



JRC Jonathan Roberts Consulting

High capacity alternatives to a road-based Lower Thames Crossing

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Purpose of report

- 1 Jonathan Roberts Consulting was asked to explore the potential for better public transport options across the Thames eastwards from London. This was to see what alternatives might be worthwhile to contrast against the largely car- and lorry-focused Lower Thames Crossing.

Background to the Thames Crossings

- 2 The context is that, everywhere, most travel is local, within a 10-15 km catchment. While the River Thames is a historic barrier to local 360 degree travel, many roads and railways reach it to serve the towns, industries and leisure activities located on its north and south banks, and to serve the other directional flows. At present, transport facilities within each riverside and its hinterland are planned separately and are subject to the policies and investment strategies of each regional and local authority.
- 3 While upstream crossings may merit investment because of their existing travel volumes, the scope for area economic growth is limited by the transport barrier which the river causes. Ferries have been the historic palliative, but for a larger scale intervention, a case for more fixed river crossings faces the twin obstacles of limited existing demand, and high infrastructure costs.
- 4 The Dartford Tunnel when it opened in 1963 focused on the local opportunities enabled with cross-river travel. The Crossing was and still is the responsibility of the riparian local authorities. Subsequent decades of transport planning have added two more layers of travel, first with the M25 and its requirement for more crossing capacity (provided by the QE2 bridge), and second with the population growth and economic expansion of East and South East London and further downstream, which has followed the regeneration of Docklands and London's growth as a 'World City'.
- 5 The current National Highways proposals for a Lower Thames Crossing are therefore as much to do with needing to manage the consequences of East and South East London and Thames Gateway travel pressures, as they are to do with national travel trends.
- 6 Official proposals haven't previously advocated a multi-modal cross-river approach with extensive public transport and rail-based freight capability. Alternatives have generally defaulted to a road proposal, because of the historic lack of rail crossings downstream from Tower Bridge until the 1990s, and lack of evidence about the possible scale of public transport passenger demand.¹

¹ The single downstream rail crossing was the East London Line, linking East and South East London.

- 7 Greater London is now managing the capacity requirements of its expansion through more sustainable transport policies and investment priorities, with higher priority given to public transport and active travel. ²Similar policy and investment frameworks could be adopted within Essex and Kent for the Thames Gateway. In both cases, the context for the Lower Thames Crossing is local or regional, not national – though it is listed as a nationally-significant project.
- 8 There is now merit in identifying:
 - How successful Greater London has been with its different strategies for investment in downstream river crossings.
 - Whether there are lessons which can be learnt from these past two decades.
 - What opportunities there are in the vicinity of the Dartford Crossings to relieve local and sub-regional travel pressures arising in East and South East London and the Thames Gateway, to redirect local and cross-river road demand to other transport modes.
- 9 A high capacity and quick journey times are essential, for any comparative transport option to be a strong alternative. This points towards rail and light rail as the primary options to review, based on experiences in recent decades in East and South East London.
- 10 There, scaling up of cross-river capacity to meet additional travel demand has proved essential. Rail can also make use of the extensive existing infrastructure in Essex and Kent, directly and via interchange. A medium capacity bus-based option would be relevant if neither rail option were viable, however the catchment scale and journey times would be less competitive against car. Projected lorry traffic wouldn't vary.
- 11 Consequently, the JRC report has focused on London's results with its new generation of cross-river rail infrastructure, and the possibility of applying those results further downstream.

² For example, former schemes such as the proposed Ringway 2 river crossing at Thamesmead were cancelled in the 1980s, and several rail schemes have since been advocated there. There is now an official Transport for London proposal for a Docklands Light Railway extension.

