HSUK LONDON TERMINAL STRATEGY

In the development of high speed rail systems, the issue of terminal location and onward distribution of passengers assumes almost as much importance as the more obvious question of route. The new lines are designed to carry large volumes of passengers on trains operating at high frequencies, and these factors combine to create major flows arriving at city terminals which must then be efficiently dispersed onto the local public transport networks. This demands full integration of high speed and local systems, with optimised transfer at dedicated and fit-for-purpose terminals. These issues apply at all UK cities where high speed lines are planned, but are most acute in London, where passenger flows are greatest, and congestion in the existing public transport system is most critical.

The following diagrams review existing central London connectivity issues, and compare and contrast the London terminal solutions proposed for HS2, and for the alternative High Speed UK proposals. For precise details of the core High Speed UK proposals (as included in the cost estimates), see the '200k' series of plans.

LTS1 : LONDON MAIN LINE NETWORK CIRCA 1963

LTS2 : EXISTING CENTRAL LONDON RAIL NETWORK INCLUDING CROSSRAIL SCHEME

These diagrams show the rail network of central London, dominated by the classic terminus stations of the Victorian era. These are mostly reliant for onward connectivity upon the Tube network, which tended to form 'nodes' around the busier/more important termini. However, the change from main line to Tube is inherently inefficient, with passengers forced to detrain en masse, and with massive congestion occurring especially at rush hours. The urban Metro model (as exemplified in the Paris RER) of tunnelled cross-city lines is vastly preferable; with many more feasible transfer points, it avoids the 'shock load' of wholesale disembarkation/reembarkation at a single point, and it offers many more through journey opportunities. The diagrams illustrate the progressive integration in central London, with the north-south Thameslink route (opened in 1988) and the ongoing east-west CrossRail project conforming to the urban Metro model.

LTS3 : ORIGINAL CROSSRAIL SCHEME ILLUSTRATING PROPOSED FREQUENCIES

The CrossRail scheme has been through many iterations, but in its final incarnation it will comprise 2 branches to the east (via Stratford to Shenfield and via Canary Wharf to Abbey Wood) and a single branch to the west along the Great Western corridor. 12 trains per hour (tph) will serve each of the two eastern branches, combining into a 24tph service in the core central section as far west as Paddington. There, 10tph will terminate, while 14tph will continue west onto the Great Western, with 4tph serving Heathrow and 10tph serving Slough and Maidenhead. The decision to terminate almost half of the service pattern at Paddington is puzzling, to put it mildly. All of these trains could usefully extend onto other main line corridors, for instance either West Coast or Chiltern routes (both of which are easily accessible to the Great Western corridor with the convergence of railways in the Willesden/Old Oak Common area). This would appear to be vastly beneficial to commuters in a huge swathe of north-west London; instead of being compelled to detrain en masse at Euston or Marylebone, and pack onto already-congested Tube trains, commuting journeys would proceed much more smoothly across the capital. Yet despite these self-evident advantages, no credible rationale has ever been advanced to explain the current CrossRail proposals.

LTS4 : ALTERNATIVE CROSSRAIL SCHEME ILLUSTRATING PROPOSED FREQUENCIES

This diagram illustrates a more balanced CrossRail proposal, with services spreading from the Great Western corridor onto the West Coast Main Line, Chiltern routes and the North London Line to Richmond. This is clearly more complex (and prone to disruption) than the existing CrossRail scheme; but all of these operating challenges have been accepted in the development of Thameslink, and there seems no reason why CrossRail could not work in the same way, and in doing so spread the benefits of the £16 billion investment to a much greater proportion of London's travelling public.

LTS5 : HS2 LONDON TERMINAL PROPOSALS WITH CROSSRAIL INTERCHANGE

The choice of Euston Station as HS2's London terminal was largely inevitable, given its large ground plan, its capacity for redevelopment and its favourable Euston Road location. Its only major drawback is its mediocre local connectivity (only 3 Tube lines, and clear of both Thameslink and CrossRail corridors). HS2 Ltd have

chosen to address these deficiencies by specifying a subsidiary London terminal at Old Oak Common on the Great Western Main Line. This will access both Heathrow services and CrossRail, and at the same time achieve the desired airport link and local connectivity (which will be considerably enhanced through the extension of the 24tph core CrossRail service as far west as Old Oak Common).

