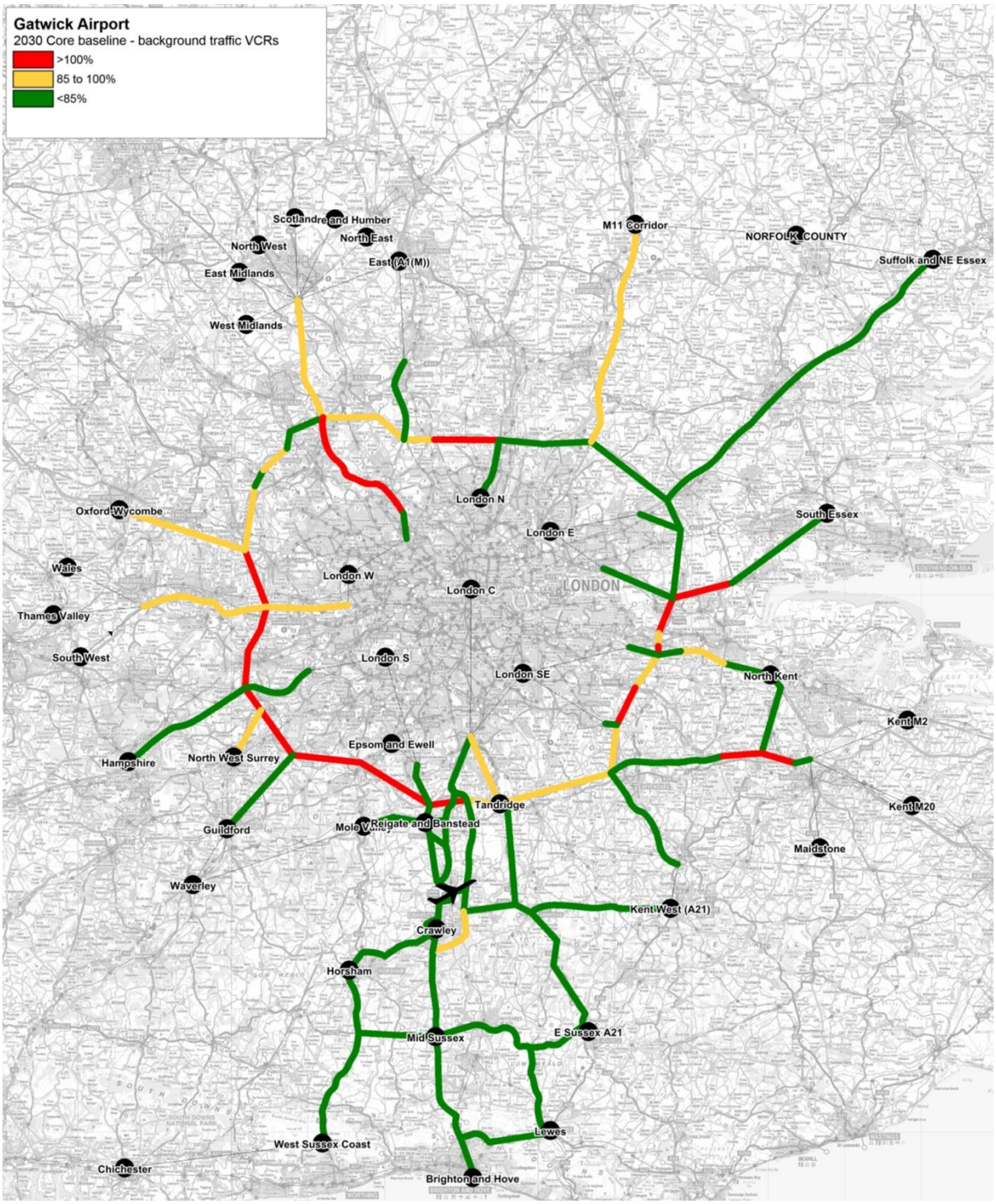
- the extent to which road users (including those making trips unrelated to the airport) change their route to avoid congested sections of the road network, and the associated knock-on impacts;
- the effect of forecast demand on junction performance and the resulting congestion impacts, both on the strategic road network and on roads in the vicinity of the airport (both stages of the assessment described above focussed on a comparison of forecast demand against theoretical link capacity).

4.2 Strategic road network assessment

Background traffic

4.2.1 The plan in Figure 12 indicates the impact of forecast background traffic on the road network in the Core Baseline in 2030. This background traffic is sourced directly from the DfT and consequently is assumed to include trips to and from Gatwick without a second runway in place in that year.

Figure 12: Background traffic Core Baseline 2030 Volume/Capacity Ratios (VCRs)



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4.2.2 The plan shows that by 2030, significant sections of the M25 are forecast to be over capacity, notably the south-west section between the M4 corridor to the west and the M23 to the south, and a number of links to the east including the Dartford Crossing. The addition of the M23 smart motorway scheme to the Core Baseline reduces background VCRs on this section of road to below 85%, significantly on the section between junctions 8 and 9 linking the airport with London and the M25 to the north.

4.2.3 It should be noted that the background traffic forecasts assume unconstrained growth and do not account for the impact of potential measures to dampen demand on strategic roads (i.e. congestion charging, the construction of parallel local distributors and changing working patterns with more home working).

Airport impacts

4.2.4 The net road impacts specifically related to the second runway at Gatwick were assessed taking into account the capacity issues created by background traffic described above. Car trips specifically attributable to the second runway, summarised in the Methodology Statement, were added to background traffic and new VCRs were calculated. These 'background + airport' VCRs were then compared with the 'background only' VCRs to identify the links where capacity issues could be attributed specifically to the second runway.

4.2.5 VCR thresholds of 85% and 100% were used to distinguish between those links where airport-related traffic pushed the link in question close to saturation point (i.e. where capacity enhancements may be needed to improved network performance), as opposed to those where the saturation point was exceeded (where enhancements would definitely be needed based on the analysis undertaken).

4.2.6 The plan in Figure 13 illustrates the results of the Core Baseline ‘background + airport’ analysis, categorising links as follows:

- links where the VCR was already over 100% as a result of background traffic;
- links where airport-related traffic increased forecast VCR to over 100% and the absolute number of airport vehicles forecast on the link was more than 2,000 (suggesting that a capacity increase of 2 additional lanes in either direction would be required to meet demand);
- links where airport-related traffic increased forecast VCR to over 100% and the absolute number of airport vehicles forecast on the link was less than 2,000 (suggesting that a capacity increase of 1 additional lane in either direction would be sufficient to meet demand);
- links where airport-related traffic increased forecast VCR to over 85% - these are links where capacity enhancements may be necessary as a result of airport-related traffic; and finally
- links with no capacity issues arising from background or airport-related traffic.

4.2.7 Table 14 summarises the VCRs on key links on the strategic road network in the vicinity of the airport for non-airport traffic only; traffic including the airport with one runway (referred to as background traffic above); and traffic including the airport with two runways (referred to as ‘background + airport’ above). The smart motorway scheme on the M23 between junctions 8 and 10 effectively adds an additional lane of traffic in the model. As a result, the plan and the table both indicate that no links exceed the 100% threshold as a result of traffic associated with the second runway.

4.2.8 In addition, no links with VCRs under 85% with the airport with one runway were flagged as over 85% when traffic associated with the second runway was added. The second runway does add traffic to flows on the southern section of the M25 in 2030 but this stretch of motorway is already forecast at over 100% VCR to the west of its junction with the M23 with the airport with one runway, and over 85% to the east – in the case of the latter, the excess traffic caused by the second runway is not sufficient to increase VCR above 100%.

Figure 13: Road works required due to net impacts of second runway (Core Baseline, 2030)

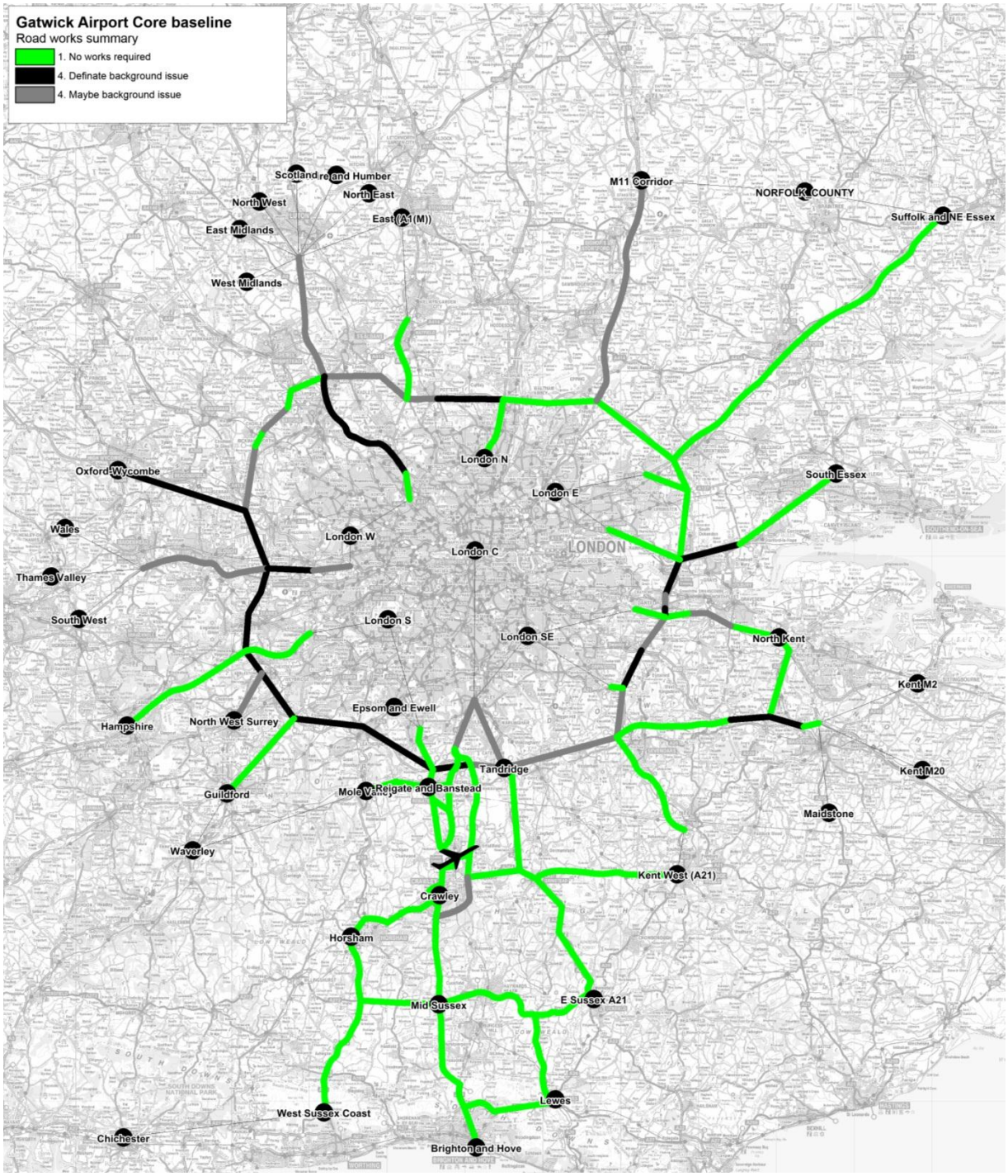

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Table 14: 2030 VCR analysis for selected highway network links

Road name	Section	TO airport			FROM airport		
		Non-airport traffic only	+ airport with 1 runway	+ airport with 2 runways	Non-airport traffic only	+ airport with 1 runway	+ airport with 2 runways
M25	Jcts 4 and 5	85%	89%	91%	86%	89%	90%
	Jcts 5 and 6	84%	90%	92%	86%	90%	91%
	Jcts 6 and 7	91%	97%	99%	94%	97%	99%
	Jcts 7 and 8	101%	109%	113%	104%	109%	112%
	Jcts 8 and 9	95%	104%	108%	98%	104%	107%
	Jcts 9 and 10	93%	102%	106%	97%	102%	105%
M23	Jcts 7 and 8	26%	26%	27%	26%	26%	27%
	Jcts 8 and 9	58%	73%	80%	64%	73%	78%
	Jcts 9 and 10	29%	66%	83%	43%	66%	78%
	Jcts 9 and 9A	66%	70%	72%	68%	70%	71%
	Jcts 10 and 11	85%	89%	90%	87%	89%	89%
A217	Jcts with A2044 and A23	19%	29%	34%	24%	29%	32%
A23	Jcts with A217 and A2044	56%	64%	67%	60%	64%	66%
	Jcts with M23 (J9A) and A217	46%	54%	58%	50%	54%	57%
	Jcts with M23 and Gatwick Rd	13%	27%	31%	22%	27%	29%
	Jcts with M23/A23 and Fleming Way r/about	12%	27%	31%	22%	27%	29%
	Jcts with Fleming Way r/about and A2220	21%	35%	39%	30%	35%	37%

Sensitivity test – current private vehicle mode share

4.2.9 As mentioned previously, the road forecasts described above were based on around 46% of air passengers travelling to and from the airport in private vehicles (cars and taxis), derived from the Jacobs 2030 model.

4.2.10 The GAL submission indicated that road network impacts were assessed using current mode share to and from the airport and as a result, a sensitivity test was undertaken as part of this analysis based on the same assumption. According to the CAA air passenger survey data, private vehicle mode share to the airport was 56.5% in 2012, accounting for a small proportion of trips travelling to and from the airport on foot or by bicycle, while employee mode share was just over 75% by private vehicle.

4.2.11 Applying these mode shares in the 2030 Jacobs model resulted in the identification of one road link that would require capacity enhancements as a result of airport-related traffic – the M25 between junctions 6 and 7. This constitutes the 4.3km section of M25 immediately to the east of its junction with the M23, and the model indicates that additional capacity would be required in excess of the smart motorway scheme included in the Core Baseline that covers this section of motorway. This would likely mean that this section of road would need to be widened permanently as a result of airport-related traffic if the change in mode share forecast by the 2030 model is not achieved.