Part 1: Passenger travel options: Changes in population and rail use eastwards from London, and consequences for cross-river public transport planning

Report topics and methodology

- 12 The report starts with a commentary which compares rail usage with population changes during 2001-2023, including pre-Covid 2019 and post-Covid 2023. A separate spreadsheet sets out the statistical information in detail and includes all railway stations in various East and South East London boroughs, and in districts and unitary authorities along the Thames on both river banks.³
- 13 A discussion follows, about the significance of population densities for strategic public transport planning, and about the scope and scale of existing public transport cross-river travel. The report on passenger travel options concludes with outline scoping for a cross-river railway in the Thames Gateway, and recommendations for next actions.
- 14 The main station data covers:
 - Census Years 2001 and 2011.
 - Either side of 2021 to allow for pre- and post-Covid rail usage in 2019 and 2023.
 - A four-yearly sequence starts in 2007, then 2011, 2015, 2019 and 2023.
- 15 The detailed tables also assemble the station data by individual route corridors, so that it is possible to see how catchment corridors such as Overground lines, or the radial commuter railways, or Docklands Light Railway (DLR) services in East and South East London, have fared in total station usage over the two decades. The station data is the whole usage at each station, not just the use of an individual service. At National Rail (NR) stations, the proportion of season ticket, full fare and reduced fare travel is set out for 2019-20 and 2023-24, which helps to highlight significant changes in rail usage as a consequence of Covid.
- 16 Data are summarised in a combined assessment table. This sets out:
 - A. Land areas involved, in sq. kilometres, for relevant local authorities**
 - This doesn't change materially from year to year. However, different authorities have varying proportions of built-up or non-built-up/rural areas.
 - B. Estimated population for the assessment years**
 - The actual population is used for the 2001, 2011 and 2023 comparisons.
 - Interpolation of the 2001, 2011 and 2021 census data is used to derive population estimates for 2007, 2015 and 2019.

³ The main source of **population estimates** is the weblink www.citypopulation.de based on national statistics and local demographic data. **Railway information** is compiled primarily from usage of individual stations within each authority. Detailed tables, available separately on TAN's website, are set out with all relevant National Rail (NR) and Transport for London's (TfL) London Underground and Docklands Light Railway stations (LUL, DLR). Station usage comes from the Office of Rail and Road (ORR) and TfL, also some from individual station data in Wikipedia. It should be noted that National Rail uses financial years, TfL uses calendar years.

C. Stated annual station entry and exit usage of each station or station element

- Where station entry/exit includes different operators, the published raw entry/exit numbers are shown, and not adjusted for interchange.
 - This causes some inaccuracy of genuine entry/exit at interchange stations, but most numbers change consistently on a four-yearly basis. It is the overall changes in rail use between four-yearly counts, and between 2007 and 2023, which are the key measures to assess changes in local rail demand.
 - Where station catchments overlap more than one authority, the proportion of journeys from each local authority is estimated. A summary is then compiled for station entry/exit volume in each local authority. This depends on the ease and proximity of access from neighbouring land areas, and the extent of built-up lands.
 - Total entry/exit numbers are halved in the combined assessment table, to omit exit volumes and to assess originating journeys. This provides a measure of originating journeys through each station and from each authority's area.
 - Most stations are within the urban areas. Combined assessments have been estimated separately for those as well as for local authorities as a whole.
- 17 The assessment table then sets out comparative changes over the years between each local authority:
- Total population volume, as above.
 - Total originating rail rides, as above.
 - Population densities, also differentiating between urban areas and whole authorities.
 - Originating rail rides per head of population, and per sq. kilometre.

There is also an urban assessment where relevant.

Understanding the changes in rail travel volume over two decades

- 18 The data enables consistent comparisons to be made about changes in originating rail journeys, in East and South East London, and in the Thames Gateway. These are against a backdrop of underlying population changes, and wider economic measures. The comparisons identify if rail usage is growing or declining year-on-year, or remaining static, **in proportion to the total population numbers.**
- 19 Rail usage should be increasing at least as fast as the general growth in local population, to maintain or increase its relevance for future travel planning – and desirably faster still if it is to offer part of the transport solution to climate change.
- 20 The choice of four-yearly 'cross-sections' starting in 2007 enables a judgement to be taken about significant rail network development and large-scale service changes affecting travel in each period. The route corridors discussed earlier also provide material for assessment of changes along each corridor.

