

**SERAS**  
**Review of Thames Reach Airport Proposal**

**December 2003**

**Halcrow Group Ltd**

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## **1 Introduction**

### **1.1 Introduction**

This report deals with the review and further appraisal of the proposal made by Bluebase for a Thames Reach Airport. It is based on information contained in the following documents submitted on behalf of Thames Reach, further information obtained from Bluebase and their consultants, and work subsequently undertaken:

- Thames Reach Airport: A Lower Thames Tunnel and Airport for London and the South East, Bluebase, September 2002
- Thames Reach Airport: Capital Investment Programme, Summary Report, E C Harris, November 2002
- Thames Reach Airport: SERAS Assessment Submission, Bluebase, June 2003
- Thames Reach Airport: Summary Report, E C Harris, June 2003

The preliminary appraisal of the Thames Reach proposal identified the following principal concerns which were raised at a meeting with Bluebase on 7 April 2003. A subsequent meeting was held on 12 June:

- The airport footprint and layout to cope with the assumed capacity,
- The costs of developing the airport,
- Surface access proposals, particularly the proposal that access by road should be difficult or costly in order to encourage a large proportion of passengers (of the order of 70%) to access the airport by public transport,
- Rail capacity
- Forecasting.

### **1.2 Document Structure**

This document is structured as follows:

- Chapter 2 deals with issues relating to the airport layout and capital costs and the operation of the airport,
- Chapter 3 deals with issues relating to airport access. These are expanded on in the Annex to the Report,
- Chapter 4 deals with the forecasting of potential traffic at Thames Reach and with the economic appraisal of the proposal, and
- Chapter 5 summarises and comments on submissions made by Bluebase following an earlier draft of this report.



## **2 Airport Layout and Capital Costs**

### **2.1 Airport Layout**

This review of the location and layout of the Thames Reach proposal relates initially to the proposal in Bluebase's submissions in 2002. The review is then updated to reflect the June 2003 submission, illustrating how the proposal has developed.

The location is similar to that of the Cliffe scheme, but the site area is considerably smaller and located further west and north, on Halstow Marshes and partially onto the tidal mud flats.

The site straddles what is termed a Lower Thames Tunnel, crossing from Canvey Island on the north bank, due south under the airport and emerging near High Halstow. The tunnel carries both road and rail routes. Rail connections are provided, by various means, to Fenchurch Street, Liverpool Street and Southend on the north side, and CTRL and local lines on the south side. Road connections are given a lower priority, to encourage rail usage, but connect the site by various local links into both Kent and Essex.

The scheme originally had two runways only (Version 1), but the November 2002 document offers two alternative layouts culminating respectively in four (Version 2) and three-runway (Version 3) layouts. Apparently, a decision on which of these would proceed could be deferred until 2012.

The footprint of the airport has been made as small as possible to minimise land take and environmental impacts. This appears mainly to have been achieved by concentrating facilities into a multi-level infield area, with a runway separation of either 1400m or 1500m. The use of in-town and on-train check-in is also mentioned as a means of reducing on-site complexity and, presumably, facility size. The small footprint is claimed to reduce impact on bird conservation areas to manageable levels and to avoid key environmentally sensitive and heritage features.

The smaller and more northerly site, relative to the Cliffe scheme, allows a lower earthworks platform. This is to be built from tunnel excavation material and dredged material arising, in part, from other construction activity in the area.

Details are not apparent of the number of aircraft stands provided, but the original layout appeared to indicate 48 passenger, 24 cargo and 12 maintenance stands, which consumed the whole of the available terminal frontage. The later Version 2 indicates a more conventional core and transverse satellite concourse layout, but stand content and other details are not clear.



Bluebase claims that capacity can be increased, and runway construction deferred, by increasing operating hours to 20 hours or more, versus the 16 hours generally used in SERAS. The rationale for this is not made clear.

Figures tabulated in the November 2002 document appear to show that two runways would offer a capacity of 92 ATM/hr, and this could be accommodated with 109 aircraft stands. Rates used generally in SERAS would indicate a need for at least 180 stands.

#### **June 2003 Submission**

This submission confirms that the airport development is led by the construction of the Lower Thames Tunnel. This provides an orbital, circulatory transport axis to complement the historic radial infrastructure north and south of the Thames. It would provide both road and rail crossings. The road crossing and associated road improvements would provide an outer orbital highway connecting the M11 at Stansted to the M2 at Rochester.

The rail crossing could permit the following services:

- CTRL services between the airport and both St Pancras and Waterloo,
- Through services between Liverpool Street and Fenchurch Street via the Lower Thames Tunnel/Thames Reach Airport and London Bridge/Cannon Street
- Connection of the proposed Crossrail lines/services (or existing services if Crossrail is delayed or abandoned) to Shenfield and Ebbsfleet via the Tunnel and Airport to provide a Thames Gateway Shuttle service throughout the Thames Gateway region.

The Thames Reach proposal is heavily dependent on rail access: the submission envisages 70% of passenger access and 95 or 100% of employee access being by rail. These proportions are considerably higher than actual or modelled proportions for other airports. Remote check-in facilities at major stations – Waterloo, Liverpool Street, Fenchurch Street, Cannon Street, London Bridge, Ebbsfleet, other stations and on board trains – are envisaged to encourage use of rail.

The proposed airport Central Terminal Area (CTA) is located above the Lower Thames Tunnel to minimise transfer time. The CTA is located on Halstow Marshes. The airport is located on the Hoo Peninsula, but some 1.5 km further north and to the west of the Cliffe proposals. The southern boundary of the airport runs from the north of Cliffe village to the north of Allhallows village. The course of Cliffe Fleet provides the western extent of the airport. The airport pushes north into the mud flats in the Thames Estuary.

The June 2003 submission generally envisages a 2 runway airport with intensive use being made of the runways: 20 hours per day for passenger operations and 24 hours per day for freight. The airport is laid out on a platform 6.72 km by 1.92 km, 12.9 sq km in total,

marginally larger than the current 12 sq km of Heathrow but only half the size of the 26 sq km of the site proposed at Cliffe.

In recent correspondence, Bluebase have suggested that the addition of two short, close-parallel runways, each 2,400 metres long and separated by 480 metres from the full-length runways, would enable their forecast capacities (750,000 ATMs and 120 mppa) to be achieved. To allow for these two additional runways the platform area is proposed to be increased by 3.23 sq km, to a total site area of around 16.1 sq km.

The area between the runways is planned to be used, from east to west, for satellite stands at 480m intervals at the eastern end of the site, the Central Terminal Area and a cargo, warehousing, airport services and aircraft maintenance area to the west of the site.

The proposed site area of around 16.1 sq km is small by comparison with other layouts appraised in SERAS, for example:

Airport	Runways	Sq km
Thames Reach proposal	Two pairs of close parallels	16.1
Heathrow	Two	12
Stansted	Two	16.5
Stansted	Two pairs of close parallels	22
Gatwick	Two (with wide spaced)	15
Gatwick	Three	18
Cliffe	Two pairs of close parallels	26

The site is proposed to be raised 6 metres above the 2 metre marsh datum level. Much of the fill is proposed to come from the tunnel workings.

A combination of the smaller site than Cliffe and the lower level of the Thames Reach site are principal reasons why the high earthworks and platform costs at Cliffe are substantially lower for the Thames Reach proposal.

Locating the airport site to the north of the Cliffe site and across the mud flats intrudes into the Thames Estuary and Marshes SPA and Ramsar site, but the Northward Hill SSSI is not taken.

## 2.2 Capital Costs

This section gives a preliminary appraisal of the Bluebase proposal. A previous review was based on documents dated September 2002. Physical airport layout proposals appear to have been substantially revised in later documents, *Thames Reach Airport – SERAS*

Assessment Submission), dated 11<sup>th</sup> June 2003, and various other papers submitted separately.

Bluebases's cost estimates have been provided by EC Harris, on the standard SERAS cost spreadsheet. Figures have been adjusted to the SERAS base date, as previous costings were to a different base.

The treatment of road and rail access costs also differs from previous submissions by Bluebase. Whereas the whole cost of the Lower Thames Tunnel, rail and road connections were previously included, this has now been reduced to include only 10% of the access infrastructure costs.

The document claims a capacity of two runways of 120mppa, based on an average load of 160 P/PATM.

The Bluebase costings have been reviewed against the individual cost rates used generally in the SERAS options. The scale of provision has then been compared to the quantities for Cliffe Option A2(4), the four runway (113 mppa) version of Cliffe.

The table below summarises the two estimates. EC Harris has added 25% on-costs and contingencies respectively, as in SERAS. Some adjustments have been made in presenting the Bluebase figures, to make the treatment of surface access costs consistent. These do not alter the overall estimated costs.