Resilience

4.2.12 The analysis summarised above suggests that the strategic road network is likely to have sufficient capacity to accommodate forecast 'background + second runway' demand in 2030. However, discussions with the HA indicate that there is a concern over the heavy reliance of Gatwick on the stretch of the M23 between junctions 8 and 9 for strategic road connectivity. In the event of a major incident it is likely that the link would be closed for a period of time, and this issue needs to be taken into consideration when assessing the merits of the proposal for a second runway at the airport.

Strategic road enhancement costs

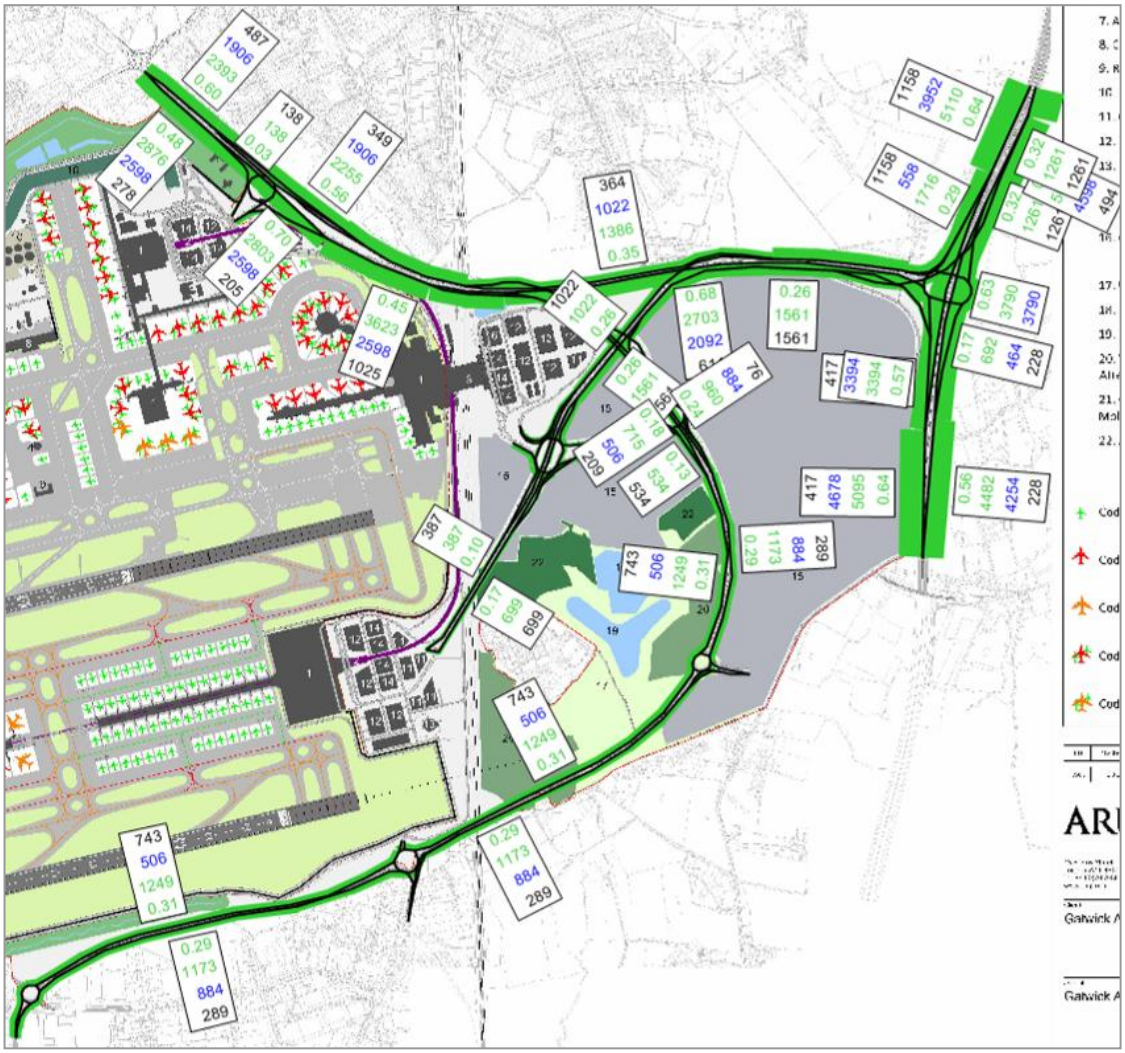
4.2.13 This study did not assign any strategic road network capacity enhancement costs to the delivery of a second runway at Gatwick. This was as a result of the analysis described above, based on the decision to move the M23 smart motorway scheme from the Extended Baseline to the Core Baseline following feedback from the HA, who now consider the scheme to be committed for delivery regardless of the second runway.

4.3 Assessment of roads in the vicinity of the airport

4.3.1 The background and airport-related traffic forecasts from the strategic model, described earlier in this chapter, were used as the basis for an independent assessment of the proposed road network in the vicinity of the airport, consisting of the schemes summarised in Figure 9.7 of Appendix A6 of the GAL submission. The methodology employed to develop this assessment is described in the Methodology Statement.

4.3.2 Figure 14 shows the result of the assignment of strategic model flows to the independent model developed for the road network in the vicinity of the airport.

Figure 14: Assigned traffic flows (forecast 2030)



Black text – Trips to/from the airport; Blue text – Non-airport trips; Green text – Total traffic flow; Green text (decimal number) – Volume/Capacity Ratio (VCR)

4.3.3 The link bands show the total traffic flow. They are scaled such that the width of the band corresponds to the size of the total flow. The VCR value is based on an assumption that the link capacity is equivalent to 2,000 vehicles per lane, which is similar to the capacity threshold applied in the strategic model. The outputs in the figure above demonstrate that across the network in the vicinity of the airport, all links have a VCR of below 100%. The following figures illustrate detailed areas of the network.

Figure 15: Forecast traffic flows around M23 junction 9

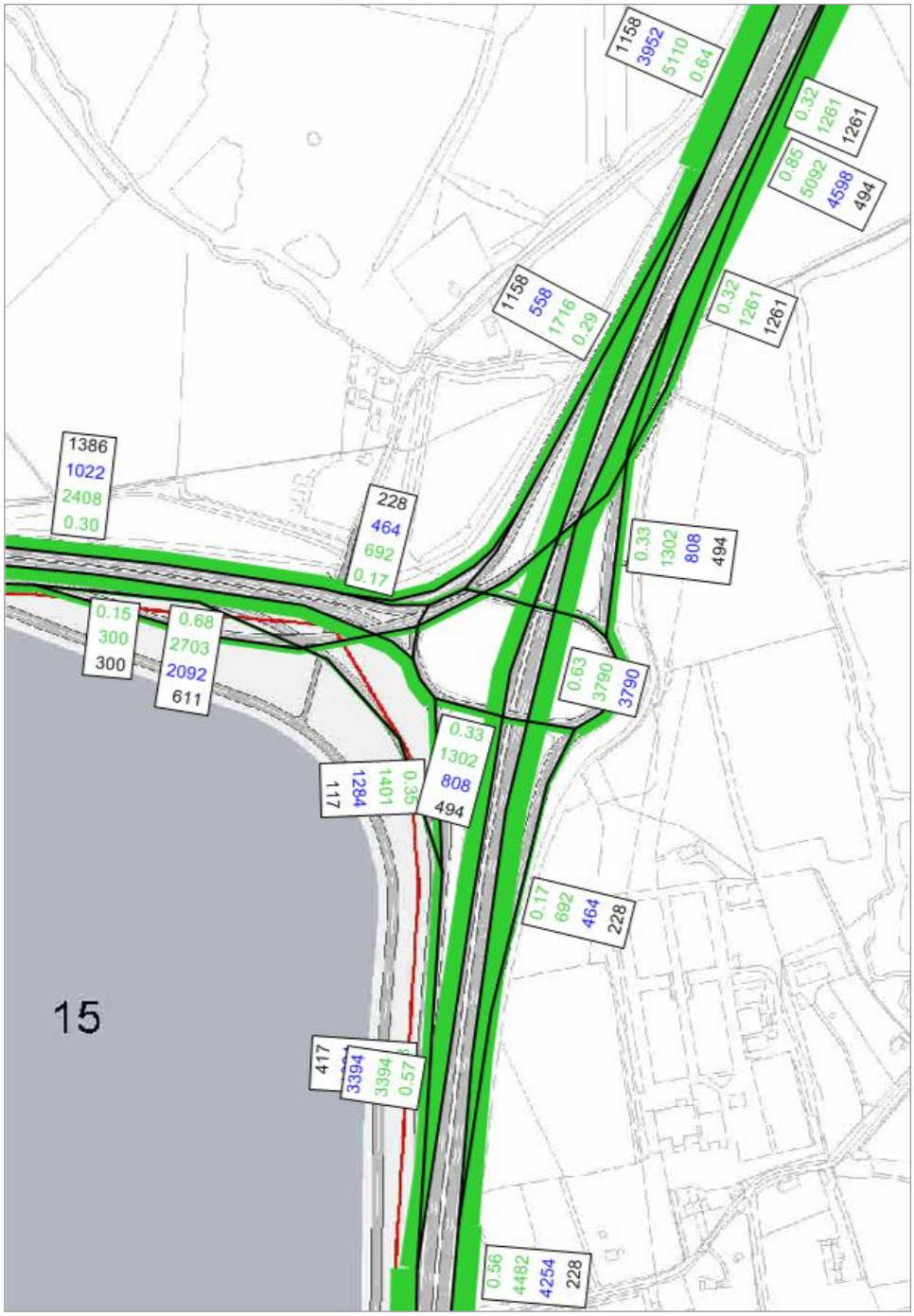


Figure 16: Forecast traffic flows around North Terminal

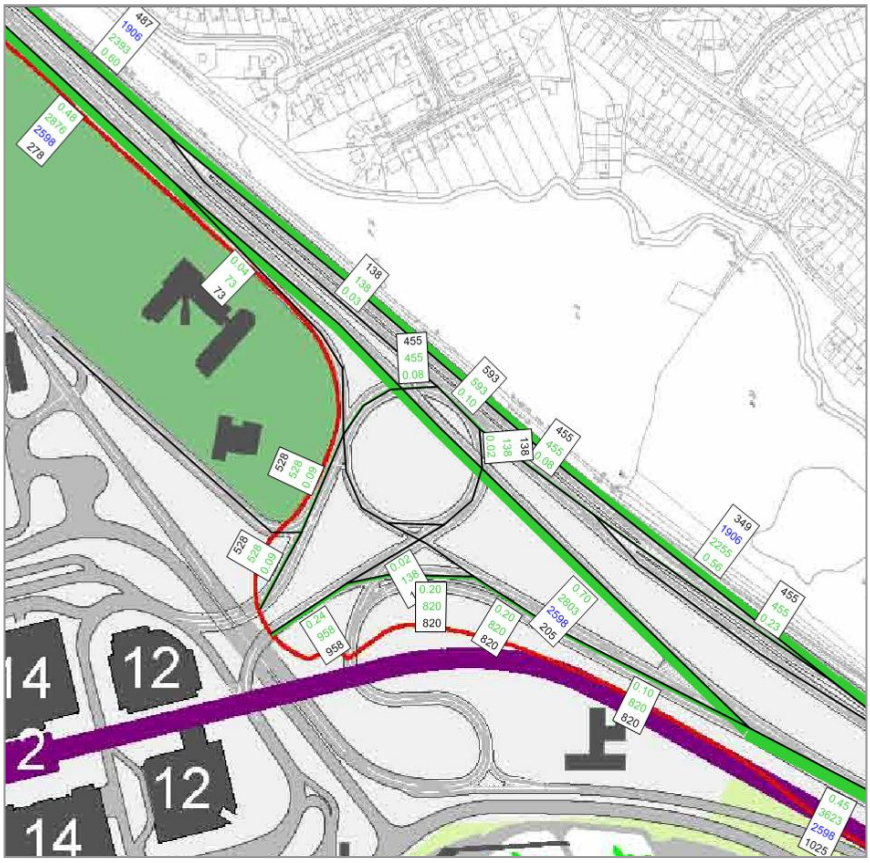
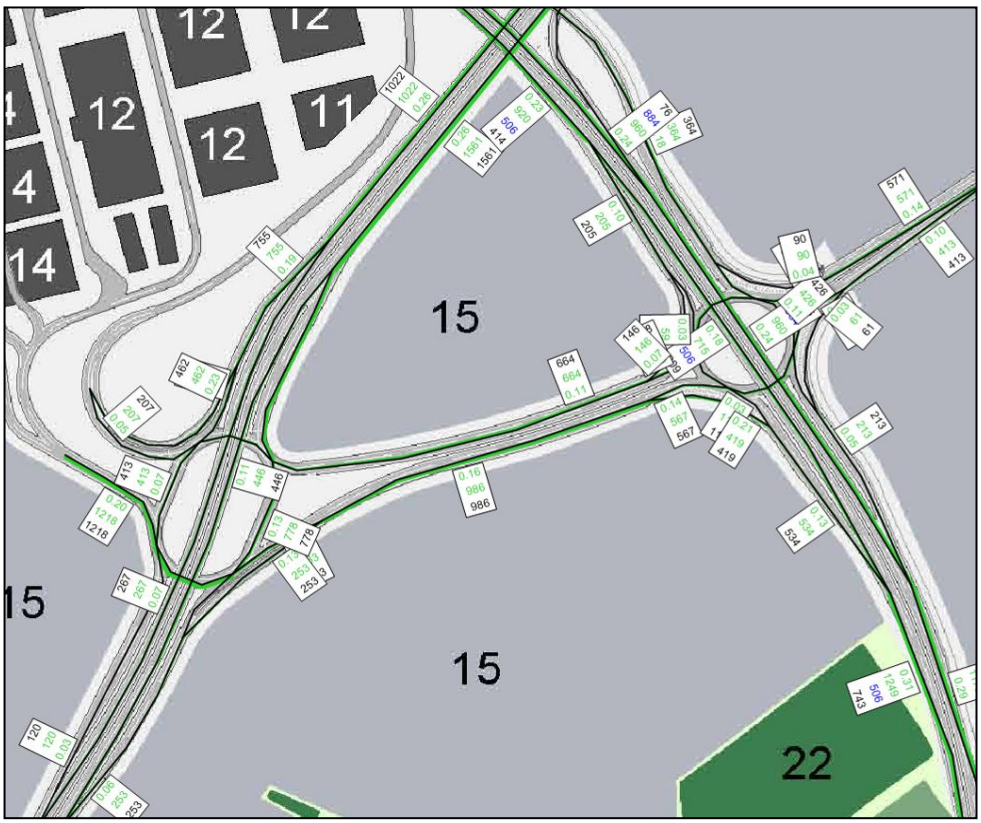


Figure 17: Traffic Flows around South Terminal and the Long Stay Car Park



4.3.4 The analysis summarised above demonstrates that forecast flows on roads in the vicinity of the airport (based on 2030 strategic model outputs with a headline private vehicle mode share of 46.2% for passengers and 60% for employees) are within the assumed link capacities. The VCR value is relatively high at 70% on the A23 Northbound between the off and on-slips at the North Terminal, while most other links have VCRs less than 70% and links around the south terminal and the new terminal have VCRs less than 30%.