2001-2007

- 21 **This followed the establishment in 1999 of the Greater London Authority and the post of Mayor of London as the new elected chief executive. There was a new transport authority, Transport for London (TfL), which reported to the Mayor, and oversaw the development of transport policies and their implementation.**

- 22 **The post-Millennium period from 2001 to 2007 saw introduction of Oyster tickets on London Underground (LUL) and DLR, though most of NR did not modernise its London ticketing.**
- 23 'Tap-in tap-out' Oyster e-tickets stimulated more tube, DLR and bus travel, due to ease of use and the introduction of hassle-free interchange between those different travel modes.
- 24 Passenger travel grew quickly where new lines had just opened in the London urban regeneration and development zones. The Jubilee Line opened in 1999 to Stratford via Canary Wharf, as did the cross-river DLR extension to Greenwich and Lewisham. DLR extended further within Docklands in 2005 with the line to London City Airport.
- 25 Decisions to invest further with DLR and the East London Line were taken by 2007, with works begun on those projects. The Channel Tunnel Rail Link (High Speed 1) through the Thames Gateway, Docklands and Stratford was under construction.
- 26 So the initial outcome saw fast growth in urban rail usage at LUL and DLR stations, along with growth stimulated by population expansion and co-ordinated public transport investment.
- 27 **There was a new rail travel datum in 2007, because of the Oyster ticketing, and some re-basing in that year of estimated National Rail travel volume.** This provides a baseline for our analysis. 2007 is a consistent starting point for subsequent changes in population and travel estimates.

2007-2011

- 28 **This period saw public transport expansion and investment in much of East and South East London. Some were a prelude to London hosting the 2012 Olympics.**
- There was the full extension of Oyster ticketing to National Rail stations in London.
 - TfL engaged in large-scale development of a rebranded Overground network (mostly, former NR orbital lines) from 2007, with investment following. London's first high-capacity express urban line – Crossrail 1 – was authorised by the Government and works were commenced, though it would take at least a decade to be completed.



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Rail passenger travel demand relative to population change, during 2007-2023