**Table 2.1: Outline Cost Comparison (£m)**

Item	Thames Reach	Cliffe Option A2(4)
Terminals & Satellites	2,347	3,408
Aircraft Pavements	1,125	1,289
Enabling & Infrastructure	2,908	4,806
Navigational Aids	111	131
Cargo & Maintenance	399	645
Support Facilities etc.	516	1,009
<b>Airport development costs</b>	<b>7,406</b>	<b>11,288</b>
Land acquisition	248	190
<b>Total including land</b>	<b>7,654</b>	<b>11,478</b>
Landside road access	276	581
Landside rail access		1,211
<b>Total including access</b>	<b>7,930</b>	<b>13,270</b>

Bluebase and their cost consultants suggest that adding two short, close parallel runways to the two costed above would add around £650 million to the costs given above, making a total cost of around £8,580 million.

Option costs are usually compared on the basis of cost per 1mppa added capacity. For the Cliffe option used here, the added capacity is 113mppa off four runways, based on an ATM capacity of 781,000 and an average load of 145 P/PATM. Adding in the additional £650 million for the two additional runways gives the following comparison.

**Table 2.2: Costs per Unit of Capacity Added, £m/mppa**

	Thames Reach	Cliffe Option A2(4)
<b>Claimed capacity added</b>	<b>120</b>	<b>113</b>
Airport Costs	8,304	11,478
<b>£m/mppa</b>	<b>69.2</b>	<b>101.6</b>
Costs including surface access*	8,580	13,270
<b>£m/mppa</b>	<b>71.5</b>	<b>117.4</b>

\* The Thames Reach cost estimates allow for only 10% of landside road and rail costs. If all the access infrastructure costs (estimated by Bluebase at £2,879M, including the Thames Tunnel) are included, the final figure for Thames Reach is £10.9 billion or £90.9m/mppa.

Aside from the variations in capital cost, these figures point up the different ways in which broadly equivalent capacities are assumed to be generated: from two runways in the case of Thames Reach and four in the case of Cliffe.

<b>Thames Reach</b>	120mppa	160 P/PATM	750,000 PATM
<b>Cliffe A2(4)</b>	113mppa	145 P/PATM	781,000 PATM.

Comparison at the individual cost item level reveals the following significant differences between the Thames Reach and Cliffe options.

*Site Areas and Layouts.* The Thames Reach site has an area of around 13 (or 16 when two additional close parallel runways are allowed for) sq km, broadly the current size of Heathrow and just half of that assumed for Cliffe. Multi-level facilities, including underground works, are proposed to counter the small site area. Further airport layout and land use planning would be necessary to confirm that the proposed site area and layout could accommodate the facilities and throughput proposed. Further information on the airport layout and construction methods, particularly in respect of the proposed multi-level construction, would be necessary to confirm major elements of the cost estimates, including Terminals and Satellites and Enabling Works.

*Enabling Works and Infrastructure.* The substantial cost differences here arise almost entirely from the differences in the overall size, location and elevation of the two schemes. The substantially lower estimated excavation and filling costs reflect the flatter topography of the more northerly-located Thames Reach site, avoiding excavation of the escarpment, and the much smaller site area. Site clearance and demolition costs are similarly reduced. The density of buildings on the smaller Thames Reach site and the use of multi-level construction also reduce the costs of landscaping. The Thames Reach scheme is significantly more expensive in its provision of car parking. The same number of spaces is provided as for Cliffe but all are multi-storey, at a very much higher unit cost.

*Aircraft Stands.* The assumptions built into Bluebase's initial submissions envisaged higher rates of utilisation of aircraft stands and therefore fewer aircraft stands than were made for other options appraised in SERAS.

*Terminals and Satellites.* Floor areas provided for Thames Reach are exactly the same as at Cliffe but a higher rate is used for satellites, reflecting the extensive underground works proposed.

*Aircraft Pavements.* The pavement area calculated for Thames Reach is lower, presumably reflecting the more compact layout, but substantially higher cost rates have been applied.

*Land.* It is not clear why land acquisition costs are greater in the Thames Reach estimate, as the airport site is smaller than the Cliffe option and partially off-shore. Either a higher land value has been used, or other areas or compensation costs have been included.

*Surface Access.* Landside road and rail access costs in Table 2.1 are substantially lower for Thames Reach, where Bluebase have attributed only 10% of the costs of major schemes including the Lower Thames Tunnel, to the airport. The next section of this report indicates that surface access costs may in any event have been under-estimated, irrespective of issues to do with the allocation of these costs to the airport and to others.

## **3 Rail Access**

### **3.1 Summary of Principal Findings**

More details of the principal findings of a review of the Bluebase surface access – principally rail – proposals for Thames Reach airport are set out in the Annex to this report. In this section we confine ourselves to a summary of the main points, which are:

- The rail access times to the airport assumed in the Bluebase submission of 30 June are over-optimistic
- The services proposed, particularly the express services between the airport and London, would not have sufficient capacity to accommodate peak demands generated by a Thames Reach airport operating close to its capacity and achieving target mode shares
- But the target mode shares – of 70% of passengers and 95% or 100% of employees accessing the airport by rail - are very high, such that they might be regarded as unachievable
- If suitable rail services are to be provided, more capacity than is proposed would be advisable at the Airport station and in the Lower Thames Tunnel and at other parts of the rail network.

#### **Rail Access Times**

The Bluebase submission claims a 25 minute journey time between the airport and either St Pancras or Waterloo. It refers to 2 trains per hour to both London termini. Subsequent discussion has suggested there might be 4 trains per hour to Waterloo and 2 or 3 trains per hour to St Pancras.

The SERAS estimates for Cliffe were for 26 minutes between the airport and St Pancras (non-stop), 30 minutes with a call at Stratford, 33 minutes to Waterloo or Victoria with a call at Bromley South. The latter may now be seen as perhaps ambitious,

The Bluebase proposed route to Waterloo is via Gravesend and Southfleet. High speed running would only be possible once the Gravesend urban area (Southfleet) were cleared and the CTRL1 alignment extends only to Fawkham Junction. A journey time approaching 50 minutes could be expected.

A faster route would be via Singlewell allowing true high speed running between Southfleet and Hoo Junction, and reasonably high speed operation between Hoo Jn and the Lower Thames Tunnel portal. But journey times will be longer than assumed for Cliffe because of increased expectation of congestion between Waterloo and Fawkham Junction and the greater distance from Hoo Jn to Thames Reach airport station via the Lower Thames Tunnel.

The proposal that there could be 10 Crossrail services per hour is unlikely to be achieved. Only 4 services per hour are proposed to Ebbsfleet, and, in the interests of maximising use of the central area tunnel, there is an interest in reducing the interaction between Crossrail services and services on other parts of the rail network. And Crossrail will not be a fast service. The fastest journey time between the City and Thames Reach airport would be around 60 minutes.

Freight. The proposed 2-track Lower Thames Tunnel, if it were operating a feasible level of local services (15 tph) and express services (6 tph south of the tunnel) would have negligible capacity for freight. A freight-friendly Lower Thames Tunnel, however, could be valuable as a rail freight connection to the Channel Tunnel.

#### **Adequacy of services to meet demand**

From the material submitted, it is our view that the capacities available on the proposed services have been overestimated in the Bluebase submission. In addition, the Bluebase capacities include an allowance for standing passengers which is not conducive to attracting passengers to rail.

The proposed express services have a 1-way capacity of 3,650 per hour between the airport and London, substantially lower than the possible peak hourly demand of 5-6,000 at the Bluebase forecast airport capacity and rail mode share.

#### **Mode Shares**

The Bluebase submission suggests 70% of passengers and 95% or 100% of employees will access the airport by rail.

For passengers, public transport mode shares (these include bus services and courtesy coach services) have been observed at or above 40% at airports well served by public transport – eg Stansted, Gatwick, Schipol.

95% of employees accessing the airport by rail seems unachievable given the 24-hour nature of the airport and shift working, and the inevitably wide residential dispersion of a large labour force. Heathrow, with a large labour catchment close to the airport and extensive local bus services, attracts 23% of its employees by public transport.

#### **Infrastructure Requirements**

If Thames Reach airport were operating close to its capacity, additional rail capacity at the Airport station and in the Lower Thames Tunnel would be advisable. Also, infrastructure enhancements would be needed in several areas of the rail network more distant from the airport.



## 4 Forecasts and Economic Appraisal

### 4.1 Passenger Forecasts

The Thames Reach passenger forecasts are summarised in Table 4.1. These forecasts are derived from the same model and using input assumptions consistent with those used in deriving forecasts for the SERAS options reported in the Consultation Document.

Capacity assumptions. It was assumed in the passenger modelling that the Thames Reach airport is added to a scenario of Maximum Use of the other South East airports. Capacity at Thames Reach is assumed to come on stream in 2011 with a terminal capacity of 40 mppa and a runway capacity of 280,000 ATMs. In 2016 the airport's operating hours are extended, with a resulting increase in capacity. By 2021 capacity increases to 130 mppa and 657,000 passenger ATMs. London City airport is assumed to shut in 2011.