4.3.5 The modelling work suggests that the proposed link capacities will be sufficient to accommodate the forecast traffic volumes. However, it should be noted that the limiting capacity on any road network typically occurs at the junctions, where the capacity for turning movements is almost always less than the link capacity. It is anticipated that were any network capacity issues to arise in the Gatwick area, they will be due to junctions rather than links.

Sensitivity test

4.3.6 It is noted earlier in this report that the headline private vehicle mode share forecast arising from the Jacobs 2030 model is lower than the current mode share for both passengers and employees. The GAL submission tested the impact of the current private vehicle mode share on the network and as a result, a sensitivity test was run on the Jacobs model using forecast demand with current mode share from the GAL submission.

4.3.7 To conduct this sensitivity test, the passenger and employee trip matrices identified in the Methodology Statement were factored up so that the total airport demand matched the GAL submission numbers. The resulting modelled flows from this increased demand are illustrated on the following plans.

Figure 18: Sensitivity test traffic flows

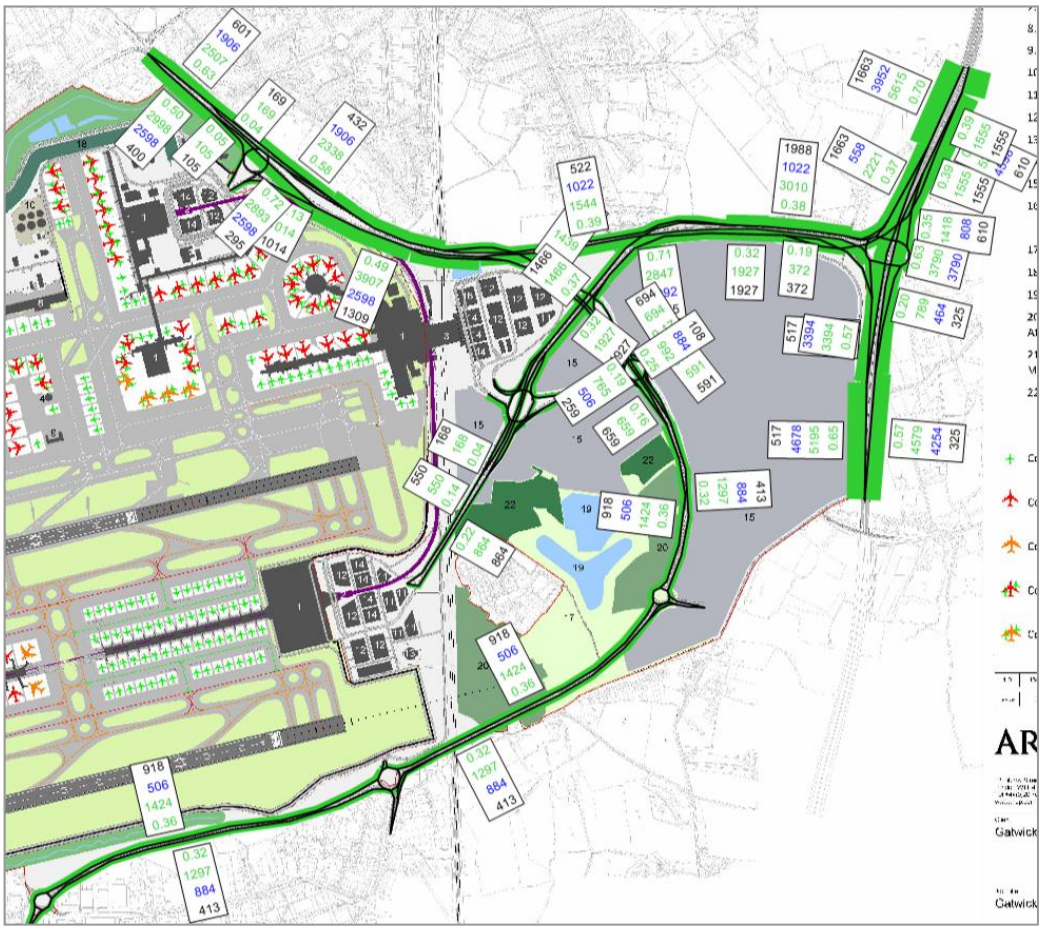


Figure 19: Sensitivity Test Traffic Flows around M23 J9

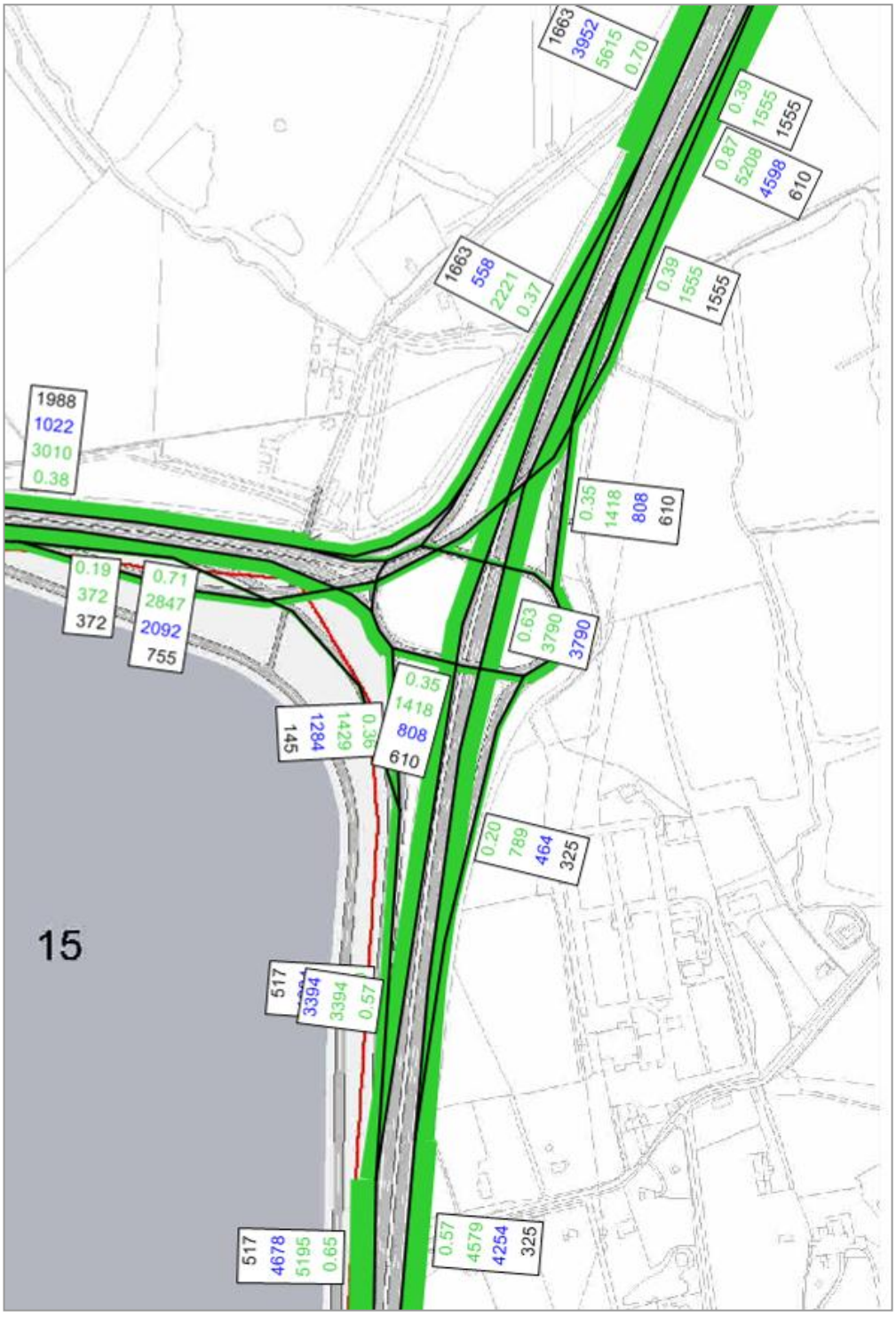


Figure 20: Sensitivity Test Traffic Flows around North Terminal

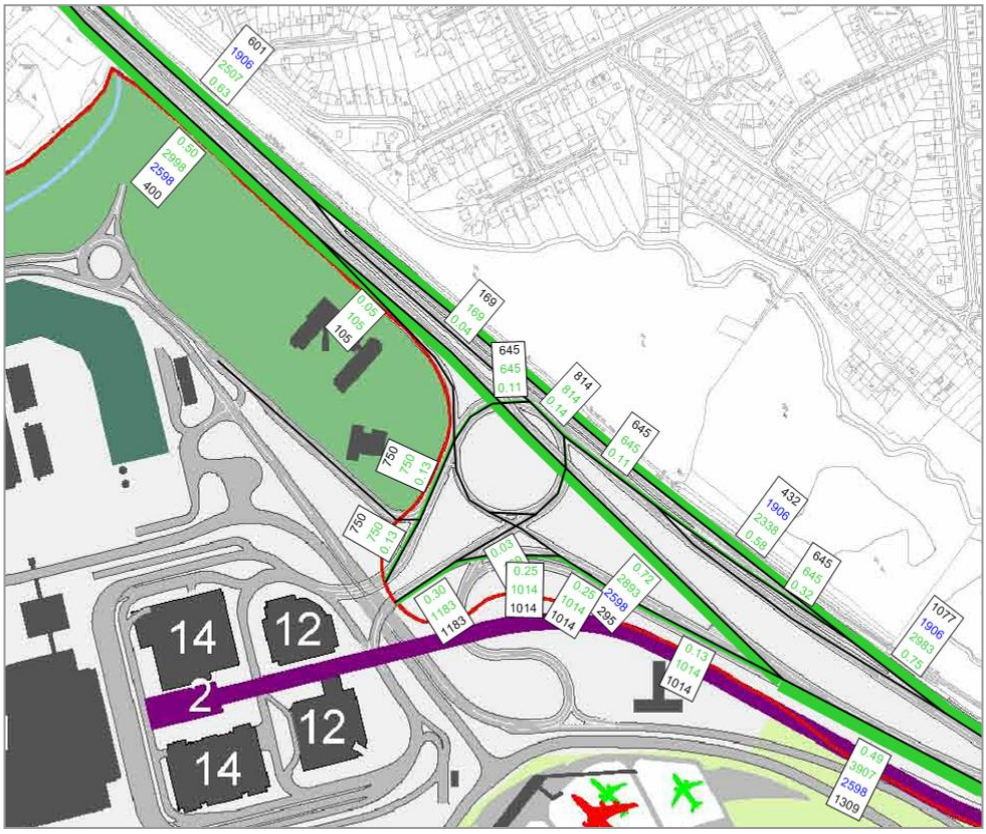


Figure 21: Sensitivity Test Traffic Flows around North Terminal

4.3.8 In the sensitivity test, all links remain within capacity, although the increased airport traffic does raise the VCR values. Around the south terminal and long stay car park, the VCRs have increased, however no single link has a VCR exceeding 40%.

4.3.9 The sensitivity test demonstrates that even with a relatively large forecast demand for vehicle trips to and from the airport, highway links in the vicinity of the airport remain within capacity. As with the original test however, it must be noted that the junction capacities are likely to be less than the link capacities, and it is therefore the junctions that will be the first to experience issues if any capacity problems were to arise.

4.3.10 On this basis, the number of lanes proposed for the main carriageway links on the road network in the vicinity of the airport is considered appropriate and no further cost beyond that already assumed as part of the GAL submission plan for road network reconfiguration need be allocated to account for road widening on main carriageway links.

Issues and caveats

4.3.11 As indicated earlier in this chapter, further work would be appropriate to consider the operational capacity of junctions in the vicinity of the airport and parking operations. The following indicates the work that could be undertaken and the data that would be necessary:

- masterplan layout and land use:
  - a number of uncertainties were identified with regard to the layout of the Masterplan – it is uncertain how the smaller areas of Long Stay car parks will be accessed as these appear to be segregated by major road links and junctions with no immediately obvious feasible location for access junctions – there may be potential for grade-separated access between the different areas of Long Stay which would incur additional cost to the Masterplan scheme which would need to be accounted for;
  - the large expansion of the site to the east and associated A23 re-alignment and provision of access junctions could provide potential for further expansion of associated industrial or commercial land use – any additional local land use plans not identified in the Jacobs assessments could markedly change the volume and pattern of movement on the road network in the vicinity of the airport;
- junction capacity:
  - standalone junction models could be developed to test the performance of the proposed key junctions on the road network in the vicinity of the airport to identify any potential operational issues and need for different junction control or capacity;
- car park operation:
  - a key determinant of the overall performance of the road-based transport system within Gatwick is how the car parks would operate and the level of demand and capacity at each location – to assess this in further detail would require existing data showing length of stay and arrival and departure accumulation profiles at the kiss & fly drop off areas, short stay, and long stay car parks for example – it would also be necessary to understand method of control e.g. barrier access etc. – this analysis would ascertain whether each car park location would have sufficient overall capacity for the forecast level of demand.