Some figures are rounded	Rail passenger volume						Change in population and rail rides taking 2007 as 100																	
	RAIL USAGE YEAR:																							
	2007	2011	2015	2019	2023		2007	2011	2015	2019	2023	2007	2011	2015	2019	2023								
Changes in rail usage 2001-2011-2023	Originating rail jnys 000s per sq.km						Population mid-year or census 000s						Originating rail jnys in year million						Rail % usage gain / loss if mirroring pop. change (blue = % gain, red = % loss)					
NORTH OF THE THAMES																								
	375	529	712	704	675		100	106	111	116	121		100	141	190	188	180	+0	+35	+79	+72	+59		
	1,221	2,105	2,943	2,890	2,704		100	109	114	120	127		100	172	241	237	221	+0	+64	+127	+117	+94		
	344	407	548	577	551		100	105	112	119	125		100	118	159	167	160	+0	+13	+47	+48	+35		
	350	412	514	527	510		100	106	110	115	118		100	118	147	150	146	+0	+12	+36	+36	+28		
Havering	125	120	145	130	145		100	102	106	111	115		100	96	116	104	116	+0	-6	+9	-7	+1		
NEARBY ESSEX																								
	39	41	45	48	40		100	103	105	108	110		100	103	114	122	102	+0	+1	+8	+14	-8		
	20	20	24	27	35		100	103	105	107	109		100	100	118	132	173	+0	-3	+14	+25	+64		
	26	26	33	36	30		100	104	109	113	117		100	101	125	139	113	+0	-3	+16	+26	-4		
	44	44	49	51	39		100	102	105	108	111		100	101	113	117	90	+0	+0	+8	+9	-21		
Castle Point District	38	44	48	48	31		100	101	101	102	103		100	117	126	126	83	+0	+16	+25	+24	-20		
Southend-on-Sea Unitary	151	158	152	161	114		100	103	105	106	108		100	105	101	107	75	+0	+1	-4	+1	-33		
SOUTH OF THE THAMES																								
	213	250	314	326	275		100	104	107	111	114		100	117	147	153	129	+0	+14	+40	+42	+15		
	270	317	398	413	348		100	104	107	111	114		100	117	147	153	129	+0	+14	+40	+42	+15		
	612	707	952	976	751		100	104	108	112	115		100	115	155	159	123	+0	+11	+48	+48	+7		
	288	454	578	617	611		100	106	112	118	122		100	158	201	214	212	+0	+51	+89	+97	+90		
Bromley (whole boro')	124	123	146	148	110		100	102	104	107	109		100	100	118	120	89	+0	-2	+13	+13	-20		
Bromley (excl. rural)	210	209	247	251	187		100	102	105	107	109		100	100	118	120	89	+0	-2	+13	+12	-20		
Bexley	146	142	155	163	143		100	102	105	107	110		100	97	106	112	98	+0	-5	+1	+5	-12		
RIVERSIDE KENT (whole)																								
	25	26	28	32	28		100	103	132	136	141		100	102	113	129	110	+0	-0	-19	-7	-31		
	64	66	73	83	70		100	103	114	118	127		100	102	113	129	110	+0	-1	-1	+11	-17		
	38	39	44	55	47		100	105	113	122	130		100	102	116	143	124	+0	-3	+2	+21	-6		
	68	69	78	97	84		100	106	116	125	153		100	102	116	143	124	+0	-4	+0	+18	-29		
Dartford (urban only)	18	19	23	25	21		100	102	104	107	108		100	108	128	141	117	+0	+6	+24	+34	+9		
Gravesham (whole district)	83	90	107	118	98		100	103	106	109	111		100	108	128	141	117	+0	+5	+22	+32	+6		
Gravesham (urban only)	24	24	26	28	24		100	102	105	107	111		100	101	106	116	99	+0	-2	+2	+9	-12		
Medway (whole unitary)	57	58	61	67	57		100	102	105	107	111		100	101	106	116	99	+0	-2	+1	+9	-13		

- Opening of the East London Line Overground (now Windrush Line) in 2010-11 included cross-river expansion in South London, and to Highbury & Islington interchange in North London. DLR's cross-river extension to Woolwich opened in 2009, with further expansion via Stratford and Docklands in 2011.
- The North London Line Overground upgrade was in 2009-10, while there was full opening of HS1 for commuter trains in 2009. Works were under way to upgrade the principal Thameslink North-South rail corridor via Central London.
- Rail usage outstripped population growth considerably where investment was taken forward, as demonstrated by adopting the results for 2007 as base 100. After subtracting population growth, the four-year growth in rail usage to 2011 was +64% in Newham and +51% in Greenwich, with the nexus of Stratford, the forthcoming Olympics, and DLR network growth including Woolwich. Elsewhere in East and South East London which benefited from those investments, the growth range was +11/13%.
- Rail travel growth in other parts of outer London and in nearby areas in Essex and Kent matched population growth in aggregate, with a +5/6% growth in Gravesham possibly responding to the establishment of Ebbsfleet International station and Gravesend HS express trains on HS1. Castle Point district, with little population growth but a +16% rail growth, also highlights the benefits in that period of line and train improvements on the 'c2c' Southend line.