The same assumptions of seeded service frequencies have been assumed at Thames Reach as were used at Cliffe Marshes for the options that feature in the Consultation Document. That is 40 per cent of Heathrow's 1998 scheduled services, 23 per cent of Gatwick's 1998 charter services and 11% of Stansted's 2000 low cost services.

**Table 4.1 Thames Reach Passenger Forecasts – Thames Reach added to SERAS Maximum Use in 2011**

	2000	2005	2010	2015	2020	2025	2030
<b>Passengers, mppa</b>							
Scheduled				19.3	37.9	46.6	57.5
I to I interlining				6.1	17.0	21.1	24.5
Charter				8.7	13.1	14.4	16.2
Domestic				1.5	2.1	2.5	2.8
Low cost				0.8	1.8	2.2	2.5
<b>Total #</b>				<b>36.4</b>	<b>71.9</b>	<b>86.8</b>	<b>103.5</b>
<b>ATMs, '000</b>							
Scheduled				203	410	474	549
Charter				53	71	76	82
Domestic				18	24	25	26

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Low cost				9	13	14	16
<b>Total #</b>				<b>283</b>	518	589	673
<b>Passengers/PATM</b>							
Scheduled				125	134	143	149
Charter				166	184	191	199
Domestic				84	87	99	106
Low cost				82	142	155	162
<b>Total #</b>				<b>129</b>	139	147	154

# Figures in bold are capacity constrained

The forecasts for Thames Reach are dominated by scheduled services and passengers. Around 80% of forecast passengers in 2030 (82 mppa) are on scheduled services with 24.5 mppa being I to I interliners. The remaining passengers are mainly charter passengers with a small number of low cost and domestic scheduled passengers.

Passengers per ATM increase on average from 129 in 2015 to 154 in 2030. For the purposes of the economic appraisal passenger forecasts are extrapolated forward to 2060. It has been assumed that Thames Reach is capped at a passenger throughput at which passengers per ATM are equal to the Heathrow with another new runway option in 2030.

The passenger mix at Thames Reach becomes increasingly business orientated as it fills up, with around 27% of passengers on scheduled services being business passengers in 2015 increasing to 35% in 2030.

The only time up to 2030 Thames Reach is forecast to reach capacity is in 2015, the year preceding the extension of the airport's operating hours.

Comparable numbers for Cliffe in 2030 are set out in Table 4.2. The forecast passenger throughput at Thames Reach is 6 mppa less than Cliffe in 2030. The average number of passengers per ATM is that same at both airports. Cliffe has a slightly higher proportion of scheduled passengers.

**Table 4.2: Comparison of Cliffe and Thames Reach Passenger Forecasts, 2030**

	Thames Reach	Cliffe
Passengers, mppa	103.5	109.7
Scheduled as % of total	79%	81%
I to I interliners as % of total	24%	23%
ATM, '000	673	712
Average P/PATM	154	154

Figure 1 shows the demand for air travel by district, and the four quadrants of London (North West, North East, South West and South East) plus Central London represented by bars, and

the percentage of this demand from each zone that is forecast to use Thames Reach in 2030 represented by graduated shading.

The height of the bars for the London area show that it is the prime area from which airport demand originates. Over 40% of air travel demand from Central London, North East and South East London is forecast to fly from Thames Reach. These parts of London, the districts of Kent and East Sussex and the whole of East Anglia, dominate the airport's catchment.

## 4.2 Economic Appraisal

The results of the economic appraisal of the Thames Reach proposal are presented in the Table below.

The core economic results, with a 6% discount rate, show benefits of £10.1 billion and costs of £3.7 billion, with a benefit:cost ratio of 2.76:1.

With the new Green Book discount rate of 3.5%, but no allowance for cost bias or delay to benefits being generated, benefits increase to £25.6 billion, costs to £5.2 billion and the benefit:cost ratio to 4.89:1.

Allowance for cost bias raises costs to £7.6 billion and reduces the benefit:cost ratio to 3.40:1.

Further allowance for delay to benefits reduces benefits to £25.0 billion and the benefit:cost ratio to 3.31:1.

There are a number of qualifications that need to be made to these estimates:

*Benefits:* No allowance for 'Comparative Proximities'. The argument has been put forward by Bluebase that a saving in transit times through the airport system is achievable for passengers at a new purpose-built airport, this being the time saving from an efficient, compact, purpose-designed, new-build operation compared with existing airports. This could be just as applicable at Cliffe as it is at Thames Reach, and assumes that facilities within existing airports will not be redesigned or rebuilt in the future that would lead to improved transit times.

Any such benefit should only realistically apply to a certain number of passengers, i.e. those passengers that would have to otherwise change terminals at an older less efficiently designed airport, in the absence of such an airport as Thames Reach. Or those passengers that would not necessarily arrive at the terminal from which their flight was scheduled to depart.

Bluebase estimate this time saving to be worth around 15 minutes per passenger. If this time saving were applied to an arbitrary 25% of Thames Reach's passenger throughput up to 2060,

at a discount rate of 6%, a benefit of £1.4bn (in 2000 prices) is calculated, based on the weighted average value of time of the different passenger types.

*Benefits:* These have been based on intensive utilisation of runways over long periods of the day (20 hours per day for passenger operations). This is likely to generate aircraft delays, which are not allowed for, and would tend to offset any 'Comparative proximity' benefit. All passengers would be likely to be subject to such delays.

*Benefits:* Thames Reach assumes a 20-hour passenger operation. It has been assumed in the modelling and the benefit estimation that passengers would choose to fly during the unsociable hours that would result from such an operation. No 'unsociable hours cost' has been applied to offset the benefits from accommodating more passengers. The risks associated with night-time passenger flights might be exacerbated by the proposed dependence on rail access to the airport. It has implicitly been assumed that night-time rail services would be available and that passengers and airport employees would be able to access night-time rail services and be willing to use them. No costs of providing and operating such services have been allowed for.

*Costs:* A better approach to handling the very large numbers of ATMs and passengers forecast for Thames Reach might be not to attempt to squeeze them through two runways for 20 hours per day every day, as is presently assumed. A 3<sup>rd</sup> or 4<sup>th</sup> runway could be introduced as necessary. Operationally, this extra capacity would reduce the risk of aircraft delay, it would allow more slots for air freighter movements, and would allow night-time periods free of aircraft activity to allow the runways to be maintained. In passenger and revenue/benefit terms this extra capacity could reduce the risks associated with attracting and serving passengers during the night. With the extra runway capacity there is a risk that its full utilisation during peak periods would increase the throughput at such times, triggering the need for increased capacity in terminal and other facilities.

Bluebase's cost consultants estimate the cost of the 3<sup>rd</sup> and the 4<sup>th</sup> runways to be of the order of £650 million. If this cost were spread over the period 2015 to 2020, when they would be expected to be constructed, its present value would be around £240 million (discounted at 6% to 2000 prices).

#### **4.3 Summary of Uncertainties in the Economic Appraisal**

The principal uncertainties surrounding the estimates of benefits and costs are set out below.

Benefits could be sensitive to the following:

- 'Comparative proximity' calculations which could add of the order of £1.4 billion to benefits

- Aircraft delay resulting from intensive use of limited runway capacity over very long periods each day. This has not been quantified but could more than offset the 'comparative proximity' benefits
- The risks to passenger numbers and benefits from making passengers fly at night

Costs could be sensitive to the following:

- The higher costs associated with accommodating passengers during the night and of providing rail/public transport services at night
- Bringing 3<sup>rd</sup> and 4<sup>th</sup> runways on stream earlier, at a cost of around £0.2 billion

*Costs:* The limited information available and the degree of checking that has been possible means that the cost estimates input to the economic appraisal are uncertain, but for the following reasons in particular, costs may have been under-estimated:

- The small airport site area relative to other options appraised in SERAS with similar capacities
- The costs associated with enabling works, since the quantities involved will reflect the airport site area and multi-level, underground construction is proposed
- The Thames Reach proposal is to make use of at-station and on-train check-in facilities, thereby reducing airport facility and site size. The feasibility of this proposal has not been confirmed and it is not clear that allowance has been made for off-airport costs.
- The basis for the lower terminal cost per mppa than in SERAS is unclear
- The proposed number of aircraft stands is lower than has been assumed in SERAS appraisals of other options of comparable capacity
- Only a small allowance for surface access costs (£276 million) has been made, said to be 10% of the costs of associated transport infrastructure schemes. These, in any event, would be unlikely to provide the capacity and the services required. The appraisal of the Cliffe option with similar capacity included an allowance of £1,790 million for surface access provision, including a second road tunnel under the Thames and a second high speed rail link into CTRL.