4.4 Road costs

4.4.1 As indicated earlier in this Chapter, this study did not assign any strategic road network capacity enhancement costs to the delivery of a second runway at Gatwick, as the M23 junction 8-10 smart motorway scheme provides sufficient capacity to meet forecast demand in 2030.

4.4.2 The road schemes included in the GAL submission were priced and assigned to the airport as indicated in Table 15.

Table 15: Gatwick enhancement capital costs for roads in the vicinity of the airport

Scheme	Units	Unit measurement	Assumed unit cost	Assumed cost (excluding risk and optimism bias)
M23 junction 9, Slip road widening	1	km	£42.5m	£42.5m
M23 junction 9, Grade-separated flyover for southbound slip	1	km	£35m	£35m
M23 9 to 9a road widening, Widening of existing D2 to 4 lanes EB and 5 lanes WB	0.75	km	£30m	£22.5m
Airport Way, Widening of existing D2 to 4 lanes in each direction	1.25	km	£30m	£37.5m
A23 re-alignment , Provision of new section of A23 to D2 standard	5.5	km	£25m	£137.5m
A23 re-alignment , Grade-separated section of A23 re-alignment	1.75	km	£35m	£61.25m
Long-term parking, New high capacity roundabout and approaches	1	item	£5m	£5m
Industrial zone, New roundabout and approaches	1	item	£5m	£5m
North Terminal access, New high capacity roundabout and approaches	1	item	£5m	£5m
North Terminal access, A23 to Airport Way grade-separated flyover	0.6	km	£35m	£21m
New Terminal access, Provision of new D2 connecting M23 to new terminal	1.3	km	£25m	£32.5m
New Terminal access, Grade-separated section of new D2 access to new terminal - includes grade-separation over new roundabout (ref 9) and EB carriageway at northern end connecting to M23 (ref 2)	1.3	km	£35m	£45.5m
South Terminal access, New high capacity roundabout and approaches	1	item	£5m	£5m
Longbridge Roundabout, Capacity enhancements	1	item	£1m	£1m
Gatwick Road, New roundabout and approaches	1	item	£5m	£5m
Balcombe Road, Re-provision of existing road (standard 7.5m width 1 lane in either direction)	3.25	km	£15m	£48.75m
TOTAL (excluding risk and optimism bias):				**£510m**
Risk factor				*0%*
Optimism bias factor:				*44%*
TOTAL (including risk and optimism bias):				**£734m**

5. Airport catchment analysis

5.1 Introduction

5.1.1 This chapter includes details of the appraisal of the 2030 surface access package for Gatwick that was undertaken specifically to assess the proposal against **Objective 3** in the AC's Appraisal Framework, which was 'to enable access to the airport from a wide catchment area'.

5.1.2 The surface access catchment for Gatwick was assessed using Visography TRACC software, which is a multi-modal transport accessibility analysis tool designed to estimate accurate travel times between user-defined origins and destinations using a range of public transport and road modes. Both the current and the Extended Baseline public transport service routes were coded in the software in industry standard (ATCO.CIF) format to ascertain the changes in travel times by public transport to Gatwick. Public transport service improvements primarily include rail schemes associated with the post-2018 TSGN timetable and those included in the Extended Baseline including initiatives further afield from the airport such as HS2, which will significantly improve public transport travel time from the West Midlands and the North West of England.

5.2 Isochrones analysis

5.2.1 Figure 22 and Figure 23 present the accessibility-by-travel time isochrones around Gatwick Airport based on the current and Extended Baseline public transport networks, identifying areas of the UK that become more accessible by public transport as a result of committed and planned service enhancements. The Extended Baseline plan indicates improved accessibility from the North West as a result of HS2, and from a number of other areas across the Midlands and East Anglia as a result of Thameslink. It should be noted however that small changes under 15 minutes are not picked up within the time bands identified on the plans and so the benefits derived from improved service frequencies on the BML for example are not immediately evident.

5.2.2 Table 16 summarises the population within public transport journey time bands to Gatwick based on the current and Extended Baseline networks. These exclude connections via car to stations and interliners (transit passengers) to Gatwick from other airports. The improvements to services associated with the Extended Baseline account for a 36% increase in the UK population within 3 hours public transport travel time of the airport.

Table 16: Population catchment to Gatwick by travel time

Public transport travel time	Current public transport network	Extended Baseline public transport network
Up to 30 minutes	530,000	570,000
Up to 60 minutes	4,400,000	5,000,000
Up to 90 minutes	11,000,000	12,000,000
Up to 120 minutes	16,000,000	18,000,000
Up to 150 minutes	20,000,000	25,000,000
Up to 180 minutes	25,000,000	34,000,000

Figure 22: Public transport travel time catchment for Gatwick Airport (current network)

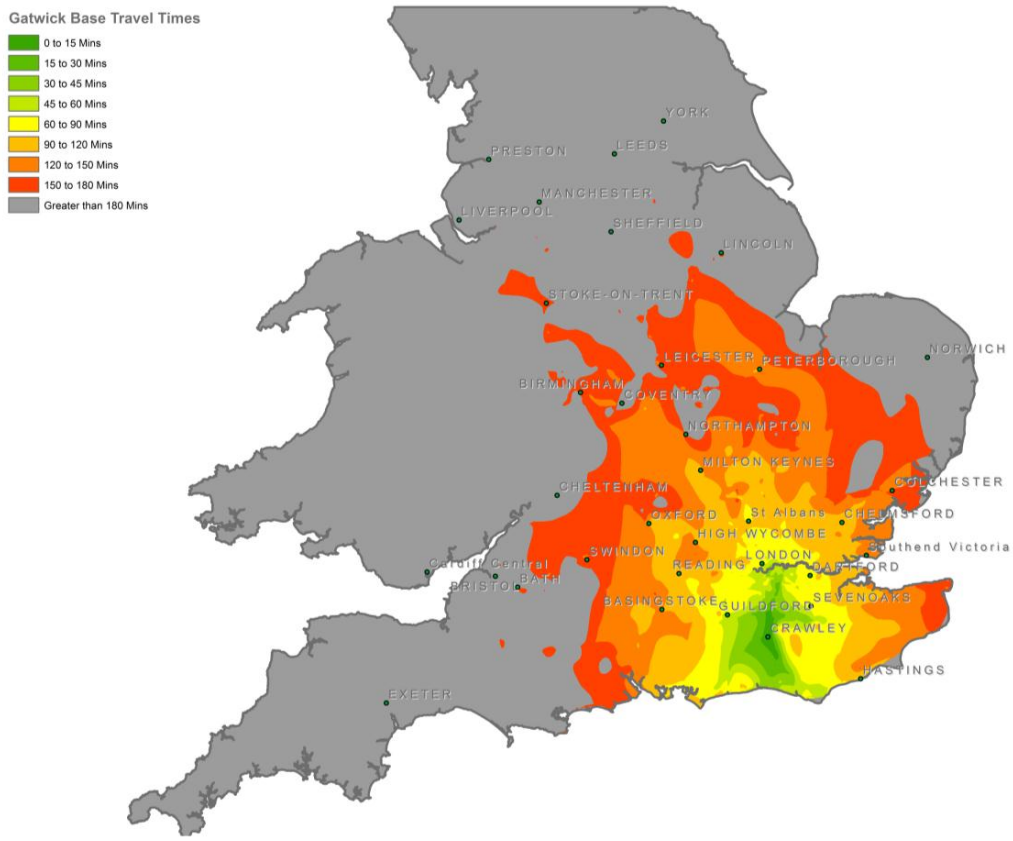
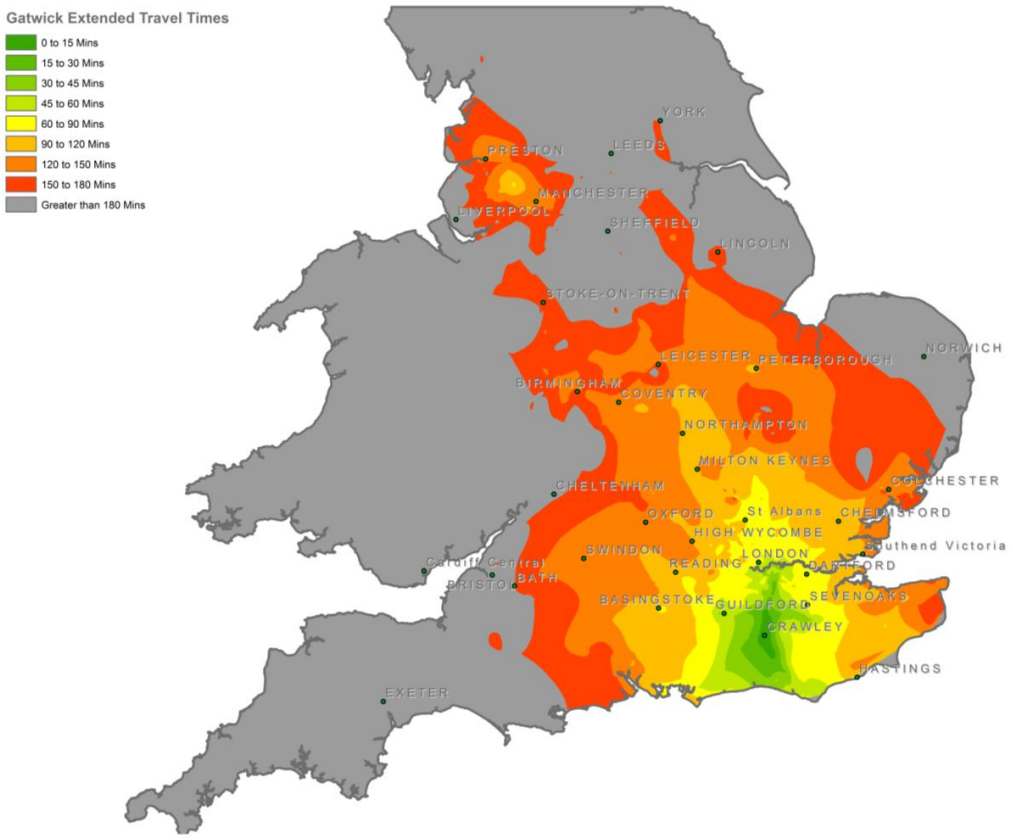


Figure 23: Public transport travel time catchment for Gatwick Airport (Extended Baseline network)



5.2.3 The GAL submission also included analysis of the catchment of the airport taking into account the enhanced connectivity associated with new public transport schemes. However, this analysis focussed on journey times across all modes (combined driving and public transport accessibility) and produced the following 2011 cumulative population estimates within journey time bands from the airport:

- 3.24 million people less than 30 minutes from the airport;
- 14.85 million less than 60 minutes from the airport;
- 19.57 million less than 90 minutes from the airport;
- 23.43 million less than 120 minutes from the airport; and
- 50.18 million less than 240 minutes from the airport.

5.2.4 The catchments summarised above are obviously larger than the estimates derived by Jacobs due to the inclusion of driving accessibility combined with public transport. The submission does not include any details on the traffic congestion assumptions that were used to assess driving accessibility (although it may be reasonable to assume that current congestion levels were applied given that 2011 Census data was used to generate the population estimates), nor does it separate out the catchments by mode so that public transport accessibility can be assessed independently.

6. Summary and conclusions

6.1 Approach

6.1.1 This Gatwick surface transport study involved estimating airport passenger and employee surface transport demand associated with a second runway at the airport in 2030; identifying surface transport measures to meet airport-related demand; and assessing the feasibility and high-level cost of the surface transport measures identified. The ultimate aim of the study was to provide guidance to the AC on the feasibility and likely surface transport issues associated with delivering a second runway at Gatwick, with specific reference to three objectives set out in the AC's Appraisal Framework:

- **Objective 1** - to maximise the number of passengers and workforce accessing the airport via sustainable modes of transport;
- **Objective 2** - to accommodate the needs of other users of transport networks, such as commuters, intercity travellers and freight; and
- **Objective 3** - to enable access to the airport from a wide catchment area.

6.1.2 A Core Baseline and an Extended Baseline of infrastructure schemes that would be developed irrespective of the delivery of a second runway were defined, and infrastructure required to accommodate airport-related demand was identified and assessed. The primary focus of all the analysis was on the Extended Baseline as by 2030 it was judged very likely that further enhancements to the UK transport network would have been delivered above and beyond the works that were fully committed at the beginning of Phase 2.

6.1.3 Demand/capacity assessments need to be undertaken at peak hour level rather than an annual or daily level. Thus, from assumptions on million passengers per annum (mppa) at Gatwick both with and without a second runway in 2030, and current observed behaviour at the airport, we were able to derive peak hour airport-related passenger and employee demand levels.

6.1.4 The next key task was to determine the private/public transport mode share and the rail sub-mode share, and a headline mode share logit model was developed by Jacobs for this purpose. Currently, 56.5% of passengers at Gatwick travel to the airport by car or taxi with 35.7% using rail and 7.9% bus/coach. Similarly, 75.3% of employees currently commute to the airport by car/taxi, with the remainder split between 11.8% using bus/coach and 12.9% using rail.

6.1.5 The GAL submission indicated that an air passenger public transport mode share target of 60% (50% rail, 10% bus/coach) was used to test the impact of the second runway on the rail network, while the current private vehicle mode share was used to assess the impact on the road network. Employee mode share was assumed to be 20% rail, 20% bus/coach and 60% private vehicle.