2011-2015-2019

29 **Further rail investments were authorised, mainly within London including 'Outer Overground' electrification on the Barking-Gospel Oak line (completed in 2018), and more capacity for commuter lines now becoming overcrowded.**

- The East London Line completed an 'Outer Circle' Overground with its 2012 extension to Clapham Junction.
- TfL introduced Overground to the West Anglia (Weaver) lines in 2015, while TfL Rail took over the City-Shenfield commuter line and the Romford-Upminster shuttle. TfL Rail took over Paddington inner commuter services in 2018. TfL Rail's eastern and western engagement was a prelude to Crossrail 1, and helped to rejuvenate the City-Shenfield line through the four North London boroughs covered in our statistical assessment. There was consequential further rail travel growth. Thameslink opened its main network changes in 2018, though patchily because of operational problems.
- Main stimulus in this period was the London region's continuing population and jobs growth, and greater effectiveness of Oyster fares and ticketing. Introduction of 'contactless' cards began at close-by commuting stations beyond London.
- Better travel data resulting from Oyster ticketing also led to a higher valuation of travel volumes in and around the London Region by national rail authorities, such as the Office of Rail & Road. This enabled better recognition of the importance of public transport networks and services for regeneration and development areas.
- Within London, rail usage considerably outstripped population growth. There was an average +90% growth in total rail usage in relevant North London boroughs by 2015, compared to the 2007 baseline, while the population grew by +11% in the same period (so a net +79%). The North London result in 2019 pre-Covid showed rail volume stabilised at +88% growth, while the population had then grown by +16%.
- The comparative data in relevant South London boroughs was +47% (2015) and +53% (2019) in rail usage, compared to +7% (2015) and +11% (2019) in South London population. There were fewer boroughs in South London which

benefited directly from the rail investments, though the TfL fares and ticketing initiatives reached everywhere. New cross-river rail tunnels and interchanges south of the river stimulated further growth in rail travel in those other South London boroughs.

- There were fewer network and service developments outside the TfL area (which for practical purposes included the City-Shenfield line into Brentwood district), which meant lesser change in rail travel growth.
- There was also a clear variation in travel responsiveness in neighbouring districts and unitaries, compared to the stimulus of greater connectivity and accessibility caused by large scale network changes within London. The closest neighbours at Brentwood, Thurrock, Dartford and Gravesham saw net rail travel gains by 2019, up to one-third in Gravesham (HS1 being an extra stimulus there), and +18% to 26% elsewhere. The ring of authorities beyond saw lesser gains, +1% in Southend-on-Sea, +9% in Medway and +14% in Sevenoaks.
- New Thameslink services are directly relevant along South-East London and riverside North Kent, with a Thameslink-Woolwich-Dartford-Gravesend-Medway service, though this is only half-hourly. The Thameslink North-South core at 20 trains per hour has helped connectivity within the wider Southern rail network, because of improved interchange at Blackfriars and London Bridge.

2019-2023

30 **The intervening Covid years savaged public transport use. Recovery has been varied, with a general drop in season ticket use on National Rail associated with less public willingness to return to a five-day working week in offices, and contrasting growth in full-fare and reduced-fare travel.**

31 **So this is a new era for travel patterns, with fewer 'classic' journeys to work, and more travel by choice. Destinations are also more varied, with fewer journeys solely to and from central London, and more of a polycentric preference.**

- The new London Region 'railway grid' was completed in 2022, with the opening of Crossrail 1 as the Elizabeth Line. Rail recovery and growth has been stimulated strongly by rail interchanges in central London and with a new cross-river tunnel at Woolwich.
- The Elizabeth Line has created a profound change in travel capabilities and urban regeneration across London on a West to East and South-East axis. The planners have put in place a new strategic network when combined with North-South Thameslink via Central London.
- This new 'regional grid' is not limited to London. Its services extend to Sevenoaks, Medway, Shenfield, Cambridge, Peterborough, Bedford, Reading and Brighton. It is complemented in London by orbital Overground lines and by the close mesh of the DLR distribution network in East and South East London.
- Thames Gateway is partially represented in this grid, having the Elizabeth Line and the Thameslink-North Kent service – but without any cross-river services directly joining-up major communities in nearby Essex and Kent.