*Benefits:* The principal drivers of economic benefits in SCAB are the capacity provided and the location of the new capacity. The additional capacity provided by 3<sup>rd</sup> and 4<sup>th</sup> runways being introduced earlier than additional capacity was allowed for from night-time operations in the SCAB run might allow some small additional benefits to both passenger and freight operations. But any additional benefits would be small in absolute terms – perhaps of the order of £100 million (cf estimated benefits of £10,000 million) – and in relation to the costs of the additional runways.

On balance, therefore, the risks attached to the estimates produced to date are that costs have been under-estimated considerably more than benefits and that the probability is that the benefit:cost ratio is over-estimated.

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(2000-2060, £m, 2000 values)		Benefits to Users				Benefits to Freight Users	Benefits to Producers	Government Revenue	Total Benefits	Costs	Net Benefits	Net Benefits Only Counting Benefits to UK Users	Benefit: Cost Ratio	NPV per mppa of additional capacity
Package	MPPA of Additional Capacity	Generated Users		Existing Users										
		UK	Foreign	UK	Foreign									
Thames Reach June Costs 6%	130	£4,061	£1,548	-£82	-£412	£255	£3,995	£758	£10,123	-£3,674	£6,449	£5,313	2.76	£50
Thames Reach June Costs 3.5%	130	£11,123	£4,580	-£61	-£912	£552	£8,652	£1,707	£25,641	-£5,244	£20,397	£16,728	4.89	£157
Thames Reach June Costs 3.5% cost bias	130	£11,123	£4,580	-£61	-£912	£552	£8,652	£1,707	£25,641	-£7,552	£18,089	£14,421	3.40	£139
Thames Reach June Costs 3.5% cost bias delay	130	£11,044	£4,539	-£61	-£912	£552	£8,164	£1,707	£25,034	-£7,552	£17,482	£13,855	3.31	£134





## 5 Implications of Subsequent Submissions

### 5.1 Subsequent Submissions

Three further communications have been received from Bluebase, the promoters of Thames Reach:

- A revised cost estimate from EC Harris on 1 October
- Comments on Draft SERAS Review of Thames Reach Airport on 1 October
- Thames Reach Airport – Review of net economic benefits on 3 October

### 5.2 Implications

The principal revisions to the cost estimates make specific allowance for the costs of building 3<sup>rd</sup> and 4<sup>th</sup> short close parallel runways and change the scale of surface access provision and increase the share of the costs of additional surface access facilities attributed to the airport. The comparison of the current and previous Thames Reach estimates and the SERAS Cliffe cost estimates is presented in Table 5.1.

**Table 5.1: Outline Cost Comparison (£m)**

Item	Thames Reach previous estimate	Thames Reach current estimate	Cliffe Option A2(4)
Terminals & Satellites	2,347	2,375	3,408
Aircraft Pavements	1,125	1,259	1,289
Enabling & Infrastructure	2,908	3,217	4,806
Navigational Aids	111	130	131
Cargo & Maintenance	399	398	645
Support Facilities etc.	516	702	1,009
Airport development costs	<b>7,406</b>	<b>8,084</b>	<b>11,288</b>
Land acquisition	248 <sup>1</sup>	248 <sup>1</sup>	190
<b>Total including land</b>	<b>7,654</b>	<b>8,332</b>	<b>11,478</b>
Landside road access	276	749 <sup>2</sup>	581

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Landside rail access			1,211
<b>Total including access</b>	<b>7,930</b>	<b>9,081</b>	<b>13,270</b>

- <sup>1</sup> The Thames Reach Land acquisition cost includes £180 million for bird strike measures including the purchase and creation of alternative habitats
- 2 Bluebase quote a construction cost of £1,917 million for roads, rail, tunnels and HV power, to which a 25% allowance for on-costs and a further 25% allowance for risks has been added, giving a total of £2,995 million. Bluebase suggest they have now attributed 25% of surface access scheme costs to the airport rather than 10% previously.

Option costs compared on the basis of cost per mppa of added capacity are set out in Table 5.2.

**Table 5.2: Costs per Unit of Capacity Added, £m/mppa**

	Thames Reach previous estimate <sup>1</sup>	Thames Reach current estimate	Cliffe Option A2(4)
<b>Claimed capacity added</b>	<b>120</b>	<b>120</b>	<b>113</b>
Airport Costs	8,304	8,332	11,478
<b>£m/mppa</b>	<b>69.2</b>	<b>69.4</b>	<b>101.6</b>
Costs including surface access	8,580	9,081	13,270
<b>£m/mppa</b>	<b>71.5</b>	<b>75.7</b>	<b>117.4</b>

<sup>1</sup> The previous Thames Reach estimate has had £650 million added as the estimated cost of a 3rd and 4th runway

The revisions do not significantly change overall cost estimates. They make a higher assessment of the surface access infrastructure cost that might be attributable to the airport. The SERAS surface access costs in respect of Cliffe allowed for connections to other parts of the road and rail networks. Bluebase acknowledge in their *Comments on Draft SERAS Review of Thames Reach Airport* that 'a substantial part of airport surface access is from the south and does not use the tunnel' but it is not clear that any costs have been allowed for accommodating this traffic. Similarly, the *Draft SERAS Review* made the point that 'infrastructure enhancements would be needed in several areas of the rail network more distant from the airport' but no costs have been estimated or included for such enhancements.

In their *Comments on Draft SERAS Review of Thames Reach Airport*, Bluebase make a number of points, with the following of most relevance:

- Rail mode share targets have been reduced from 95% of employees and 70% of passengers to 55-60% of both
- The assumed capacity of the Lower Thames Tunnel has been increased to accommodate peak, long-term demands. The road tunnel is assumed to be of

dual 4-lanes; 4-tracking of the rail tunnel is assumed from 2018; 2 more platforms are assumed in the airport station

- In-town and on-train check-in facilities are seen as a bonus but are not essential. The on-site facilities are said to be adequate to check in all passengers
- Bluebase state that their layout can provide over 200 aircraft stands when different aircraft sizes are allowed for, which, at the rates assumed in SERAS, could accommodate almost 100 ATM/hour
- Bluebase claim additional benefit from the feasibility of 24-hour operation at the airport – in terms of operational flexibility, capacity for passenger and freight movements, and better utilisation of facilities and resources
- Bluebase quote fastest rail journey times from St Pancras to Thames Reach of 26 minutes (as SERAS estimated at the time for Cliffe) or 30 minutes with a stop at Stratford; 40 minutes from Waterloo and 55 minutes from Liverpool Street on Crossrail services via Shenfield
- Bluebase claim additional benefits from their proposals of: saving the public purse £2 billion of expenditure on transport infrastructure to serve the Thames Gateway and wider Thames Gateway benefits in terms of additional jobs and a reduction in rail commuting into London

In their Review of Net Economic Benefits, Bluebase start with the SERAS estimates of benefits and costs and make several adjustments:

- 1) They claim total benefits of £1.8 billion and costs of £0.5 billion for the variations in their latest communications – 3<sup>rd</sup>/4<sup>th</sup> runways, additional rail surface access, additional on-site parking, longer operating hours, increased freight benefits, higher allocation of surface access costs
- 2) Benefits of £1.4 billion from 'comparative proximities' – their claim that it will take passengers 15 minutes less to pass through Thames Reach than through existing airports
- 3) Benefits of £0.5 billion from other new-build design features – fuel efficiency, staff and maintenance costs, supplementary shell (offices, hotels, warehousing) valuations
- 4) Benefits of £1.25 billion from comparative compensation benefits – land, noise, NO<sub>2</sub>, risk, planning and legal costs – relative presumably to development at existing airports
- 5) Wider strategic planning benefits of £2 billion described as – New hub, Thames Gateway, Communities Plan, freight rail, employment, utilities, sea defences, etc.

On the basis of all of these adjustments, Bluebase claim that Thames Reach has higher benefits and a better benefit:cost ratio than Package 15 – additional runways at Heathrow, Gatwick and Stansted.

These adjustments are dealt with in turn below.

1). Benefits of £1.8 billion and costs of £0.5 billion for the variations in their latest communications. The capacities of the 3<sup>rd</sup> and 4<sup>th</sup> runways have been allowed for in the forecasting and economic appraisal so it is not clear why additional benefits should be allowed for. The additional rail surface access and on-site parking referred to have been included by Bluebase to provide sufficient capacity to accommodate forecast demand. They do not represent any significant enhancement in the level of service of the surface access provision over that assumed in the SERAS appraisal of Thames Reach, so again it is not clear why additional benefits should be allowed for. Bluebase assume that since they have reduced the assumed use of the airport for night-time passenger services, there is now more night-time capacity for freight services and therefore more freight benefits. The SERAS freight forecasts at Thames Reach effectively assumed that the night-time runway capacity of the airport was available for freight services, so again it is not clear why additional benefits should be allowed for. There is no case for allowing additional benefits since the level of surface access provision assumed in the SERAS appraisal allowed for the Bluebase schemes.