However, it is fair to point out that over 9km of tunnel will be required to bring HS2 to Old Oak Common (and a further 14km to reach Ruislip), and thus make a Heathrow connection which will still require a change of trains; and to achieve more direct airport access a further 30km of tunnel will be required, if configured as a loop (or 12km if configured as a spur). It is also reasonable to question whether the extension of CrossRail's core 24tph service to Old Oak Common, for 10tph to terminate there (instead of at Paddington), represents the best use of the new connectivity that CrossRail will bring. WCML commuters will still be forced to transfer to the Tube at Euston where the introduction of high speed services seems certain to increase congestion; and it will also be necessary to physically expand the station into surrounding residential/commercial property.

One further drawback of the HS2 hybrid terminal solution is that the stop at Old Oak Common (which all trains will be forced to make, to enable interchange with CrossRail and Heathrow services) will add circa 5 minutes to the timings of every train on HS2. This will have the effect of making journeys to Birmingham around 1 minute longer than via the slightly slower and more circuitous M1/M6 route adopted in the original High Speed UK proposals, and effectively destroys any logic in HS2's ultra direct route through the Chilterns. It should also be noted that the Old Oak Common connection (by which one third of HS2's passengers are predicted to access high speed services to regional destinations) will be wholly reliant upon CrossRail, and as such is vulnerable to disruption).

It must be stressed that all the above comprise the local drawbacks of the Old Oak Common proposition; for a more national perspective as to Old Oak Common's connectivity deficiencies, see diagrams LBC1-10 and NND1-14.

LTS6: HIGH SPEED UK LONDON TERMINAL PROPOSALS FOCUSSED ON ENHANCED EUSTON

Euston's deficiencies in local connectivity are addressed by the High Speed UK proposals in a radically different fashion. Links to Heathrow are provided by separate development of integrated 'Compass Point' links to east, south, west and north, with the northern link joining the high speed line at Brent Cross. With no immediate prospect of improved Tube links (note the projected Chelsea-Hackney Tube aka CrossRail 2) the better option for Euston is to create a dedicated local distributor system to deliver incoming passengers to nearby hubs, specifically Kings Cross/St Pancras (for Piccadilly, Circle/Met and Thameslink), Tottenham Court Road (for Central and CrossRail) and Waterloo (for South-Western and South-Eastern services). With the distributor system fully integrated into the planning of the new Euston terminal, and located immediately below the main line platforms at an optimal mid-platform position, swift transfers to the adjacent hubs are possible, effectively analogous to a 'horizontal escalator'. Under this strategy, high speed rail connectivity can symmetrically extend around the London conurbation, and as far as the South Coast.

Plan LTS6 shows the preferred HSUK-HS1 link routed via the Midland Main Line and St Pancras. This can be accomplished within the existing railway boundary, with relatively minor impact on the surrounding communities in the London Borough of Camden.

The proposed passenger distributor system allows Euston to be developed into the 'Gateway to the North' with no need to physically expand, and far smoother and more efficient transfer from high speed to local networks. WCML local flows will be transferred to CrossRail with huge benefits to commuter journeys, and with the convergence of western routes at Old Oak Common, a transport hub will naturally form there that will be at least as valuable as that envisaged with HS2.

Brent Cross Interchange (located on the Cricklewood railway site) will perform a subsidiary role, facilitating airport access for regional cities without direct services to Heathrow. It will also allow interchange with Thameslink with onward connections as far as the South Coast, and a range of new local services to destinations such as Wembley, Old Oak Common, Clapham Junction, as well as longer distance links to cities such as Cambridge.