32 **London's updated rail network now offers useful possibilities for inter-suburban and orbital journeys, and is not limited to travel via Central London.** This diversity of travel possibilities is proving attractive in the post-Covid context.

- London urban areas have responded quickly to this new 'railway grid'. Stratford, and all Elizabeth Line stations in Central London, are now in the 'Top 10' league of busiest stations in Britain – outstripping almost all other National Rail stations, including ALL stations and interchanges outside London and the Home Counties.

- In 2023, rail travel in London Boroughs directly advantaged by rail investment is still markedly ahead of population growth, with a net +59% retained growth over population changes in North London. The Elizabeth Line has stimulated a net +90% gain vs population growth in the Royal Borough of Greenwich, and +64% in Brentwood. Lewisham's retained growth is only +7%, with two specific causes – the decline of Canary Wharf as an office destination, and the cut to NR services at Lewisham stations south of New Cross Gate.
- Elsewhere, outer London and nearby Essex and Kent have mostly seen slower recovery in rail demand post-Covid, with fewer stimuli to make rail more relevant. Comparing population and rail growth between 2007 and 2023, the net rail results in Essex were rail +64% at Brentwood to -33% at Southend-on-Sea. In the urban areas at riverside Kent, the overall results were rail +6% at Gravesham to -29% at Dartford.
- Looking at individual rail corridors, the headline is the continuing strength of the Overground orbital network as well as the Elizabeth Line. Retained growth in rail travel at stations served has been over +150% on the 'Outer Overground' Barking-Gospel Oak (Suffragette Line), and on the East London Overground (Windrush Line) extensions, comparing 2007 and 2023. The eastern section of the North London Overground (Mildmay Line) has retained growth of over +120%. Elizabeth Line (EL) stations have seen explicit growth at local stations in East London and adjoining Essex, with +14% between 2019 and 2023 despite Covid, and +144% overall when compared with usage at pre-EL 2007 stations.
- Along other rail corridors, comparing 2007 and 2023, there were absolute gains on most corridors though a decline on a few.
- Corridor gains were:
 - » +184% at stations from Dartford to Maze Hill on the North Kent inner and South London riverside catchment, this includes new DLR and Elizabeth Line stations and interchanges at Woolwich and Abbey Wood, which were the main stimulus;
 - » over +50% to +200% on parts of DLR;
 - » +60% on the combined Thameslink and HS1 outer North Kent sector between Rainham, Medway, Gravesend and to Ebbsfleet and Stratford;
 - » +34% on the West Anglia Overground (Weaver) Line;
 - » +15% on the District Line between Upminster and West Ham;
 - » +5% overall on the c2c Tilbury Loop lines.
- Declines were:
 - » -19% on the inland South East London NR commuter lines via Bexleyheath and Sidcup;
 - » -16% at local stations between Medway and Bromley on the Kent Coast direct line;
 - » -10% on the Central Line north-east of Stratford, with TfL Rail and Elizabeth Line having successfully relieved overcrowded stations between Leyton and Gants Hill since 2015, though there was an additional Covid effect from 2019;
 - » -8% on the c2c main corridor east from Upminster to Shoeburyness.

Policy and delivery implications

- 33 The consistent message which comes from this analysis over two decades, is that the experience in London has been positive, with investment in well-connected high-capacity public transport in turn underpinning and enabling large-scale population growth. This has been both an enabling cause and a land-use consequence, supporting higher density urban capacity without so many of the detrimental elements which would arise with a roads-only development pattern.
- 34 The scale of population change during these two decades has been considerable. The relevant boroughs in East and South East London grew in population by +26% overall between 2001 and 2023 (1.86 million to 2.35 million). Those authorities which saw major development grew still more: +46% Newham (+114,000), +35% Greenwich (+77,000), +34% Barking & Dagenham (+57,000), +29% Redbridge (+71,000). Localised developments were also relevant, such as in Central Lewisham, Stratford and Woolwich. Also as a consequence, substantial planning applications are continuing in well-connected centres such as Woolwich, and if approved will boost numbers further.
- 35 A similar overall population change has been identified in nearby Essex and Kent authorities for 2001-2023, with +28% growth overall (1.06 million to 1.36 million). The growth rate is slightly lower if looking only at urban areas and authorities, +22% (1.01 million to 1.23 million), though this is on a smaller land area (656 sq. km) than the whole authority areas (877 sq.km) so that population density is higher in the urban context.