There does not appear to be a good case for including any of these additional benefits of £1.8 billion, but the additional costs for the 3<sup>rd</sup> and 4<sup>th</sup> runways and higher surface access costs should be included.

In estimating the cost implications of moving from an assumption of a two-runway airport operated on a 24-hour basis to a four-runway airport operated on a more normal working day, Bluebase allowed for the additional site enabling works and aircraft pavement works associated with a larger site and additional runways. One consequence of the increase in the number of runways is an increase in peak hour runway capacity, which in turn may require an increase in terminal capacity. The estimated Thames Reach terminal and satellite costs, at £2.4 billion (see Table 5.1), are some £1 billion ((30%) lower than the Cliffe estimated costs for similar capacity. More confidence would be needed in both the terminal capacity provided and in the costs of providing the capacity before the lower estimate could be accepted without reservation.

The surface access costs allocated by Bluebase are 25% of the costs of the Lower Thames Tunnel. The basis of the 25% allocation is not clear. Bluebase suggest that the volume of airport traffic would equate to 25% of the LTT's capacity – capacity rather than throughput. There is no evidence that the other 75% of the tunnel's capacity would be taken up and paid for by non-airport traffic.

The additional costs of the 3<sup>rd</sup> and 4<sup>th</sup> runways and of the surface access schemes necessary to serve the airport need to be included in the appraisal, but it is not yet clear that an adequate allowance has been made in either case.

2) Benefits of £1.4 billion from 'comparative proximities'. Bluebase say that the compact nature of their site helps reduce taxiing times and results in comparative proximities benefits. The site layout, with terminals, satellites and aircraft stands sited between two pairs of close parallel runways, means that the outer runways are accessed either by crossing the inner runways, which may reduce capacity, or by taxiing around the inner runways which can greatly add to taxiing time.

While a more compact site would generally reduce taxiing distances, runway to gate time is more a function of traffic circulation and movement conflicts. These are likely to be more difficult to resolve with a smaller infield area. Hence, it cannot simply be assumed that there will be substantial journey time savings.

3) Benefits of £0.5 billion from other new-build design features. The basis of the Bluebase estimates is not clear. Taxiing distances and movement conflicts on the ground have been referred to above and it cannot just be assumed that there will be significant fuel efficiencies. SERAS has made an adequate allowance for the reduced labour force at new airports and Bluebase's assertion that benefits have not been claimed for supplementary shell valuations is true of all SERAS appraisals.

4) Benefits of £1.25 billion from comparative compensation benefits. It appears that this is Bluebase's estimate of the additional cost that could be incurred by an additional runway at Heathrow. If the estimates were accepted they should feature in a Heathrow cost:benefit appraisal not in a Thames Reach appraisal.

5) Wider strategic planning benefits of £5 billion. The basis of these is not clear. In different versions of their *Thames Reach Airport – Review of net economic benefits* issued in October 2003, Bluebase quoted £2 billion and £5 billion as *preliminary figures currently being assessed*. It has not been demonstrated that the proposed airport would of itself generate benefits or resource savings of this magnitude.

### 5.3 Summary

In summary, a number of adjustments and some positive claims have been made by Bluebase. Many of the claims for additional benefit made by Bluebase do not appear to be well-founded, and there remain important differences between the Bluebase claimed benefits and the SERAS estimated benefits which are outlined below.

Bluebase's estimated airport development costs are low in relation to the SERAS estimates for Cliffe and lower than can readily be explained by differences in site location. The Thames

Reach site area is deliberately kept small which keeps down the costs of creating the site platform and airport pavements, but it is not clear that the small site would allow the necessary operational flexibility. Terminal and satellite costs per mppa at Thames Reach are considerably lower than at Cliffe though annual and peak hour capacities would need to be similar. It is not clear that proper allowance for additional terminal capacity to accompany the 3<sup>rd</sup> and 4<sup>th</sup> runways has been made.

Bluebase's estimated surface access costs are low in relation to SERAS estimates and seem to omit surface access schemes that should be included. 25% of the costs of the Lower Thames Tunnel, estimated at £3 billion, have been allowed for on the basis that airport traffic might equate to 25% of its capacity. But a substantial part of airport traffic will not use the tunnel and no costs are assumed to accommodate this traffic nor for infrastructure enhancements which would be needed in several areas of the rail network more distant from the airport. The Cliffe estimate assumed that surface access schemes costing £1.8 billion in addition to the Lower Thames Crossing would be needed to serve the airport. Most of these schemes, costing of the order of £1.4 billion could still be needed to serve the Thames Reach airport, but only £0.7 billion has been allowed for.

The bases for proposed additional benefits are not clear.

Variations proposed by Bluebase in their recent communications – 3<sup>rd</sup> and 4<sup>th</sup> runways, additional rail access, additional on-site parking, longer operating hours, increased freight benefits – do not generally offer more capacity or better surface access provision than has already been assumed in the estimation of benefits, so generally there is no case for allowing additional benefits.

'Comparative proximities' benefit are claimed from shorter taxiing distances, but outer runways would have to be accessed by crossing or going round inner runways and runway to gate time is more function of traffic circulation and movement conflicts than distance alone. A smaller infield area is likely to make it more difficult to resolve conflicts.

Benefits from other new-build design features have been claimed, but significant fuel efficiencies from reduced taxiing distances cannot just be assumed, SERAS has made an adequate allowance for the reduced labour force at new airports and benefits for supplementary shell valuations have not been claimed in any SERAS appraisal.

Comparative compensation benefits appear to be estimates of additional costs that could be incurred by an additional runway at Heathrow. If they were accepted, they should feature in a Heathrow not a Thames Reach cost:benefit appraisal.

Wider strategic planning benefits of up to £5 billion have been claimed. Throughout SERAS, posited wider, or indirect, economic benefits have not been taken into account, because:

- There can be considerable overlap between direct and indirect benefits, so that to count both would be double-counting,
- Any comparison of alternative development proposals taking account of such wider impacts would have to apply to all such proposals, not just for one proposal.

Finally, any saving in public expenditure due to any utilisation of excess capacity on CTRL, if such were to take place at and beyond the time at which Thames Reach airport were in place, is a Government financial transaction and not a resource saving which could count in economic appraisal.



## Annex: Rail Infrastructure and Services

### Feasibility of Proposed Rail Services

This Annex reviews the proposed arrangements for surface access, principally by rail, to a Thames Reach airport made by Bluebase particularly in their submission to DfT of 30 June.

The review is structured into assessments of

- The feasibility of running the proposed rail services using the infrastructure improvements described
- The suitability of the proposed services and facilities for the transport task envisaged, and
- The likely extent of the further infrastructure enhancements necessary to operate the proposed services.

Bluebase propose an immersed-tube multi-modal Lower Thames Tunnel (LTT) containing two rail tracks, connecting rail lines north and south of the Thames and running beneath the airport site, and up to 8 highway lanes.

Within the Airport the rail alignment would widen to 8 tracks: 2 for freight (with associated sidings beneath the cargo terminal); 2 northbound for regional and local passenger services; 2 southbound for regional and local passenger services; and 2 terminal platforms (possibly through by 2030) for high speed passenger services.

To the north there would be connections:

- near Benfleet, facing east (towards Shoeburyness) and west (towards Pitsea, for Fenchurch Street via either Grays or Upminster); and
- near Wickford, facing east (towards Southend Victoria) and west (towards Shenfield, for Liverpool Street or Crossrail).

Further afield, a chord is proposed near Shenfield to allow through running between the Airport and Chelmsford, Colchester, Ipswich, Norwich etc.

South of the Airport the LTT alignment diverges from the road alignment to run west along the (existing, single track) Grain freight branch, which would be upgraded, to Hoo Jn. At Hoo a west-facing connection to the North Kent Line links to Gravesend, Dartford and London. An east-facing chord would be re-instated for access to the Medway Towns, Maidstone and East Kent.

In the November 2002 proposal access to CTRL is for extra tracks on the North Kent Line between Hoo Jn. and Coulton Avenue (west Gravesend). There, tracks to Waterloo would run via the disused Gravesend Riverside line to join CTRL 1 (which uses the Riverside alignment between Southfleet and the Chatham Main Line at Fawkham). Trains to St Pancras would run via the planned link between the North Kent Line and CTRL 2 at Ebbsfleet.

The Submission adds an alternative proposal, the (faster but more expensive) SERAS/Cliffe proposal for a new line from Hoo Jn. to CTRL at Singlewell/ Claylane Wood (south east of Gravesend). This would make the 4-track section through Gravesend and reinstatement between Coulton Avenue and Southfleet redundant. There could also be an east-facing chord at Singlewell for through services to Ashford International and the Continent.