6.1.6 Surface access trip distribution of passengers and employees at Gatwick was defined using a gravity model calibrated using CAA 2012 passenger survey data and accounting for forecast changes in population, jobs and the Generalised Cost (GC) of trips by different modes to the airport in 2030. Despite the distribution model having a relatively simple structure, the model calibrated well and the predicted trip distribution in 2030 appeared realistic. The overall share of passenger trips originating in London was forecast to increase slightly by 2030 as a result of high forecast population/job growth and improvements in rail services expected in the capital when compared with other areas in the UK. Employee home locations were assumed to remain clustered around the airport as they are at present.

6.1.7 The next task was to assign the airport surface transport trips to the respective rail and highway networks. Rail trips were assigned using the sub-rail component of the headline mode share logit model (also calibrated using 2012 CAA passenger survey data) to predict demand on different rail services. NR provided estimates of seated/total capacity on services associated with the post-2018 TSGN timetable and related to currently uncommitted schemes included in the Extended Baseline, as well as 2030 background demand forecasts. The net impact of demand associated with the second

runway was added to the background forecast to determine whether additional capacity was required and to assess the impact on passenger level of service. The approach used to forecast rail demand is consistent with the principles set out in the latest version of the PDFH, released in 2013.

6.1.8 The GAL submission indicated that planned rail infrastructure associated with delivering the post-2018 TSGN franchise high-peak timetable and the Extended Baseline schemes would be sufficient to accommodate both background demand and demand associated with the delivery of a second runway at Gatwick. As a result, the aforementioned rail assessment undertaken as part of this study was focussed on assessing the validity of this claim.

6.1.9 To assign the car/taxi trips, we defined a strategic road network consisting of motorways and major A-roads that car trips would use to access the airport. We extracted 2012 daily observed flows on each of the links from the TRADS database and used DfT NTM outputs to forecast the increase in background non-airport-related demand in 2030. This enabled us to identify capacity issues not related to the provision of a second runway at Gatwick. We then manually assigned the airport-related demand and identified capacity issues on individual links caused by airport-related traffic. This analysis also fed into an independent assessment of the road proposals included in the GAL submission.

6.2 Conclusions

Objective 1 – maximising the use of sustainable modes of transport

6.2.1 The Jacobs model indicated that the proportion of air passengers using public transport to travel to and from Gatwick Airport is forecast to rise from 44% in 2012 to 54% in 2030, with rail mode share increasing from 36% to 43% as a result of anticipated improvements to services.

6.2.2 An overall increase in sub-rail mode share was also forecast for standard rail services, with GEX mode share falling from 35.4% of all air passenger rail trips currently to 29.6% in 2030 as a result of improvements associated with the post-2018 TSGN timetable and the additional services made feasible by Extended Baseline schemes. For employees, Jacobs reviewed the 2040 GAL submission and concluded that the headline mode share target of 60% private vehicle, 20% bus/coach, and 20% rail constituted a reasonable assumption in light of planned improvements to rail and bus/coach services and the potential impact of traffic demand management measures on employee car use at the airport in 2030.

6.2.3 Based on the assumptions described above, the Jacobs model forecasted a net impact of up to 1,200 additional rail trips to the airport in the AM peak hour in 2030 as a result of the second runway, with up to 750 additional rail trips leaving the airport.

Objective 2 – accommodating the needs of other users (rail)

6.2.4 The analysis indicated that additional passengers related to the second runway at Gatwick constituted a very low proportion of total forecast volumes on the BML in 2030. On the section between Three Bridges and Redhill where airport passengers are most concentrated, the overall VCR increases by less than 2% as a result of the second runway, and on the section between East Croydon and London Bridge the uplift is only 1%. As a result, the rail capacity assessment was largely focussed on the implications for background non-airport passengers using the BML during the identified peak hour in 2030.

6.2.5 The key finding of this assessment was that the network is likely to have sufficient capacity to accommodate total forecast demand including airport passengers on all sections of the BML during the AM peak hour in 2030 if the aforementioned uncommitted rail infrastructure is delivered, which means that from a rail perspective the second runway proposal is likely to deliver **Objective 2** of the AC's Appraisal Framework to a satisfactory degree in 2030.

6.2.6 Airport passengers travelling to London should not have any issues boarding trains at Gatwick during the AM peak-hour – the overall VCR on the section between the airport and Redhill to the north is forecast to reach only 40% in the direction towards London, and when fast line services are considered separately, background VCR only reaches 50%.

6.2.7 The forecast also suggests that across all services on this section, there should be enough spare seats available to accommodate additional second runway passengers travelling north from Gatwick, although the majority of available seats are likely to be on unattractive slow line services – background seated VCR on fast line services is forecast at 98% on this section.

6.2.8 The forecast does indicate that passengers on the BML are likely to experience crowded conditions on services travelling into London Bridge during the peak hour, with the VCR on this branch north of East Croydon station reaching 87% of total capacity by 2030. This means that some passengers will experience heavily crowded conditions due to the uneven loading of carriages and fluctuations in demand across the AM peak hour. It also suggests that during the PM peak, passengers are likely to experience crowded conditions when attempting to board trains on the Thameslink branch in central London, although the PM peak hour has not been modelled as part of this study.

6.2.9 As mentioned above, the provision of adequate capacity to accommodate demand in 2030 is dependent on the delivery of a number of currently uncommitted and unfunded rail schemes, including the following:

- the redevelopment of the airport station;
- works in the Windmill Bridge Junction area (including grade-separation, the provision of new track to East Croydon, and the lengthening of the Selhurst Spurs);
- the remodelling of East Croydon station with additional platforms;
- the remodelling of Stoats Nest Junction (including grade-separation);
- the re-designation of Platform 8 at London Victoria (with a new access from the Platform 9 approach);
- alterations in the Clapham Junction area to allow for additional train paths (the benefits and costs of switches and crossings (S&C) alterations and partial track re-modelling are being compared by NR with signalling enhancements associated with implementation of the ERTMS);
- the provision of a third track and/or grade-separation at Keymer Junction;
- works to deliver bi-directional capability on the Up fast line into Victoria;
- works to deliver turn-back capability at Haywards Heath.

6.2.10 If these schemes are not delivered and capacity enhancements are limited to the committed infrastructure associated with the post-2018 TSGN timetable, the analysis indicates that the East Croydon-London Bridge section of line reaches around 95% of total capacity by 2030. This would result in passengers experiencing severe over-crowding on services in the peak hour, with some non-airport passengers on platforms at East Croydon and stations to the north being unable to board services.

6.2.11 The Sussex Route Study currently being developed by NR (the draft for consultation is due to be published in October 2014) is examining the Value for Money (VfM) rating for several infrastructure packages. One package does include all the works identified above but a number of others assume for example that some services will terminate closer to London than the service pattern assumed for the purpose of the rail assessment described in this report. As a result, it is possible that not all the schemes listed above will be progressed further following publication of the Route Study. In addition, the scope of some of the works still needs to be defined, for example the aforementioned re-development of the airport station.

6.2.12 The forecast transfer of demand away from GEX described in the previous section highlights the potential benefit of pricing as a mechanism for maximising the use of available rail capacity. A

sensitivity test was undertaken using the Jacobs model to determine the impact of operating GEX without a premium fare in 2030. As indicated in Appendix B of this report, GEX sub-mode share is forecast to rise to 37.9% in this scenario from 29.6% in the central scenario, suggesting that there may be some scope to relieve crowding on standard rail services to a small extent with such an approach. However, further assessment would be required to determine the impact on non-airport users since evidence suggests that significant numbers currently use GEX services during peak periods and the NR 2030 forecasts indicate an expectation that this is likely to continue in future with a premium fare in place.

6.2.13 Some additional capacity may be provided via installation of the Level 2 ERTMS without line-side signals, and NR is currently examining implementation dates for the BML. The ERTMS will remove some of the constraints of line-side signal block boundaries and establish minimum separation times based on the maximum permitted speed and braking characteristics of rolling stock. However, line capacity will still be limited by other existing constraints and since the committed and planned infrastructure enhancements described previously are already expected to provide up to 32 trains per hour through Gatwick Airport in the AM peak, the capacity benefits associated with the ERTMS may be limited (although it is difficult at the present time to quantify any capacity benefits prior to full system modelling).

6.2.14 In the event that the full package of works in the Extended Baseline is not delivered, further assessment would be required to ascertain the importance of the excluded works for delivering a sufficient rail service to support the delivery of a second runway at Gatwick in 2030, and the extent to which the costs of such works should be included in the cost of a second runway.

6.2.15 The assessment also highlighted that the provision of four tracks between East Croydon and Gatwick and direct connections to two London terminals does provide for a good degree of resilience against service disruptions and station closures. However, it is noted that south of East Croydon, disruptive incidents (for example power supply failures, signalling failures and track trespassing incidents) can lead to a total suspension of services between London and the airport. Performance data provided by NR indicates that 22 ‘four-line block’ incidents requiring the closure of the BML have occurred in the last three years on the section between London and Gatwick, an average of just over 7 per year. Of these events, approximately 70% involved fatalities and it is noted that in these circumstances, NR aim to re-open the line within 90 minutes.

6.2.16 The analysis suggests that by the 2040s, additional investment will likely be required to increase capacity beyond the aforementioned measures included in the Extended Baseline. As a result, Jacobs undertook a high-level review of potential long-term capacity enhancement options for the BML, which are summarised below. It should be noted that these options do not constitute an exhaustive list of proposals for increasing rail capacity beyond the schemes listed in the Extended Baseline.

6.2.17 The review suggested that additional capacity could be added on the BML between East Croydon and London Bridge by extending services on the Uckfield and Caterham/Tattenham Corner branch lines to 12-car operation. This would entail electrifying the Uckfield line, ordering new rolling stock to operate services on both lines, and also potentially remodelling a number of stations on both lines, notably Purley. It should be noted that the extension of these services to 10-car is already committed for CP5 and is included in the 2030 capacity assumptions for the rail assessment detailed in this report.

6.2.18 Train lengthening beyond 12-car could also provide more capacity although a number of challenges would need to be overcome. Specific train lengthening would likely need to be targeted at express services that do not stop at intermediate stations on the BML, which would reduce the capacity-related benefits and still potentially involve dedicated platform extensions at Victoria, London Bridge, Gatwick and Brighton – services currently using those platforms would need to be re-routed. In contrast, a general extension to 14- or 16-car would involve the remodelling of most major stations on the BML (including London Bridge and Victoria), the potential acquisition of land on the approaches to Victoria and London Bridge, and significant changes to the complex network of junctions north of East Croydon.

6.2.19 Further options would involve a more significant investment in infrastructure. The delivery of a new rail tunnel from the Purley area into (and potentially through) central London incorporating an underground station at Croydon would constitute a major infrastructure project requiring significant national investment. Another infrastructure-led option identified is double-decking, although with limited capacity available in the terminating platforms at London Bridge, this is likely to involve extensive gauge clearance works covering the Thameslink tunnels and routes north of London as well as the widening of the Balcombe and Clayton tunnels south of Gatwick. These schemes would not only be very expensive but also involve extensive disruption to network operations during construction.

Objective 2 – accommodating the needs of other users (roads)

6.2.20 In terms of road traffic, the Jacobs model forecasted a net impact of up to 1,000 additional car/taxi trips to the airport in the AM peak hour in 2030 as a result of the second runway, with up to 600 additional car/taxi trips leaving the airport.

6.2.21 The strategic highway analysis indicated that if schemes in the baselines (notably the M23 smart motorway between junctions 8 and 10) are included in the analysis, no links on the road network would require capacity enhancements as a result of the second runway in 2030. In effect, this additional capacity means that second runway-related traffic will not significantly affect the needs of other strategic road users and therefore, from a strategic roads perspective the second runway proposal is likely to deliver **Objective 2** of the AC's Appraisal Framework to a satisfactory degree in 2030.

6.2.22 The M23 scheme, which would involve increasing road capacity through hard-shoulder running, was initially included in the Extended Baseline but was moved to the Core Baseline during this study following discussions with the HA, who indicated that the scheme is now considered to be committed for delivery by 2030 regardless of a second runway at Gatwick. The current expectation is that the scheme will operate 24-hours a day with CCTV monitoring in place, pending further assessment to ascertain whether sustained operation will create any resilience issues.

6.2.23 Other key sections of the strategic network serving Gatwick, notably southern sections of the M25, were highlighted as issues related to background demand but forecast additional traffic flows associated with the second runway did not significantly increase overall traffic volumes on these links and they were not identified as second runway-related issues as a result. It should be noted that these M25 capacity issues, if not addressed, will be highly detrimental to all the short-listed airport expansion options currently being assessed by the AC.

6.2.24 Discussions with the HA indicated that there is a particular concern over the heavy reliance of Gatwick on the stretch of the M23 between junctions 8 and 9 for strategic road connectivity. In the event of a major incident it is likely that the link would be closed for a period of time, and this issue needs to be taken into consideration when assessing the merits of the proposal for a second runway at the airport.

6.2.25 The analysis undertaken by Jacobs indicated that forecast flows were within assumed link capacities associated with the road network in the vicinity of Gatwick. VCRs reached a maximum of 70% on the A23 northbound between the off- and on-slips at the North Terminal but links around the South Terminal and the New Terminal typically had VCRs of less than 30%.

6.2.26 The overall conclusion therefore was that the proposed road network in the GAL submission would provide sufficient link capacity to accommodate forecast flows including non-airport traffic, which means that from this perspective the second runway proposal is likely to deliver **Objective 2** of the AC's Appraisal Framework to a satisfactory degree in 2030. However, it was noted that the limiting capacity on any road network typically occurs at the junctions, where the capacity for turning movements is almost always lower than the link capacity. If any network capacity issues do arise in the Gatwick area, they will be due to junctions rather than links and it is recommended that more detailed modelling is undertaken to assess the impact of forecast flows on key junctions.

Objective 3 – enabling access to the airport from a wide catchment area

6.2.27 In addition to addressing capacity issues, our rail analysis also suggested that overall rail GC and journey times to Gatwick are likely to reduce slightly between now and 2030 as a result of improvements to standard rail services associated with the post-2018 TSGN timetable and the additional services made feasible by the Extended Baseline schemes. The overall demand-weighted average GC of a rail trip to Gatwick (taking into account journey duration, wait times and interchanges required, and the monetary cost related to Value of Time) is forecast to fall from 151 minutes to 139 minutes in 2030, although this includes an assumption that real Values of Time and rail fares do not change between now and then but that a higher proportion of airport passengers are travelling for business purposes and consequently have a higher Value of Time.