LTS7 & LTS8: HS2 & HIGH SPEED UK LONDON TERMINAL PROPOSALS : QUANTIFIED CONNECTIVITY

The London connectivities achieved by HS2 and the alternative High Speed UK scheme are simplistically assessed by counting the number of stations directly accessible from the proposed high speed terminal(s). In this assessment, High Speed UK's proposed local distributor system extending to nearby hubs is considered as a 'virtual escalator', an effective extension of Euston station. The comparisons examine HS2 exactly as proposed, and with Euston Square underground station rebuilt closer to Euston to allow direct passenger transfer to Circle and Metropolitan Lines. In either case, High Speed UK's more symmetrical and more widespread connectivity vastly outperforms the restrictive connectivity offered by HS2.

LONDON TERMINAL STRATEGY : 1

LONDON MAIN LINE NETWORK CIRCA 1963

DIAGRAM LTS 1

CRICKLEWOOD/ BRENT CROSS *RAILWAY MAINTENANCE DEPOT*

MIDLAND MAIN LINE

EAST COAST MAIN LINE

FINSBURY PARK

WEMBLEY

CHILTERN

WEST HAMPSTEAD

NORTH LONDON LINE

NORTH LONDON LINE

NORTH LONDON LINE

WEST COAST MAIN LINE

GREENFORD

St PANCRAS

3

3

KINGS CROSS

MARYLEBONE

1

2

EUSTON

GREAT EASTERN MAIN LINE

STRATFORD

WILLESDEN JUNCTION

UNTIL 1988 OPENING OF THAMESLINK, TUBE LINES COMPRISED THE ONLY LINKS BETWEEN MAIN LINE TERMINI

CITY WIDENED LINES

GREAT WESTERN MAIN LINE

MOORGATE

2

3

3

LIVERPOOL STREET

3

PADDINGTON

HOLBORN VIADUCT

0

BROAD STREET

LONDON TILBURY SOUTHEND

EALING BROADWAY

OLD OAK COMMON *RAILWAY MAINTENANCE DEPOT*

NUMBER OF TUBE LINES CONNECTED AT MAIN LINE TERMINUS

VICTORIA

2

BLACK-FRIARS

2

1

FENCHURCH STREET

1

CHARING CROSS

2

CANNON STREET

KENSINGTON OLYMPIA

WATERLOO

2

LONDON BRIDGE

1

LONDON TERMINUS TUBE CONNECTIVITY ASSESSED FOR 1963, PRIOR TO OPENING OF VICTORIA & JUBILEE LINES

WEST LONDON LINE (Peak hours/ occasional use only)

SOUTH CENTRAL

RICHMOND

SOUTH WESTERN

CLAPHAM JUNCTION

LEWISHAM

SOUTH EASTERN

LONDON TERMINAL STRATEGY : 2

EXISTING RAIL NETWORK C/W CROSSRAIL SCHEME

DIAGRAM LTS 2

CRICKLEWOOD/ BRENT CROSS *RAILWAY MAINTENANCE DEPOT*

MIDLAND MAIN LINE

EAST COAST MAIN LINE

FINSBURY PARK

WEMBLEY

CHILTERN

WEST HAMPSTEAD

NORTH LONDON LINE

WEST COAST MAIN LINE

NORTH LONDON LINE

NORTH LONDON LINE

STRATFORD INTERNATIONAL

GREENFORD

St PANCRAS

5 5

KINGS CROSS

MARYLEBONE

3

1

EUSTON

GREAT EASTERN MAIN LINE

WILLESDEN JUNCTION

UNTIL 1988 OPENING OF THAMESLINK, TUBE LINES COMPRISED THE ONLY LINKS BETWEEN MAIN LINE TERMINI

THAMESLINK

STRATFORD

MOOR-GATE

LIVERPOOL STREET

TOTTENHAM COURT ROAD

GREAT WESTERN MAIN LINE

3

2 3

PADDINGTON

CROSSRAIL (under construction)