The services to run on this infrastructure are grouped into three categories:

- High speed services;
- Thames Gateway Shuttles, linking London termini north and south of the Thames via the LTT – it is proposed to join the Shenfield and Ebbsfleet branches of Crossrail as part of this service; and
- Local services linking towns in Essex/East Anglia and East Kent via the Airport.

#### **High Speed Services**

The Submission indicates 4 trains per hour, 2 to Waterloo and 2 to St Pancras, taking 25 minutes. Correspondence relating to NAAM modelling of the proposal refers to 4tph to Waterloo and 2-3tph to St Pancras.

Terminal arrangements for 4tph are described in detail: a 12-minute dwell in an arrival platform for passenger discharge before clearing this platform for the next train (presumably by movement to layover sidings between the LTT running lines north of the Airport station) followed by a 12 minute dwell in a departure platform for passenger boarding.

This differs from the usual arrangement for other airport express services: alternate arrivals and departures on either side of an island platform - a train arrives in platform A to discharge before the train in platform B departs, the train in platform A then loads, departing after the next train has arrived at platform B. With this arrangement a train is always waiting, meaning that passengers do not need to mill around on the platform, but the benefit of this arrangement is lower if, as proposed for Thames Reach, there are services to more than one destination.

More frequent services could be accommodated within the Bluebase scheme by reducing the respective dwell times, e.g. to 7 minutes with a 10-minute headway. However, this would give a 10:20 service interval to Waterloo, for a 15-minute headway to Waterloo dwell time for the St

Pancras service and 50% of the Waterloo services would come down to an inadequate 4 ½ minutes.

Given the intended train loading (see Section 3), extended alighting/boarding periods are desirable. Adding the possibility of additional high speed services to the East Coast Main Line (rail:air substitution services to Edinburgh) and Paris/ Brussels etc., it seems likely that **more platforms dedicated to high speed rail services will be needed**. Given the difficulty in altering station layout with facilities for regional and local services to the east and west of the high speed station and a fully-functional 24-hour airport operating above the station, **these would need to be provided for in the first wave of construction**.

Bluebase's aspiration of a 25-minute journey time to Waterloo or St Pancras would not seem to be achievable without significant additional rail infrastructure. SERAS estimated times of 26 minutes between Cliffe and St. Pancras non-stop, 30 minutes with a call at Stratford and 33 minutes to Waterloo/ Victoria with a call at Bromley South, both services accessing CTRL at Singlewell.

In the initial Bluebase proposal the St Pancras service would be an extension of (or use the same route as) the proposed St. Pancras-Ebbsfleet-Gravesend service. The SRA consultation document on such CTRL-DS services estimates a journey time of 23 minutes to Gravesend (more with a stop at Stratford). Adding the SERAS estimate of 10-11 minutes from Gravesend to Cliffe, roughly co-locational with Thames Reach Airport, journey time would be 34-37 minutes for Thames Reach-St. Pancras. (The alignment between Ebbsfleet and Hoo Jn. would not be suitable for high speed operations, running largely through an urban area, nor is it envisaged that the line between Hoo Jn. and the airport would be particularly fast.)

Similarly, a Waterloo service running via Gravesend and Southfleet (even non-stop) could not run "high speed" until clear of the Gravesend urban area (Southfleet), and the CTRL 1 alignment extends only as far as Fawkham Jn. Between Fawkham and Waterloo trains would be on the heritage-rail Chatham Main Line (70-100mph), sharing the predominantly 2-track route with intensive South Eastern inner- (all stations) and outer-suburban services. Draft CTRL timetables allow 29 minutes for Waterloo-Fawkham, suggesting that the SERAS assumption of 33 minutes via Singlewell (23 minutes Waterloo to Fawkham) is itself ambitious. Thames Reach-Waterloo via Gravesend would take nearly 50 minutes.

Routing trains via Singlewell reduces journey time by allowing true high-speed running between Southfleet and Hoo Jn., and reasonably high-speeds (100mph+) between Hoo Jn. and the LTT southern portal. Even so, times are likely to be longer than those assumed by SERAS rather than less, due to increased (SRA) expectations of congestion between Waterloo and Fawkham (Waterloo service only) and the greater distance from Hoo Jn. to Thames Reach airport station via the LTT tunnel portal than the more direct route from Hoo Jn. to Cliffe.

It should be noted that, with 6 Eurostar and 8 CTRL-DS paths per hour on CTRL 2, this route is at capacity in the peaks, services to St Pancras must either be extensions of

Ebbsfleet/Gravesend services (with implications for capacity for airport passengers, see Section 3) or run instead of a planned service.

#### **Thames Gateway Shuttle**

These services are proposed at "up to 10tph", linking radial commuter lines (notably Crossrail, if built) on the north and south sides of the Thames. With the exception of Crossrail (Submission page 10) no routes are detailed.

The frequency of any Crossrail service at Thames Reach may be limited to 4tph. All 12 Crossrail tph via Ilford could run on to Shenfield, but only 4 are planned to Ebbsfleet, with little scope to increase this number: with 24tph through the central London core it is important for Crossrail services to run on time, and scheme designers have gone to great lengths to insulate Crossrail services from "network pollution" – delays caused by other services – by giving Crossrail exclusive use of its own tracks wherever possible.

To this end it was originally proposed that Crossrail take over the North Kent Line between Charlton and Dartford, with only a few trains to Ebbsfleet (sharing tracks with South Eastern services). The Business Case proposal is for the present pattern of South Eastern services on all three lines to Dartford to continue, with Crossrail running through the Royal Docks to Abbey Wood, where most trains would terminate (insulating Crossrail from South Eastern delays). 4tph would run on as additional (rather than replacement) services to Ebbsfleet through developing areas of the Thames Gateway. While it should be feasible to extend these via Thames Reach to Shenfield (again as additional services, re-signalling through Gravesend required), an increase above 4tph is unlikely to be unacceptable to Crossrail.

It should also be noted that these services will be slow. Crossrail is essentially an all-stations service in the east. With projected journey times from Liverpool Street of 39 minutes to Shenfield and 40 to Ebbsfleet – the fastest Crossrail time from the City to Thames Reach will be around 60 minutes.

Bluebase note that all lines to London are congested and thus propose to spread their services thinly over many routes to avoid over-loading any particular route. In reality all lines into London are effectively at track, junction or terminus capacity in the peaks. Thames Gateway Shuttle services thus need to extend or divert existing services. There are many candidates: in the north to Liverpool Street via Wickford and Romford (if no Crossrail), Fenchurch Street via Basildon and Upminster, Fenchurch Street via Grays; in the south to Charing Cross or Cannon Street via Dartford and Sidcup, Bexleyheath or (if no Crossrail) Woolwich.

This can give 4-6tph (plus Crossrail) to the Airport from both sides of the River. These services are additional only east of Dartford (with Crossrail, services to Thames Reach, CTRL-DS and the existing Dartford-Gillingham service, Dartford-Hoo Jn. would be congested) and between Shenfield and Wickford.

An operational down-side would be loss of lay-over time at the suburban termini to allow late running services to recover time. While a 5-minute dwell time at Thames Reach is proposed, for busy services much of this would be needed for passenger turnover. The only layover time then available on London-London services would be at the London termini, where platform capacity is limited and there is a need to get trains in and out as fast as possible (especially at the 4-platform Fenchurch Street and 6-platform Charing Cross).

### **Local Trains**

These services are also proposed at "up to 10tph", linking East Anglia and Kent via the Airport. Destinations in the north include Norwich, Southend via Rayleigh, and Shoeburyness via Southend (duplication of service to Southend?). Options to the south include Thanet and Dover via the Medway Towns, Maidstone and possibly Ashford. Given capacity constraints on the Great Eastern Main Line between Shenfield and Colchester, and at Rochester Bridge Jn. on the route to Chatham, there is limited scope for these services, 6tph at most.

The key nodes and links where network capacity may constrain Local Trains (these will largely be extra trains rather than diversions) are:

- Shenfield, where the main line is at capacity during the peaks;
- Between Higham and Strood, which may need re-signalling for an additional 4-6tph (the other constraint on this section – Strood Tunnel – is scheduled to be refurbished in 2004); and
- At Rochester Bridge Jn., where the North Kent Line joins the Chatham Main Line – the chord is short (8-car train maximum) steeply banked, tightly curved and thus subject to a severe speed restriction. Any increase in the number of trains using this chord will reduce the capacity of the junction and thus the Chatham Main Line.

Further, the proposed station arrangements at Thames Reach, with a 5-minute dwell-time, will also limit capacity. Allowing, as on the high-speed platforms, a 3-minute platform re-occupation margin, each train consumes 8 minutes, allowing 7.5tph on each of 2 northbound or southbound platforms, i.e.15tph per direction. Potential platform capacity at the Airport is thus closely aligned with the number of paths likely to be available elsewhere on the network (14-16) for the combined frequency of Thames Gateway Shuttle and Local trains.