6.2.28 When the components of GC related to fares and wait/interchange penalties were removed, the model indicated a reduction in demand-weighted average standard rail journey time from 72 minutes at present to 63 minutes by 2030, driven by more direct connections via the Thameslink core and increased service frequency on the BML. This journey time benefit is partially off-set when GEX services are included in the calculation, primarily because of the skewed distribution of GEX trips in 2012. The CAA data indicates that over 60% of all GEX trips originated in three London Boroughs with lower-than-average GEX travel times. The expected improvement in standard rail journey time from these boroughs in 2030 therefore effectively results in the transfer to standard rail of a large number of GEX trips with lower-than-average 2012 journey times. This results in an increase in average GEX travel time in 2030 when weighted by demand from different districts, although in many cases the actual GEX travel time between the airport and individual districts does not change.

6.2.29 The forecast change in demand-weighted rail journey times coupled with consideration of the new direct connections to Gatwick provided by the post-2018 TSGN timetable (which will encourage a mode shift to rail for longer distance journeys) suggest that the overall rail catchment of the airport will be significantly larger in 2030 than it is today.

6.2.30 Both the current and the Extended Baseline public transport service routes were coded in accessibility software to ascertain the changes in travel times by public transport to Gatwick as a result. This isochrones analysis indicated that significant areas of the UK are expected to become accessible by public transport to Gatwick as a result of committed and planned service enhancements. In particular, benefits for air passengers from the north-west of England were immediately evident, in addition to a number of other areas across the Midlands, East Anglia and the South West that also benefit from improved connections.

6.2.31 According to this analysis, the improvements to services associated with the Extended Baseline account for a 36% increase in the UK population within 3 hours public transport travel time of Gatwick, suggesting that the proposal for a second runway performs well against **Objective 3** in the AC's Appraisal Framework.

6.3 Scheme costs

6.3.1 This study has not assigned any rail-related costs directly to the delivery of a second runway at Gatwick as the analysis indicated that the additional rail trips generated constituted a very low proportion of total forecast volumes on the BML in 2030. However, the analysis did indicate that funding will need to be secured for the aforementioned uncommitted BML rail infrastructure to provide sufficient capacity to accommodate background demand in 2030.

6.3.2 In addition, NR and GAL are investigating whether the scheme currently being developed to enhance the airport station would have sufficient capacity to accommodate passengers associated with a second runway. The analysis undertaken as part of this study is not detailed enough to assess individual station capacity impacts and further assessment is required to determine whether some station re-development costs should be assigned to the cost of delivering an additional runway at Gatwick. It is noted that GAL have allocated £50m in their second runway cost plan for enhancements to the airport station if additional works are required.

6.3.3 This study also did not assign any strategic road network capacity enhancement costs to the delivery of a second runway. This was as a result of the M23 smart motorway scheme being moved from the Extended Baseline to the Core Baseline following feedback from the HA, who now consider the scheme to be committed for delivery regardless of the second runway.

6.3.4 The schemes associated with the GAL roads proposal were priced independently by Jacobs based on a QS assessment and out-turn costs from comparable recently-completed schemes, and an initial estimate of **£510m** was derived for all the identified schemes, as indicated in the breakdown provided in Table 17. This included pure engineering costs, land costs, environmental mitigation costs and the consequential costs of the schemes themselves. This estimate rises to **£734m** with the inclusion of optimism bias.

6.3.5 Asset replacement and operational expenditure (OPEX) were not considered during this study, but analysis of these costs was undertaken as part of a separate work stream and is detailed in a report entitled '*Deliverable 13.2: Cost calculations*'.

Table 17: Summary of Gatwick second runway capital costs for roads in the vicinity of the airport

Location	Requirement	Length (km - both dir)	Unit cost (£ per km for links)	Estimated cost (£)
M23 jcts 8-9	Road widening required in Core Baseline	11.7	£20m	£234m
M23 jct 9	Slip road widening	1	£42.5m	£42.5m
	Grade-separated flyover for southbound slip	1	£35m	£35m
M23 jcts 9 to 9a road widening	Widening of existing D2 to 4 lanes EB and 5 lanes WB	0.75	£30m	£22.5m
Airport Way	Widening of existing D2 to 4 lanes in each direction	1.25	£30m	£37.5m
A23 re-alignment	Provision of new section of A23 to D2 standard	5.5	£25m	£137.5m
	Grade-separated section of A23 re-alignment	1.75	£35m	£61.3m
Long-term parking	New high capacity roundabout and approaches	~	£5m	£5m
Industrial zone	New roundabout and approaches	~	£5m	£5m
North Terminal access	New high capacity roundabout and approaches	~	£5m	£5m
	A23 to Airport Way grade-separated flyover	0.6	£35m	£21m
New Terminal access	Provision of new D2 connecting M23 to new terminal	1.3	£25m	£32.5m
	Grade-separated section of new D2 access to new terminal	1.3	£35m	£45.5m
South Terminal access	New high capacity roundabout and approaches	~	£5m	£5m
Longbridge Roundabout	Capacity enhancements	~	£1m	£1m
Gatwick Road	New roundabout and approaches	~	£5m	£5m
Balcombe Road	Re-provision of existing road (standard 7.5m width 1 lane in either direction)	3.25	£15m	£48.8m
			TOTAL	**£510m**
			Risk	*0%*
			Optimism bias	*44%*
			TOTAL (including risk and optimism bias)	**£734m**

Appendix A. Core and Extended Baselines

A.1 Core Baseline

A.1.1 Rail infrastructure (excluding high speed)

In addition to the existing network and services, the rail Core Baseline will include all of the schemes identified in the Network Rail (NR) Control Period 5 (2014-19) Enhancement Delivery Plan, with the exception of Western Rail Access to Heathrow, which does not yet have a fully secured funding package. This is available online at http://www.networkrail.co.uk/publications/delivery-plans/control-period-5/cp5-delivery-plan/.

Elements of relevance to proposals may include (but not be limited to):

- Crossrail;
- Reading Area Station redevelopment;
- Thameslink programme;
- ERTMS in-cab signalling roll-out;
- East Coast Main Line capacity enhancements;
- West Anglia Main Line enhancements;
- Great Eastern Main Line capacity enhancement (Bow Junction);
- East Kent re-signalling;
- Redhill Station additional platform;
- London Victoria Station capacity improvements;
- London Waterloo Station capacity improvements;
- Great Western Main Line electrification;
- Intercity Express Programme roll-out;
- Thames Valley branch line enhancements;
- Oxford Corridor capacity improvements;
- Swindon to Kemble redoubling; and
- Birmingham Gateway development.

Scheme promoters are encouraged to consult the Enhancement Delivery Plan for the full details and delivery timescales for schemes.

A.1.2 Rail services (excluding high speed)

The Department for Transport (DfT) is responsible for the design and procurement of new and replacement rail franchises on the national rail network for which it is the franchising authority. The DfT is in the process of tendering a number of rail franchises, details of the rail franchise schedule can be found at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/301976/rail-franchise-schedule.pdf. This includes information on the timing and scope of competitions for future franchises. Each individual franchise has its own specific requirements and addresses a particular set of challenges and so the requirements set out in each franchise competition are tailored to meet the needs of the areas they serve. The DfT has moved towards more output-based specifications to give greater flexibility to bidders while recognising the need for Government to protect essential service levels for all passengers. Details of the Department's activities during each of the stages of a franchise competition can be found at https://www.gov.uk/government/publications/franchise-competition-process-guide.

In developing the baseline the Commission will assume that service levels will be broadly similar as they are today unless an infrastructure scheme or introduction of new rolling stock triggers a change. Details of the investment programme for 2014-19 can be found at http://www.networkrail.co.uk/publications/delivery-plans/control-period-5/cp5-delivery-plan/.

The Commission will monitor the results of current franchise competitions and, when the outcomes of these competitions become known, will discuss the implications of the franchise with scheme promoters. The Commission recognises that dialogue on this issue will need to continue after the receipt of revised scheme proposals.

The outcome of the competition for the Thameslink, Southern and Great Northern franchise is clearly of particular relevance to scheme promoters and understanding and discussing the components of this will be a priority for the Commission.

A.1.3 Rail – High Speed

In respect of the High Speed 1 link and the Channel Tunnel, the Commission will assume for its baseline no fundamental changes to infrastructure or services, though it will use existing demand forecasts for both passenger and freight traffic to inform its baseline for capacity utilisation.

In respect of the High Speed 2 link, the Commission has noted that the "phase 1" route between London Euston and Birmingham and the "phase 2" route from Birmingham to Manchester and Leeds represents stated Government policy and has cross-party support. The Commission has, therefore, decided to include these elements of the scheme in its Core Baseline. The Commission has also noted, however, the Secretary of State for Transport's statement that he will delay a decision on whether to proceed with a spur from HS2 to Heathrow Airport until after the Airports Commission's Final Report. This spur will not, therefore, form part of the Core Baseline.

For an overview of the HS2 programme, scheme promoters are encouraged to consult the following documents:

- https://www.gov.uk/government/publications/hs2-strategic-case
- https://www.gov.uk/government/publications/high-speed-rail-investing-in-britains-future-phase-two-the-route-to-leeds-manchester-and-beyond

The Commission has also noted that the recent review by Sir David Higgins made a number of recommendations regarding the delivery of HS2. On the basis of this, the Government has already taken the decision not to proceed with a link between HS2 and HS1. This link will not, therefore, form part of either baseline. It is possible that the Government may suggest further changes to the timing and phasing of the HS2 delivery programme on the basis of Sir David's report; the Commission will monitor developments and incorporate any material changes into the baseline. Sir David's report is available at: http://assets.hs2.org.uk/sites/default/files/inserts/Higgins%20Report%20-%20HS2%20Plus.pdf.

A.1.4 London Underground, London Overground and Docklands Light Railway

The Commission has taken advice from TfL on the status of various forthcoming enhancements to the London Underground, Overground and DLR networks. On the basis of information provided, the Commission will include the following schemes in the Core Baseline:

- London Underground Subsurface upgrade – Signalling and rolling stock replacement, complete by 2018;
- Croxley link – Metropolitan line link to Watford Junction, planned to complete by 2021;
- Northern line upgrade – planned to complete by 2020;
- Victoria line upgrade – planned increase in service frequency to 36tph;
- Piccadilly line upgrade – planned for completion by 2026;

- Bakerloo line upgrade – planned for completion by 2031;
- Central line upgrade – planned for completion by 2031;
- London Underground station redevelopments – e.g. Bank and Victoria;
- Waterloo & City Line Upgrade – Planned for completion by 2031;
- London Overground extension of class 378s to 5 car – deployed by end 2015;
- Gospel Oak to Barking electrification – complete by 2019;
- DLR 3-car upgrade Poplar to Stratford – complete by 2026; and
- DLR Inter-peak service enhancements (base service plan A) – due September 2014.

A.1.5 Strategic roads network

Following discussions with the Highways Agency (HA), the Commission's view is that the following schemes should be included in the Core Baseline:

- M23 Junction 8 to 10 "smart motorway" (all lanes running) – subject to value for money and deliverability assessment;
- M25 Junction 23 to 27 "smart motorway" (all lanes running) – complete by 2015;
- M25 Junction 5 to 6/7 "smart motorway" (all lanes running) – complete by 2014; and
- M3 Junction 2 to 4a "smart motorway" (all lanes running) – complete by 2016.

A.2 Extended Baseline

A.2.1 Rail infrastructure (excluding high speed)

The Commission has held discussions with NR, the DfT and other parties with an interest in the process regarding rail schemes which are likely – but not certain – to be funded in the coming years to meet growth in background demand regardless of decisions on airport expansion. These include:

- Western Rail Access to Heathrow: which forms part of the Control Period 5 settlement (meaning it is highly likely to progress) but does not yet have a fully agreed funding package. Should the funding package be secured, this scheme would become part of the Core Baseline.
- Gatwick Airport Station redevelopment: recommended as part of the Commission's interim report. Discussions are ongoing between Government, NR and the airport regarding the nature and scale of the redevelopment.
- Proposed capacity enhancements to the Brighton Main Line: Currently under development and may potentially be identified for funding as part of the CP6 (2019-2024) programme. Components include:
- Windmill Bridge Junction area re-modelling
    - New flyover for Up London Bridge Fast line
    - New flyover carrying the Down London Bridge Fast over the Wallington and Victoria Slow lines
    - Reusing the current dive under for realigned Up London Bridge Slow services removes path conflicts of current flat junction
    - New 6th track between East Croydon and Windmill Bridge
    - East Croydon Station remodelling and additional platforms
    - Selhurst Spurs lengthened to provide 12-car signal standing – removes current conflicts
- Stoats Nest Junction grade separated junction for Up Redhill trains to join the Up Fast line
- London Victoria re-designation of platform 8 and new access from platform 9 approach

- Clapham Junction area alterations to allow for additional train paths (no feasibility work yet undertaken)
- Keymer Junction – third track to enable Up Lewes train to join main line whilst an Up train is passing and enables the Brighton Main Line to remain open when the junction is unusable.
- Potential outcomes of the Wessex, Sussex and East Sussex route studies: which will inform the future development of infrastructure and services on those routes.
- London Victoria: further redevelopment beyond 2019, subject to business case.
- Clapham Junction: further redevelopment beyond 2019, subject to business case.
- Crossrail 2 – subject to significant further specification and assessment.

A.2.2 Rail Services (excluding high speed)

As with the development of the Core Baseline, the Commission will monitor progress on the DfT's refranchising programme. Where the outcomes of franchise competitions are not known, but the Invitation to Tender gives clear indications regarding the probable contents of the franchise, these will be incorporated into the Extended Baseline.