CANNON STREET

LONDON TILBURY SOUTHEND

EALING BROADWAY

OLD OAK COMMON *REDUNDANT RAILWAY MAINTENANCE DEPOT*

NUMBER OF TUBE LINES CONNECTED AT MAIN LINE TERMINUS

VICTORIA

3

2

BLACK-FRIARS

2

2

1

FENCHURCH STREET

CANARY WHARF

CHARING CROSS

WEST LONDON LINE

WATERLOO

3

LONDON BRIDGE

2

EAST LONDON LINE

SOUTH CENTRAL

SOUTH LONDON LINE

RICHMOND

SOUTH WESTERN

CLAPHAM JUNCTION

LEWISHAM

SOUTH EASTERN

LONDON TERMINAL STRATEGY : 3

ORIGINAL CROSSRAIL SCHEME ILLUSTRATING PROPOSED FREQUENCIES

DIAGRAM LTS 3

EAST COAST MAIN LINE

MIDLAND MAIN LINE

FINSBURY PARK

CHILTERN

WEMBLEY

WEST HAMPSTEAD

WEST COAST MAIN LINE

GREENFORD

St PANCRAS

STRATFORD INTERNATIONAL

MARYLEBONE

EUSTON

KINGS CROSS

GREAT EASTERN MAIN LINE

WILLESDEN JUNCTION

THAMESLINK

STRATFORD

GREAT WESTERN MAIN LINE

CROSSRAIL

PADDINGTON

TOTTENHAM COURT ROAD

24 tph

MOOR-GATE

LIVERPOOL STREET

12 tph

12 tph

14 tph

EALING BROADWAY

OLD OAK COMMON

14 tph

10 tph

CROSSRAIL

CANNON STREET

CANARY WHARF

CROSSRAIL ONLY SERVES GWML CORRIDOR TO WEST OF LONDON

10tph OF 24tph SERVICE IN CENTRAL SECTION TERMINATE AT PADDINGTON

VICTORIA

BLACK-FRIARS

FENCHURCH STREET

CHARING CROSS

WATERLOO

LONDON BRIDGE

EAST LONDON LINE

SOUTH CENTRAL

RICHMOND

SOUTH LONDON LINE

SOUTH WESTERN

CLAPHAM JUNCTION

LEWISHAM

SOUTH EASTERN

LONDON TERMINAL STRATEGY : 4

ALTERNATIVE CROSSRAIL SCHEME ILLUSTRATING PROPOSED FREQUENCIES

DIAGRAM LTS 4

7 tph transfer of WCML commuter flows from Euston to CrossRail accounts for all off-peak London Midland services. Terminating platforms at St Pancras & Paddington offer capacity for extra 5tph LM peak hour services to Euston

MIDLAND MAIN LINE

EAST COAST MAIN LINE

2 tph TO AMERSHAM & AYLESBURY

WEMBLEY

WEST HAMPSTEAD

CHILTERN

FINSBURY PARK

WEST COAST MAIN LINE

7 tph TO WCML ##

GREENFORD

St PANCRAS ##

STRATFORD INTERNATIONAL

HS1

GREAT EASTERN MAIN LINE

KINGS CROSS

DIVERSION OF WCML COMMUTER SERVICES TO CROSSRAIL RELIEVES PRESSURE ON EUSTON

WILLESDEN JUNCTION

EUSTON

MARYLEBONE

2 tph TO HIGH WYCOMBE

GREAT WESTERN MAIN LINE

OLD OAK COMMON

24 tph

PADDINGTON ##

TOTTENHAM COURT ROAD

THAMESLINK

24 tph

LIVERPOOL STREET

STRATFORD

12 tph

12 tph

10 tph TO READING & HEATHROW

EALING BROADWAY

CROSSRAIL

CANNON STREET

CANARY WHARF

OLD OAK COMMON PRIMARY WEST LONDON SUBURBAN HUB, WITH CROSSRAIL SERVICES RADIATING TO WCML, CHILTERN & SOUTH-WESTERN CORRIDORS PLUS LINKS TO NLL/WLL