### **Freight and Overall Capacity**

Bluebase make great play of the value of the LTT for rail freight, but give little detail on how freight would access the line from the south. The main focus of rail freight in Kent is the Channel Tunnel, but the only works proposed to link the Tunnel with the LTT is the "European" chord at Claylane Wood, allowing access via CTRL, which has only limited capacity for express freight (around 10 trains per day), and none at all for heavy freight.

Another potential source of traffic is Grain container terminal, but no chord to allow these trains direct access to the LTT is indicated (reversal in Hoo Jn. Yard is possible). Sheerness and other ports in East Kent generate very little rail freight.

A freight-friendly LTT could be extremely useful to Tunnel freight, allowing it to avoid the congested South and West London Lines which are closed to freight traffic for several hours a day. However, **additional infrastructure will be needed to allow this traffic to access the LTT**. Further, with up to 15 stopping services per hour both north and south of the airport, and up to 6 express services south of the airport (total 21tph), a 2-track LTT will be full and will have **no capacity for freight** during much of the passenger airport the day (and may need to be partially closed for maintenance at other times). It would thus offer freight a more, rather than less time-restricted way round London than the current route

### Suitability of Proposed Services

The extensive network of express and local services are intended to allow Thames Reach Airport to achieve very high levels of public transport access – targets of 70% for passengers and 95% for employees are mentioned in Bluebase's original submission. Bluebase have subsequently revised downwards their estimates of the proportions of passengers and employees who might access the airport by public transport. This section is an assessment largely based on the original, higher percentage rates. These gives rise to two issues:

- Are the services adequate for this transportation task; and
- Are the services attractive to enough users to make the target mode split realistic?

### Capacity

The Bluebase Submission assumes capacities of:

- 800 per Express and, at 4tph, a 2-way capacity of 6,400 per hour;
- 1000 per Thames Gateway Shuttle or Crossrail service - a 2-way capacity of 40,000 is quoted which, at 10tph, counts capacity twice, i.e. to the Airport and from the Airport on each through train; and
- 800 per Local service - a 2-way capacity of 32,000 is quoted which, at 10tph, also counts capacity twice.

Bluebase estimate rail demand as:

- 130m air passengers / 365 days / 20-hour operating day = 18,000 trips per hour \* 70% on rail = 12,500 trips per hour 2-way;
- 90m employees / 3 shifts per day = a peak directional flow of 30,000 trips in a shift changeover hour.

Assuming an 80% load factor airport expresses carry 5,000 passengers/hr 2-way, leaving 7,500 to be carried on other services - Bluebase believe that locating an international hub airport in the Thames Gateway will increase the propensity to fly in areas to the east of London, i.e. a significant proportion of air passengers would have O/Ds between London and the Airport and wish to use Thames Gateway Shuttle / Local services.

With employee demand assumed to spread over 6 hours (3 in, 3 out) peak 2-way ordinary rail demand is then estimated at 7,500 air passengers and 30,000 employees. The total of 37,500 is only 52% of the calculated 2-way capacity of 72,000, and the proposed service level is considered to be more than adequate.

While this appears to be a reasonable conclusion based on Bluebase's assumptions, detailed modelling would be needed to determine whether there was sufficient capacity in each direction on individual services. This has not been carried out but, given reservations regarding the operability of the proposed service level a re-assessment of supply and demand have been undertaken as part of this review, concentrating on peak 1-hour flows and capacities.

Bluebase adopt realistic design capacities (including standees) for their services, but if air passengers and employees are to be attracted to using PT, passengers will expect a seat. More realistic capacities are the planned 650 seats per (10-car) Crossrail train, 780 seats on other (12-car) Thames Gateway Shuttle trains and 520 on (8-car) Local trains. With only 15tph each way this gives 18-20 thousand seats to or from the airport in a peak hour (36-40,000 combined) depending on the mix of services run, significantly lower than the estimate of 72,000 places per hour in the Submission.

The effective capacity of expresses will depend on length, seating density, whether (as alluded to in the Submission) there are facilities for on-train check-in, and whether the trains also need to serve commuters at Ebbsfleet. Platforms at International stations will be at least the length of a Eurostar -381m - (it is presumed that, post CTRL 2, capacity will be available at Waterloo), but at Ebbsfleet and St. Pancras CTRL-DS platform lengths may be as short as 240m<sup>1</sup>.

Assuming long platforms, a Eurostar has around 750 seats, but is notoriously short of luggage space, essential for an airport service, even with a high degree of remote check-in, suggesting fewer seats in airport express configuration. However, the 2 buffet cars (redundant on a 30-minute trip) and a high proportion of low density 1<sup>st</sup> class seats offer the potential to increase seating density.

Ignoring the locomotives, there is 336m of trainlength available for seats and luggage. At the seating density of Gatwick Express (2.25 seats /m, Heathrow Express has only 1.8) 760 seats is realistic<sup>2</sup>. At the 6tph now being assumed, this gives a capacity of 4,560/h one way, 3,650 at the 80% load factor adopted.

Considering demand, although Thames Reach is planned as a 130mppa airport, its hub nature means there will be a high level of interlining and the number of passengers entering and

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<sup>1</sup> If international demand continues to fall short of forecasts, it may be possible to take over 2 Eurostar platforms at St Pancras (and some Eurostar trainpaths) for Thames Reach services.

<sup>2</sup> A Thames Reach-St Pancras service accessing CTRL at Singlowell could use trains built to the more generous UIC B+ loading gauge, with double deck seating areas and greater capacity. Loading gauge between Fawkham and Waterloo is too restricted for double-deck trains.

leaving will be fewer, probably less than 90mppa. However, this demand will not be spread evenly through the operating year, and there will be peaks in demand, both through the day and through the year. For this exercise 1/320<sup>th</sup> of annual traffic has been assumed on an 80% busy day, with a peak hourly flow of 1/15<sup>th</sup> of the daily flow, 9,400 passengers per direction - at the 70% mode split target, 6,600 use rail.

Experience at other airports distant from the city they serve is that public transport mode share is concentrated among trips with a city O/D. With SPASM forecasting that 60-80% of trip ends will be in or beyond London, it will be London services that will face the bulk of PT demand and, given the journey time differential between the expresses (27-39 minutes) and Shuttles (over 60 minutes) it is likely that demand will be concentrated on the express service.

The practical 1-way capacity of the express rail services, at 3,650/hr, is thus much **less than the potential peak 1-way demand of 5-6,000/h**, even if demand splits between London termini in proportion to the service level.

To meet mode split targets, the balance of air passengers, some 2,900/hr, need to be carried on other rail services, along with employees. While the airport may support 90,000 jobs on site, not all employees are on-site every day – typically for an airport of this size it will be around 60% each day, say 55,000 employees. Spread over 3 shifts, and assuming the day (passenger airport) shifts are more heavily staffed than the night shift, the peak employee movement is around 22,000/hr to or from the airport (assuming all types of employee clock on/off at the same time) each way, say 21,000/h 1-way for rail at the target mode share.

Adding in residual air passenger demand, this gives a peak directional demand of 26,000/hr compared with an estimated available capacity of 18-20,000. Again, **capacity is less than that needed to meet the intended demand**, especially if some through, non-airport related demand is also to be carried on these trains. While, at a new airport, it may be possible to arrange shift patterns so that not all workers will seek to enter or leave the airport at the same time, reducing peak demand below the potential level of supply, capacity may still be an issue if employee trip ends do not have the same geographical distribution as the supply of rail seats.

#### **Attractiveness**

Disregarding the apparent lack of peak capacity that would be available on the feasible rail service level, Bluebase have adopted extremely demanding targets for public transport (principally rail) access, particularly for employees.

High PT mode shares for **air passenger access**, up to 55%, are claimed for new airports that are remote from the city they serve and the only alternative is a tolled highway link (e.g. Tokyo, Hong Kong), while PT mode shares above 40% (where PT includes hotel and tour company courtesy coaches) have been observed at airports that have good PT links (e.g. Gatwick, Stansted, Schipol).



While a mode choice modelling exercise has not been undertaken for Thames Reach airport, SERAS mode choice tests for Cliffe assuming a somewhat lower level of rail access indicate a PT mode split of around 40% of air passengers (34% on rail). This rises to 62%, 57% on rail, for inner London.

Even with the full level of service proposed, a PT mode share of 70% (implying 90% for trips to central London) seems unlikely to be achievable without some degree of coercion to use PT, e.g. low (subsidised) PT fares, bundling PT access with air tickets at Thames Reach, limited on-site parking, or tolled highway access.

The last two methods could be combined with extensive car parks at remote check-ins (helping shift demand from express services to Shuttles). However, if such methods were to be applied at Thames Reach, but not at other major South East airports, it is unlikely that this airport would attract the planned air passenger throughput. It thus seems unlikely the target level of air passenger surface access demand will be forthcoming. While this means the feasible level of rail service would be adequate, in a no-coercion scenario demand for parking at the airport could be significantly higher than planned. This is considered further below.