A.2.3 High Speed Rail

The Government has deferred a decision regarding a spur from HS2 to Heathrow Airport until after the Airports Commission publishes its final report. This spur will, therefore, be placed within the Extended Baseline. The Commission notes, however, that the need to progress the HS2 hybrid bill through Parliament may result in changes in Government policy in this area and will keep any such developments under review, in respect of the relationship of the spur to the baselines.

A.2.4 London Underground, London Overground and Docklands Light Railway

The Commission has taken advice from TfL on the status of various forthcoming enhancements to the London Underground, Overground and DLR networks. On the basis of information provided, the Commission will include the following schemes in the Extended Baseline:

- Jubilee line upgrade: increase to 34tph, requires additional stock;
- Northern line extension to Battersea: subject to TWA approval, potentially open in 2020;
- Northern line full separation: potentially by 2026;
- Bakerloo line southern extension: aspirational only at present;
- London Overground additional 2 tph all day between Clapham Junction and Stratford via West / North London Lines – planned for 2019, but dependant on additional rolling stock;
- London Overground additional 2tph on East London Line – dependant on additional rolling stock;
- London Overground Gospel Oak to Barking extended to Barking Riverside – possible by 2021;
- London Overground 6- and 8-car operation on East, North and West London Lines – possible in 2020s / 2030s;
- DLR new franchise service plan – by 2016/17;
- North route double tracking phase 2 – requires additional rolling stock;
- DLR Royal Rocks initial capacity enhancements – requires additional rolling stock;
- DLR full 3-car operation – requires additional rolling stock;
- DLR extension to Catford – aspirational only at present; and
- DLR extension to Bromley – aspirational only at present.

A.2.5 Strategic Roads

Following discussions with the HA, the Commission's view is that the following schemes should be included in the Extended Baseline:

- M4 Junction 3 to 12 "smart motorway" (all lanes running) – subject to value for money and deliverability assessment;
- Lower Thames Crossing – work progressing, but no decision yet as to nature of any option that might proceed.

Appendix B. Sensitivity tests

B.1 Carbon-Capped Assessment of Need (CC AON)

This sensitivity test involved changing the headline MPPA and interlining assumptions in the main model to match the AC's CC AON forecast, which is summarised as follows:

- 2030 one-runway forecast = 41.1mppa (5.0% interliners);
- 2030 two-runway forecast = 45.6mppa (6.3% interliners);
- net surface transport impact of second runway = 3.7mppa.

In this scenario there is no change in main or sub-rail mode share from the central Jacobs scenario, as the GCs estimated for the logit model were fixed costs.

In addition, the net surface transport impact of the second runway in the central scenario amounted to 17.5mppa so the forecast number of peak hour trips related to the second runway in the CC AON scenario was significantly lower than in the central scenario.

As a result, this sensitivity test did not change the conclusions of the central scenario road and rail assessments, which did not assign any rail or strategic road-related costs to the delivery of a second runway at Gatwick in 2030.

The rail capacity analysis associated with this scenario is shown in Table 18 at the end of this section. No road links were identified as requiring capacity enhancements as a result of the second runway in this test.

B.2 Carbon-Traded Low Cost is King (CT LCK)

This sensitivity test involved changing the headline MPPA and interlining assumptions in the main model to match the AC's CT LCK forecast, which is summarised as follows:

- 2030 one-runway forecast = 43.7mppa (3.7% interliners);
- 2030 two-runway forecast = 72.0mppa (26.2% interliners);
- net surface transport impact of second runway = 11.1mppa.

In this scenario there is no change in main or sub-rail mode share from the central Jacobs scenario, as the GCs estimated for the logit model were fixed costs.

As with the CC AON scenario, the net surface transport impact of the second runway in this test was significantly lower than the central scenario, which amounted to 17.5mppa. The forecast number of peak hour trips related to the second runway in the CC LCK scenario, although higher than the CC AON scenario, was therefore significantly lower than the central scenario.

As a result, this sensitivity test did not change the conclusions of the central scenario road and rail assessments, which did not assign any rail or strategic road-related costs to the delivery of a second runway at Gatwick in 2030.

The rail capacity analysis associated with this scenario is shown in Table 19 at the end of this section. No road links were identified as requiring capacity enhancements as a result of the second runway in this test.

B.3 Staff 'low productivity'

In this scenario the number of staff assumed to work at the airport increases from the 29,685 estimate applied in the central 2030 Jacobs forecast to around 43,000, in line with the ratio of 1,509 annual passengers per employee indicated for Gatwick in 2030 in the AC's low productivity employment scenario.

This increase in staff numbers has no impact on headline or sub-rail mode share in the Jacobs model as the GCs estimated for the logit model were fixed costs, but it does increase the number of rail and road trips forecast to and from the airport during the AM peak hour.

For rail, the capacity analysis for this test is provided in Table 20 at the end of this section. The table indicates that the net impact of the second runway amounts to around 1,300 additional rail trips to the airport in the AM peak hour, increasing from just under 1,200 in the central scenario. The scale of the increase is related to the overall staff rail mode share, which is assumed to remain fixed at 20% in both scenarios.

As a result, because the increase in rail trips in this scenario is low and the vast majority of trips on the BML are not related to the airport, the conclusions arising from the rail assessment undertaken for the central 2030 scenario in the main report do not change.

The additional vehicles on the road network as a result of the increase in staff numbers does however impact on the findings of the roads assessment, as in both scenarios 60% of staff are assumed to travel by car. As a result, this sensitivity test does identify one link (the M25 between junctions 6 and 7) that exceeds the 100% VCR threshold as a result of second runway traffic – this amounts to a 4.3km stretch of motorway. It should be noted that this link was also flagged as requiring capacity enhancement as a result of the second runway in the sensitivity test undertaken to assess the impact of applying the 2012 headline mode share in the 2030 model, which is summarised in the roads assessment chapter of this report.

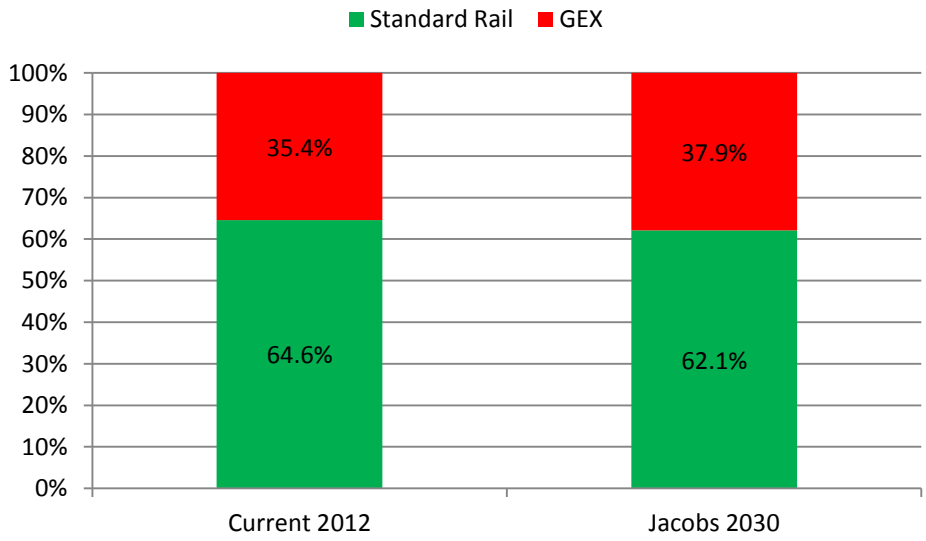
This sensitivity test also indicates that the M23 would have sufficient capacity to accommodate forecast 'low productivity' staff demand if the junction 8-10 smart motorway scheme and GAL's proposed upgrade to the junction 9-9A link are both delivered.

B.4 GEX standard fare

This sensitivity test indicates the impact of removing the premium fare for GEX and assuming the same pricing structure applied to standard rail services on the BML in the central Jacobs 2030 scenario. In the central scenario for example, a single ticket from Victoria is assumed to cost £19.90 on GEX compared to £15 for standard rail – this test assumes both tickets cost £15.

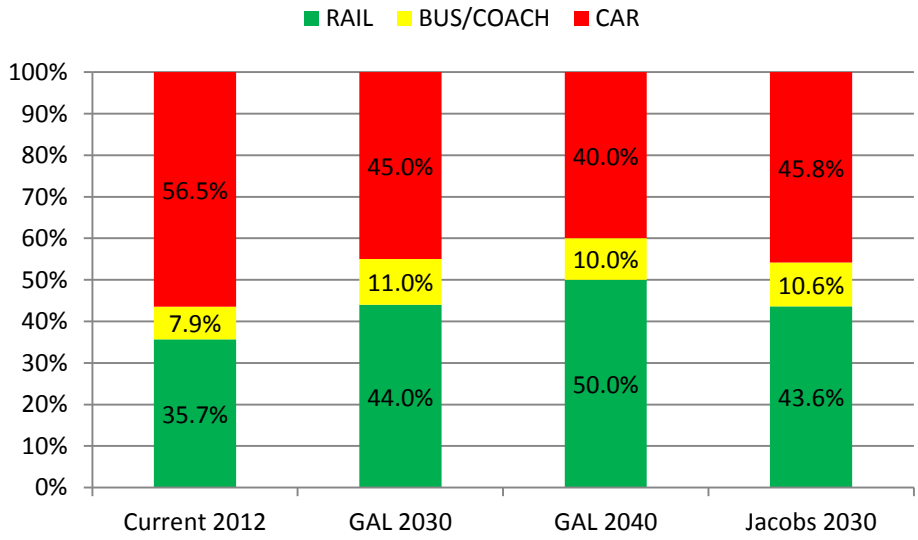
The graph below indicates that instead of a forecast decrease in GEX sub-rail mode share from around 35% in 2012 to under 30% in the central scenario, GEX sub-rail share in this scenario increases to just under 38%.

Figure 24: 2030 sub-rail mode share forecast with standard fare for GEX



The associated reduction in GEX GC as a result of the removal of the fare premium also increases the overall rail mode share by a very small margin. The graph below indicates an overall rail mode share of 43.6% in this scenario in the Jacobs 2030 model, compared with 43.0% in the central forecast.

Figure 25: 2030 headline mode share forecast with standard fare for GEX



The rail capacity analysis for this scenario is provided in Table 21 at the end of this section. The table indicates a very slight increase in overall rail trips related to the mode shift described above – for example, the total number of airport passengers travelling to Gatwick with two runways in the AM peak hour increases from 3,716 in the central Jacobs scenario to 3,761 in this scenario. However, as with the central scenario and the other sensitivity tests, the airport passenger forecasts on the BML are dwarfed by the volume of background passengers on services.

In addition, the total number of passengers travelling to Gatwick with two runways via GEX from Victoria increases from 949 in the central scenario to over 1,200 in this scenario as a result of the reduction in fare.

In terms of the roads assessment, there is a very marginal reduction in car mode share when compared with the central scenario as a result of the removal of the premium GEX fare. As a result, no road links are identified as requiring capacity enhancements as a result of second runway traffic in this scenario.

Table 18: Carbon-capped Assessment of Need – rail capacity analysis

Line	Section (between)	Direction (related to Gatwick)	Direction (related to London)	*2030 capacity + background demand*							*Gatwick Airport rail forecast flows*		*Gatwick + background rail forecast V/C*	
				Gatwick train paths (NR info)	Total train paths (NR info)	Hourly capacity (seated)	Hourly capacity (total)	2030 background passengers	2030 background V/C (seated)	2030 background V/C (total)	Option 3 (Gatwick submission)	Option 0 (one runway)	Option 3 (2nd runway) NET - seated	Option 3 (2nd runway) NET - total
GEX	Victoria-Airport	To	Down	4	4	2,880	4,752	1,730	60%	36%	678	572	64%	39%
GEX	Airport-Victoria	From	Up	4	4	2,880	4,752	3,460	120%	73%	492	425	122%	74%
Brighton Main Line (South)	Brighton-Burgess Hill	To	Up	13	13	9,060	18,384	6,202	68%	34%	169	146	69%	34%
Brighton Main Line (South)	Burgess Hill-Three Bridges	To	Up	19	19	13,320	26,100	11,581	87%	44%	258	221	87%	45%
Brighton Main Line (South)	Three Bridges-Airport	To	Up	28	28	19,080	38,352	14,651	77%	38%	547	461	77%	38%
Brighton Main Line (North)	London Bridge-East Croydon	To	Down	12	20	12,460	29,288	12,585	101%	43%	579	494	102%	43%
Brighton Main Line (North)	Victoria-Clapham Junction	To	Down	14	18	12,720	20,988	6,036	47%	29%	473	426	48%	29%
Brighton Main Line (North)	Clapham Junction-East Croydon	To	Down	14	18	12,720	20,988	6,036	47%	29%	766	672	48%	29%
Brighton Main Line (North)	East Croydon-Redhill	To	Down	26	26	18,120	36,768	9,149	50%	25%	1,437	1,245	52%	25%
Brighton Main Line (North)	Redhill-Airport	To	Down	28	28	17,520	35,778	6,990	40%	20%	1,575	1,360	41%	20%
Brighton Main Line (South)	Airport-Three Bridges	From	Down	28	28	19,080	38,352	7,325	38%	19%	204	179	39%	19%
Brighton Main Line (South)	Three Bridges-Burgess Hill	From	Down	19	19	13,320	26,100	5,790	43%	22%	135	119	44%	22%
Brighton Main Line (South)	Burgess Hill-Brighton	From	Down	13	13	9,060	18,384	3,101	34%	17%	98	87	34%	17%
Brighton Main Line (North)	Airport-Redhill	From	Up	28	28	17,520	35,778	13,979	80%	39%	1,003	891	80%	39%
Brighton Main Line (North)	Redhill-East Croydon	From	Up	26	26	18,120	36,768	18,298	101%	50%	947	843	102%	50%
Brighton Main Line (North)	East Croydon-Clapham Junction	From	Up	14	18	12,720	20,988	12,071	95%	58%	508	459	95%	58%
Brighton Main Line (North)	Clapham Junction-Victoria	From	Up	14	18	12,720	20,988	12,071	95%	58%	321	298	95%	58%
Brighton Main Line (North)	East Croydon-London Bridge	From	Up	12	20	12,460	29,288	25,171	202%	86%	389	340	202%	86%
North Downs (Reading) Line	Guildford (Dorking)-Redhill	To	~	2	2	360	594	87	24%	15%	100	83	29%	18%
North Downs (Reading) Line	Redhill-Guildford (Dorking)	From	~	2	2	360	594	175	49%	29%	42	35	50%	31%
Tonbridge Main Line	Tonbridge-Redhill	To	Up	2	2	960	1,584	299	31%	19%	5	5	31%	19%
Tonbridge Main Line	Redhill-Tonbridge	From	Down	2	2	960	1,584	149	16%	9%	3	3	16%	9%
Horsham Branch Line	Horsham-Three Bridges	To	Up	5	5	3,480	7,116	2,352	68%	33%	106	89	68%	33%
Horsham Branch Line	Three Bridges-Horsham	From	Down	5	5	3,480	7,116	1,176	34%	17%	51	45	34%	17%
										TOTAL (to)	2,800	2,393		
										TOTAL (from)	1,698	1,495		