ALL OF 24tph CENTRAL SECTION SERVICE CONTINUES WEST OF PADDINGTON

VICTORIA

BLACK-FRIARS

CHARING CROSS

FENCHURCH STREET

WATERLOO

LONDON BRIDGE

EAST LONDON LINE

3 tph

SOUTH CENTRAL

RICHMOND

SOUTH LONDON LINE

SOUTH WESTERN

CLAPHAM JUNCTION

LEWISHAM

SOUTH EASTERN

LONDON TERMINAL STRATEGY : 5

HS2 PROPOSALS WITH CROSSRAIL INTERCHANGE

DIAGRAM LTS 5

WCML & MML, TERMINATING AT EUSTON & St PANCRAS, REMAIN PRIMARY PASSENGER ROUTES TO SE MIDLANDS CITIES ALONG M1 CORRIDOR

~~*HS2-HS1 LINK, REQUIRING:*~~
~~*• 6km OF TUNNEL FROM OLD OAK COMMON TO PRIMROSE HILL*~~
~~*• SURFACE RUNNING ALONG NORTH LONDON LINE*~~
~~*4-TRACKING THROUGH CAMDEN ROAD STATION*~~
Now cancelled in 2014 Higgins review

EUSTON EXPANDED INTO ADJACENT COMMERCIAL/ RESIDENTIAL PROPERTY TO ACCOMMODATE BOTH EXISTING COMMUTER SERVICES AND NEW HIGH SPEED SERVICES. NO IMPROVEMENTS PROPOSED BY HS2 LTD TO IMPROVE EUSTON'S SURFACE CONNECTIVITY

HS2 EXITS LONDON IN TUNNEL VIA CENTRAL LINE CORRIDOR

HS2-HS1 LINK

HS2

HS1

CROSSRAIL

MAJOR PROPERTY DEVELOPMENT AT OLD OAK COMMON

24tph CROSSRAIL SERVICE LEVELS EXTENDED TO OLD OAK COMMON TO OPTIMISE CONNECTION TO HS2. NO OTHER SIGNIFICANT CHANGES TO CROSSRAIL PROPOSALS

14 tph *10 tph* *24 tph* *24 tph* *12 tph* *12 tph*

WEMBLEY
WEST HAMPSTEAD
FINSBURY PARK
GREENFORD
WILLESDEN JUNCTION
MARYLEBONE
St PANCRAS
EUSTON
KINGS CROSS
STRATFORD INTERNATIONAL
STRATFORD
TOTTENHAM COURT ROAD
LIVERPOOL St
EALING BROADWAY
PADDINGTON
CANARY WHARF
VICTORIA
CHARING CROSS
BLACK-FRIARS
CANNON St
FENCHURCH St
WATERLOO
LONDON BRIDGE
RICHMOND
CLAPHAM JUNCTION
LEWISHAM

LONDON TERMINAL STRATEGY : 6

HSUK SCHEME FOCUSSED ON ENHANCED EUSTON WITH HSUK-HS1 LINK VIA St PANCRAS

DIAGRAM LTS 6

HIGH SPEED UK ROUTED ALONG M1 CORRIDOR SUPERSEDES WCML & MML AS PRIMARY PASSENGER ROUTE TO MIDLANDS CITIES

BRENT CROSS INTERCHANGE

2 tph TO AMERSHAM & AYLESBURY

WEMBLEY

DIRECT 'COMPASS POINT' LINK TO HEATHROW VIA CHILTERN LINE

GREENFORD

2 tph TO HIGH WYCOMBE

7 tph TO WCML

EALING BROADWAY

10 tph TO READING & HEATHROW

3 tph

RICHMOND

HSUK-HS1 LINK VIA EXISTING MIDLAND MAIN LINE TRACKS TO St PANCRAS

NEW CHORD AT NEASDEN

CRICKLEWOOD & OLD OAK COMMON RAILWAY SITES REGENERATED

WEST HAMPSTEAD

WILLESDEN JUNCTION

OLD OAK COMMON

OLD OAK COMMON PRIMARY WEST LONDON SUBURBAN HUB, WITH CROSSRAIL SERVICES RADIATING TO WCML, CHILTERN & SOUTH-WESTERN CORRIDORS PLUS LINKS TO NORTH & WEST LONDON LINES