The 95% PT mode share for employees seems un-achievable, given the 24-hour shift patterns associated with airport employment and the wide residential dispersion necessary for such a large labour force.

Even in city centres, with very high levels of public transport provision, the PT mode share for employee access is observed to be less than 90% for conventional (9-5) workers, and much lower for those starting earlier or finishing later. At airports, with early shifts starting around 05:00 and late shifts ending around 23:00, public transport is not a viable access option for many employees – Heathrow, located on the edge of the urban area, with a high proportion of employees resident close to the airport and an extensive network of local buses (many of them free) operating over a 19-hour day, achieves a PT mode share for employees of just 23%.

While a dense network of rail services linking Thames Estuary airport with most urban areas within 20 miles of the airport is proposed, covering a large potential workforce, late evening and early morning PT access is likely to be poor. Maintenance (of both vehicles and infrastructure) will lead to a lower level of rail service at these times, while there is unlikely to be any local public transport during these hours to carry employees between their homes and nearest station.

High PT mode share at the Airport could be achieved via extensive park&ride sites at each end of the core route (e.g. Benfleet and Hoo Jn.). As with air passengers, this implies a degree of coercion to use PT to actually access the airport, and may deter some potential employees, making jobs at the airport harder to fill.

The Bluebase submission indicates that a significant amount of on-site car parking is to be provided, in two multi-story car parks, each of 800,000m<sup>2</sup>. These would provide around 100,000

parking spaces on site, which would be more than adequate even for the 130mppa airport were the target mode shares to be achieved.

However, if the passenger mix at Thames Reach displays the same mode choice and travel characteristics as that at Heathrow at present, on an 80% busy day "Park&Fly" passengers will bring around 9,000 cars to the airport. With average trip duration of around 14 days, this level of demand requires around 130,000 long term parking places for Park&Fly alone. Short-term parking ("kiss&fly"), other visitors and employees will add considerably to the parking requirement, i.e. if Thames Reach achieves the target demand level, but not the target mode shares, a large number of additional on-site car parking spaces will be required

## **Additional Infrastructure Requirements**

The fully developed (120-130mppa) Thames Reach Airport will require either a higher level of rail service, i.e. more rail infrastructure both within the airport and LTT and on the existing rail network, or additional car parking facilities within the airport.

While no network modelling of Thames Reach Airport has been undertaken, the proposed 8 lanes of highway access in the LTT should be adequate for airport traffic, but may overload the adjoining highway network if target mode shares are not met, particularly to the south of the Airport, where most strategic flows will need to use the already congested A2/M2 corridor. It is not clear from the Bluebase Submission whether the northern extension of the A130 towards Stansted is a Thames Reach Airport / LTT scheme, or is assumed to be constructed following the LOIS Multi-modal Study

Assuming the feasible level of passenger rail service outlined above, there would be no capacity for rail freight, either to/from the airport cargo terminal or through trains between ports in Kent and O/Ds north of the Thames for much of the day.

Additional rail capacity, both at the Airport station and through the LTT may therefore be advisable. SERAS assumed 8 platforms at Cliffe, 4 for Airport Expresses and 4 for other services, and 4 rail tracks between the Airport and Hoo Jn. With the high level of passenger services proposed between the Airport and the north side of the Thames, particularly with Thames Reach-Stansted-Edinburgh rail:air substitution services in the more distant future, 4 rail tracks north as far as Benfleet may also be useful.

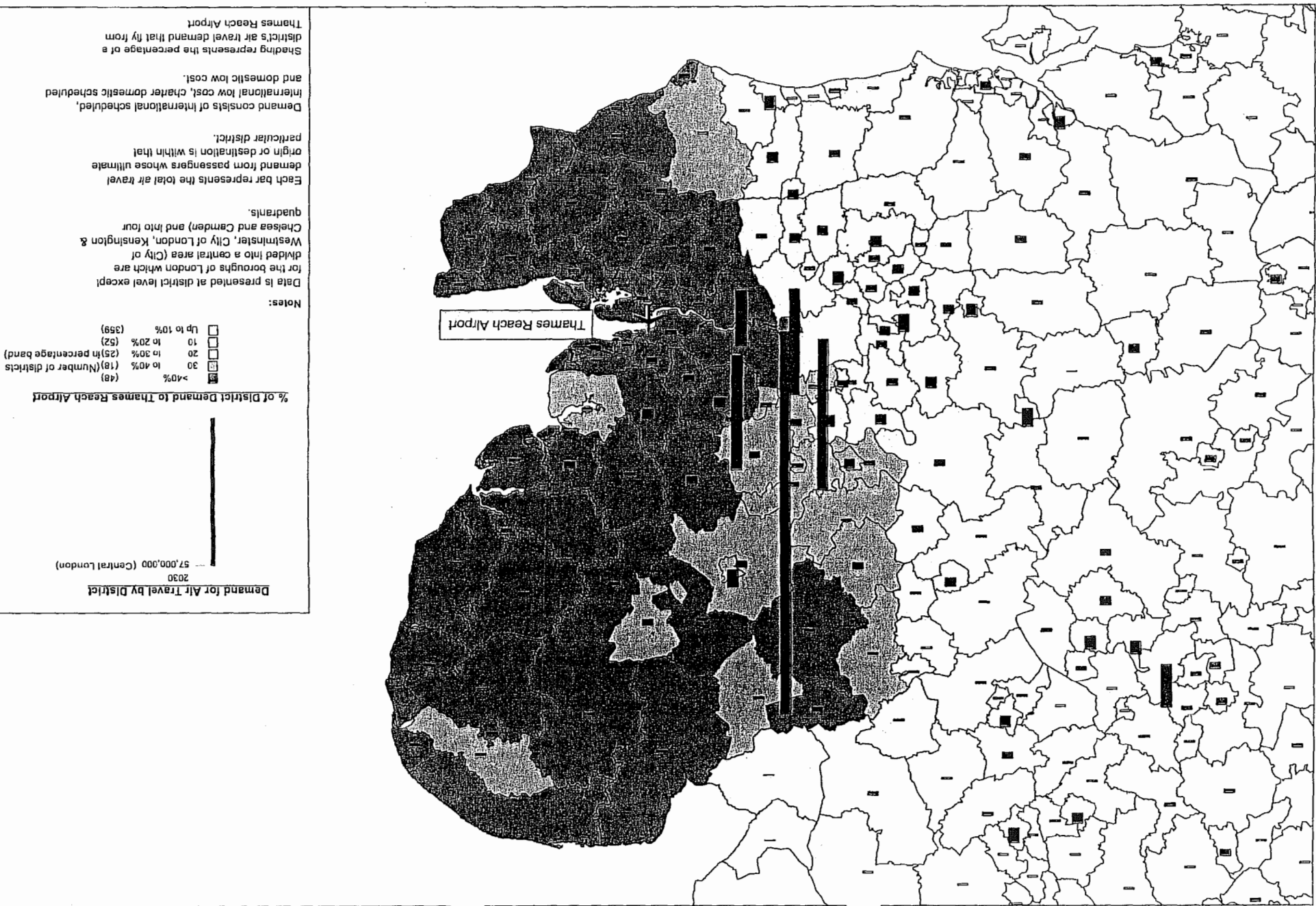
As well as creating capacity for freight to run via the LTT all day, the extra tracks will permit segregation of services, with heavy freight (Channel Tunnel freight trains can weigh up to 1,600 tonnes, and will be slow to ascend the 1:100 grades out of the LTT) and slower Shuttle and Local trains on one track and Express and faster Shuttle services on the other. This would allow some acceleration of Express services between the Airport and Hoo Jn.

Beyond the Airport and LTT further enhancements to those described in the Submission may be required in order to allow the full range of services to run. These may include:

- New lines or chords to allow heavy Channel Tunnel freight to use the LTT, e.g. between the Medway Valley Line and Swanley-Ashford line at Allington, near Maidstone (this could also be used for passenger services);
- An east-facing chord at Cooling to give Thamesport container traffic direct access to the LTT;
- Re-signalling (and possible lengths of multi-tracking) between Strood and Dartford to accommodate the increased frequency of trains;
- Re-signalling (and possible lengths of multi-tracking) between Wickford and Shenfield to accommodate the increased frequency of trains; and
- Grade separation of the north-facing chord at Shenfield to allow northbound Airport trains to Norwich to avoid conflict with southbound services on the Great Eastern Main Line.

Finally, to address the problem of layovers and service regulation, destinations north and south of the Airport could be re-paired, e.g. Fenchurch Street-Dover, Charing Cross-Shoeburyness, to allow longer recovery time at the suburban terminus.

Figure 1 - Demand For Air Travel At Thames Reach Airport



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