Table 19: Carbon-traded Low Cost is King – rail capacity analysis

Line	Section (between)	Direction (related to Gatwick)	Direction (related to London)	*2030 capacity + background demand*							*Gatwick Airport rail forecast flows*		*Gatwick + background rail forecast V/C*	
				Gatwick train paths (NR info)	Total train paths (NR info)	Hourly capacity (seated)	Hourly capacity (total)	2030 background passengers	2030 background V/C (seated)	2030 background V/C (total)	Option 3 (Gatwick submission)	Option 0 (one runway)	Option 3 (2nd runway) NET - seated	Option 3 (2nd runway) NET - total
GEX	Victoria-Airport	To	Down	4	4	2,880	4,752	1,730	60%	36%	844	617	68%	41%
GEX	Airport-Victoria	From	Up	4	4	2,880	4,752	3,460	120%	73%	613	459	125%	76%
Brighton Main Line (South)	Brighton-Burgess Hill	To	Up	13	13	9,060	18,384	6,202	68%	34%	201	155	69%	34%
Brighton Main Line (South)	Burgess Hill-Three Bridges	To	Up	19	19	13,320	26,100	11,581	87%	44%	302	233	87%	45%
Brighton Main Line (South)	Three Bridges-Airport	To	Up	28	28	19,080	38,352	14,651	77%	38%	609	478	77%	39%
Brighton Main Line (North)	London Bridge-East Croydon	To	Down	12	20	12,460	29,288	12,585	101%	43%	709	530	102%	44%
Brighton Main Line (North)	Victoria-Clapham Junction	To	Down	14	18	12,720	20,988	6,036	47%	29%	580	458	48%	29%
Brighton Main Line (North)	Clapham Junction-East Croydon	To	Down	14	18	12,720	20,988	6,036	47%	29%	935	721	49%	30%
Brighton Main Line (North)	East Croydon-Redhill	To	Down	26	26	18,120	36,768	9,149	50%	25%	1,753	1,333	53%	26%
Brighton Main Line (North)	Redhill-Airport	To	Down	28	28	17,520	35,778	6,990	40%	20%	1,908	1,453	42%	21%
Brighton Main Line (South)	Airport-Three Bridges	From	Down	28	28	19,080	38,352	7,325	38%	19%	249	192	39%	19%
Brighton Main Line (South)	Three Bridges-Burgess Hill	From	Down	19	19	13,320	26,100	5,790	43%	22%	167	129	44%	22%
Brighton Main Line (South)	Burgess Hill-Brighton	From	Down	13	13	9,060	18,384	3,101	34%	17%	121	94	35%	17%
Brighton Main Line (North)	Airport-Redhill	From	Up	28	28	17,520	35,778	13,979	80%	39%	1,245	960	81%	40%
Brighton Main Line (North)	Redhill-East Croydon	From	Up	26	26	18,120	36,768	18,298	101%	50%	1,176	909	102%	50%
Brighton Main Line (North)	East Croydon-Clapham Junction	From	Up	14	18	12,720	20,988	12,071	95%	58%	631	495	96%	58%
Brighton Main Line (North)	Clapham Junction-Victoria	From	Up	14	18	12,720	20,988	12,071	95%	58%	399	321	96%	58%
Brighton Main Line (North)	East Croydon-London Bridge	From	Up	12	20	12,460	29,288	25,171	202%	86%	483	367	203%	86%
North Downs (Reading) Line	Guildford (Dorking)-Redhill	To	~	2	2	360	594	87	24%	15%	113	86	32%	19%
North Downs (Reading) Line	Redhill-Guildford (Dorking)	From	~	2	2	360	594	175	49%	29%	51	38	52%	32%
Tonbridge Main Line	Tonbridge-Redhill	To	Up	2	2	960	1,584	299	31%	19%	6	5	31%	19%
Tonbridge Main Line	Redhill-Tonbridge	From	Down	2	2	960	1,584	149	16%	9%	4	3	16%	9%
Horsham Branch Line	Horsham-Three Bridges	To	Up	5	5	3,480	7,116	2,352	68%	33%	122	94	68%	33%
Horsham Branch Line	Three Bridges-Horsham	From	Down	5	5	3,480	7,116	1,176	34%	17%	63	48	34%	17%
										TOTAL (to)	3,361	2,549		
										TOTAL (from)	2,106	1,611		

Table 20: Staff low productivity scenario – rail capacity analysis

Line	Section (between)	Direction (related to Gatwick)	Direction (related to London)	*2030 capacity + background demand*							*Gatwick Airport rail forecast flows*		*Gatwick + background rail forecast V/C*	
				Gatwick train paths (NR info)	Total train paths (NR info)	Hourly capacity (seated)	Hourly capacity (total)	2030 background passengers	2030 background V/C (seated)	2030 background V/C (total)	Option 3 (Gatwick submission)	Option 0 (one runway)	Option 3 (2nd runway) NET - seated	Option 3 (2nd runway) NET - total
GEX	Victoria-Airport	To	Down	4	4	2,880	4,752	1,730	60%	36%	949	621	71%	43%
GEX	Airport-Victoria	From	Up	4	4	2,880	4,752	3,460	120%	73%	689	461	128%	78%
Brighton Main Line (South)	Brighton-Burgess Hill	To	Up	13	13	9,060	18,384	6,202	68%	34%	239	163	69%	34%
Brighton Main Line (South)	Burgess Hill-Three Bridges	To	Up	19	19	13,320	26,100	11,581	87%	44%	366	250	88%	45%
Brighton Main Line (South)	Three Bridges-Airport	To	Up	28	28	19,080	38,352	14,651	77%	38%	781	539	78%	39%
Brighton Main Line (North)	London Bridge-East Croydon	To	Down	12	20	12,460	29,288	12,585	101%	43%	813	542	103%	44%
Brighton Main Line (North)	Victoria-Clapham Junction	To	Down	14	18	12,720	20,988	6,036	47%	29%	664	467	49%	30%
Brighton Main Line (North)	Clapham Junction-East Croydon	To	Down	14	18	12,720	20,988	6,036	47%	29%	1,076	739	50%	30%
Brighton Main Line (North)	East Croydon-Redhill	To	Down	26	26	18,120	36,768	9,149	50%	25%	2,019	1,370	54%	27%
Brighton Main Line (North)	Redhill-Airport	To	Down	28	28	17,520	35,778	6,990	40%	20%	2,216	1,504	44%	22%
Brighton Main Line (South)	Airport-Three Bridges	From	Down	28	28	19,080	38,352	7,325	38%	19%	286	197	39%	19%
Brighton Main Line (South)	Three Bridges-Burgess Hill	From	Down	19	19	13,320	26,100	5,790	43%	22%	189	130	44%	22%
Brighton Main Line (South)	Burgess Hill-Brighton	From	Down	13	13	9,060	18,384	3,101	34%	17%	137	95	35%	17%
Brighton Main Line (North)	Airport-Redhill	From	Up	28	28	17,520	35,778	13,979	80%	39%	1,404	968	82%	40%
Brighton Main Line (North)	Redhill-East Croydon	From	Up	26	26	18,120	36,768	18,298	101%	50%	1,325	915	103%	51%
Brighton Main Line (North)	East Croydon-Clapham Junction	From	Up	14	18	12,720	20,988	12,071	95%	58%	711	499	97%	59%
Brighton Main Line (North)	Clapham Junction-Victoria	From	Up	14	18	12,720	20,988	12,071	95%	58%	450	323	96%	58%
Brighton Main Line (North)	East Croydon-London Bridge	From	Up	12	20	12,460	29,288	25,171	202%	86%	544	369	203%	87%
North Downs (Reading) Line	Guildford (Dorking)-Redhill	To	~	2	2	360	594	87	24%	15%	143	96	37%	22%
North Downs (Reading) Line	Redhill-Guildford (Dorking)	From	~	2	2	360	594	175	49%	29%	58	39	54%	33%
Tonbridge Main Line	Tonbridge-Redhill	To	Up	2	2	960	1,584	299	31%	19%	7	5	31%	19%
Tonbridge Main Line	Redhill-Tonbridge	From	Down	2	2	960	1,584	149	16%	9%	5	3	16%	10%
Horsham Branch Line	Horsham-Three Bridges	To	Up	5	5	3,480	7,116	2,352	68%	33%	150	102	69%	34%
Horsham Branch Line	Three Bridges-Horsham	From	Down	5	5	3,480	7,116	1,176	34%	17%	71	49	34%	17%
										TOTAL (to)	3,945	2,664		
										TOTAL (from)	2,379	1,626		

Table 21: GEX standard fare – rail capacity analysis

Line	Section (between)	Direction (related to Gatwick)	Direction (related to London)	*2030 capacity + background demand*							*Gatwick Airport rail forecast flows*		*Gatwick + background rail forecast V/C*	
				Gatwick train paths (NR info)	Total train paths (NR info)	Hourly capacity (seated)	Hourly capacity (total)	2030 background passengers	2030 background V/C (seated)	2030 background V/C (total)	Option 3 (Gatwick submission)	Option 0 (one runway)	Option 3 (2nd runway) NET - seated	Option 3 (2nd runway) NET - total
GEX	Victoria-Airport	To	Down	4	4	2,880	4,752	1,730	60%	36%	1,233	821	74%	45%
GEX	Airport-Victoria	From	Up	4	4	2,880	4,752	3,460	120%	73%	895	610	128%	78%
Brighton Main Line (South)	Brighton-Burgess Hill	To	Up	13	13	9,060	18,384	6,202	68%	34%	220	154	69%	34%
Brighton Main Line (South)	Burgess Hill-Three Bridges	To	Up	19	19	13,320	26,100	11,581	87%	44%	328	233	88%	45%
Brighton Main Line (South)	Three Bridges-Airport	To	Up	28	28	19,080	38,352	14,651	77%	38%	645	477	78%	39%
Brighton Main Line (North)	London Bridge-East Croydon	To	Down	12	20	12,460	29,288	12,585	101%	43%	704	472	103%	44%
Brighton Main Line (North)	Victoria-Clapham Junction	To	Down	14	18	12,720	20,988	6,036	47%	29%	541	381	49%	30%
Brighton Main Line (North)	Clapham Junction-East Croydon	To	Down	14	18	12,720	20,988	6,036	47%	29%	900	622	50%	30%
Brighton Main Line (North)	East Croydon-Redhill	To	Down	26	26	18,120	36,768	9,149	50%	25%	1,720	1,175	54%	27%
Brighton Main Line (North)	Redhill-Airport	To	Down	28	28	17,520	35,778	6,990	40%	20%	1,884	1,294	44%	22%
Brighton Main Line (South)	Airport-Three Bridges	From	Down	28	28	19,080	38,352	7,325	38%	19%	275	191	39%	19%
Brighton Main Line (South)	Three Bridges-Burgess Hill	From	Down	19	19	13,320	26,100	5,790	43%	22%	186	128	44%	22%
Brighton Main Line (South)	Burgess Hill-Brighton	From	Down	13	13	9,060	18,384	3,101	34%	17%	135	94	35%	17%
Brighton Main Line (North)	Airport-Redhill	From	Up	28	28	17,520	35,778	13,979	80%	39%	1,227	842	82%	40%
Brighton Main Line (North)	Redhill-East Croydon	From	Up	26	26	18,120	36,768	18,298	101%	50%	1,152	791	103%	51%
Brighton Main Line (North)	East Croydon-Clapham Junction	From	Up	14	18	12,720	20,988	12,071	95%	58%	606	422	97%	59%
Brighton Main Line (North)	Clapham Junction-Victoria	From	Up	14	18	12,720	20,988	12,071	95%	58%	371	265	96%	58%
Brighton Main Line (North)	East Croydon-London Bridge	From	Up	12	20	12,460	29,288	25,171	202%	86%	479	324	203%	87%
North Downs (Reading) Line	Guildford (Dorking)-Redhill	To	~	2	2	360	594	87	24%	15%	119	85	37%	22%
North Downs (Reading) Line	Redhill-Guildford (Dorking)	From	~	2	2	360	594	175	49%	29%	55	37	54%	33%
Tonbridge Main Line	Tonbridge-Redhill	To	Up	2	2	960	1,584	299	31%	19%	7	5	31%	19%
Tonbridge Main Line	Redhill-Tonbridge	From	Down	2	2	960	1,584	149	16%	9%	5	3	16%	10%
Horsham Branch Line	Horsham-Three Bridges	To	Up	5	5	3,480	7,116	2,352	68%	33%	131	93	69%	34%
Horsham Branch Line	Three Bridges-Horsham	From	Down	5	5	3,480	7,116	1,176	34%	17%	69	47	34%	17%
										TOTAL (to)	3,761	2,592		
										TOTAL (from)	2,396	1,643		