CLAPHAM JUNCTION - BRENT CROSS LINK VIA OLD OAK COMMON

DIVERSION OF LONDON MIDLAND WCML OFF-PEAK COMMUTER FLOWS TO CROSSRAIL ELIMINATES ANY REQUIREMENT TO EXPAND EUSTON. NOTE EXTRA TERMINATING CAPACITY AT PADDINGTON & St PANCRAS FOR PEAK-HOUR FLOWS

EUSTON DEVELOPED AS INTERCITY GATEWAY TO NORTH, WITH COMMUTER SERVICES DIVERTED TO CROSSRAIL. MAJOR IMPROVEMENTS PROPOSED TO EUSTON'S SURFACE CONNECTIVITY, WITH RAPID DEDICATED 'INTERCONNECTOR' TO ADJACENT TUBE HUBS, TO ACCESS:

- THAMESLINK
- CROSSRAIL
- SOUTHERN NETWORKS

HSUK INTERCONNECTOR: DEDICATED HIGH CAPACITY PEOPLE MOVER SYSTEM TO TRANSFER PASSENGERS TO ADJACENT HUBS

MARYLEBONE

CROSSRAIL 24 tph

24 tph

PADDINGTON ##

VICTORIA

CHARING CROSS

WATERLOO

TOTTENHAM COURT ROAD

FINSBURY PARK

THAMESLINK

HIGH SPEED UK

St PANCRAS ##

EUSTON

KINGS CROSS

0

1.1

2.0

4.4

BLACK-FRIARS

CANNON St

LONDON BRIDGE

TIMINGS IN MINUTES FROM EUSTON

CLAPHAM JUNCTION

LEWISHAM

LIVERPOOL St

FENCHURCH St

STRATFORD INTERNATIONAL

HS1

STRATFORD

12 tph

12 tph

CANARY WHARF

KEY

Station directly linked to high speed terminal

(32) Number of stations connected along main line or Tube line within M25 ring

	No. of stations directly linked	
	within M25 ring	Home Counties
HS2 (Euston unchanged)	108	116
HS2 (linked to Met/Circle	175	188
HSUK via Interconnector	395	594

LONDON TERMINAL STRATEGY : 7

HS2 PROPOSALS: QUANTIFIED CONNECTIVITY

DIAGRAM LTS 7

WEMBLEY

WEST HAMPSTEAD

~~HS2-HS1 LINK~~ Now cancelled in 2014 Higgins review

FINSBURY PARK

GREENFORD

HS2

WILLESDEN JUNCTION

MARYLEBONE

MET/ CIRCLE

St PANCRAS

EUSTON

KINGS CROSS

NORTHERN

HS1

STRATFORD

VICTORIA

TOTTENHAM COURT ROAD

MET/ CIRCLE

LIVERPOOL St

PADDINGTON

NORTHERN

EALING BROADWAY

OLD OAK COMMON

CROSSRAIL

CANARY WHARF

VICTORIA

CHARING CROSS

BLACK-FRIARS

CANNON St

FENCHURCH St

WATERLOO

LONDON BRIDGE

RICHMOND

CLAPHAM JUNCTION

LEWISHAM

LONDON TERMINAL STRATEGY : 8

HIGH SPEED UK SCHEME: QUANTIFIED CONNECTIVITY

DIAGRAM LTS 8

KEY

- Station directly linked to high speed terminal
- (32) Number of stations connected along main line or Tube line

	No. of stations directly linked	
	within M25 ring	Home Counties
HS2 (Euston unchanged)	108	116
HS2 (linked to Met/Circle	175	188
HSUK via Interconnector	395	594

NOTE: INTERCONNECTOR LOCATED AT MID-PLATFORM POSITION AT HSUK EUSTON TERMINAL AND DESIGNED TO OFFER 'VIRTUAL TRAVELATOR' LINK TO ADJACENT HUBS