The significance of population densities

- 36 The scale of population density is important, as it is the volume of homes in close proximity to existing and proposed public transport (and workplaces, schools, colleges and hospitals at the destination), which will have greatest influence on the scale of public transport usage.
- 37 Average population density in relevant North and South London boroughs increased from 3,500 people per sq. kilometre in 2001, to 4,400 in 2023 (4,800 in urban settlements). By 2023, the range between individual boroughs is 2,400 in Havering, 3,500 in the urban parts of Bromley, then 4,100 (Bexley), 5,600 (Redbridge), 6,200 (Barking & Dagenham, and Greenwich), 8,700 (Lewisham) and 10,000 (Newham).
- 38 In nearby Essex and Kent, 2023 population densities in whole authorities, or urban areas where identified, are stronger south of the Thames, and patchy north of the river. Dartford urban is 2,800 people per sq. kilometre, Medway urban 3,400, and Gravesham urban 4,200. These are a good baseline for further developments allied to supporting public transport services and infrastructure investment.
- 39 In Essex, there are larger rural zones within local authority areas, and urban zones can be identified as individual built-up areas. Public transport plans will need to be selective in how network capability can be improved without excessive infrastructure spend or low travel benefits. This is the same problem as is faced by the Lower Thames Crossing proposals. For example, Brentwood has a population density of only 510 people per sq. kilometre, because of the large rural areas in the north and south of the district. However this hasn't deterred the district's strongly positive response to the provision of Elizabeth Line services, with a +64% growth in rail usage from 2007 to 2023, which is net of population growth.

40 Elsewhere in nearby Essex, the wholly urban Southend-on-Sea achieves 4,400 people per sq. kilometre, which is the same as the East and South East London average. The overall levels of population density are lower elsewhere: 1,100 (Thurrock), 1,700 (Basildon), and 2,000 (Castle Point). Within those authorities, individual built-up areas achieve higher densities which are themselves a good baseline for further developments, and for supporting public transport services and infrastructure investment, as illustrated by Brentwood. The table that follows relies on 2021 Census data.

Authority	Built-up area	2021 pop.	Sq. km.	Pop. density (pop./sq.km.)
Basildon	Basildon	115,964	26.06	4,450
	Billericay	34,072	8.22	4,148
	Wickford	27,524	6.40	4,299
Brentwood	Brentwood	55,358	14.40	3,844
Castle Point	Canvey Island	38,003	9.35	4,066
	Thundersley, incl. Benfleet, Hadleigh	49,881	12.87	3,876
Thurrock	Aveley	9,369	2.06	4,541
	Chafford Hundred	23,579	7.38	3,194
	Grays	44,341	8.12	5,459
	Orsett	1,427	0.44	3,252
	Purfleet	5,883	2.83	2,080
	South Ockenden	22,442	3.96	5,666
	Stanford-le-Hope	29,521	9.43	3,131
	Tilbury	14,184	6.57	2,158



Ebbsfleet

Credit: Shutterstock.com

Public transport usage via River crossings

- 41 Prior to 1999, there was only one railway crossing of the River Thames downstream of Tower Bridge - the historic **East London Line** using the Brunels' Thames Tunnel.
- 42 From 1941, this offered a short distance shuttle within inner East and South East London. It linked the London Underground network via Whitechapel, and the Southern suburban networks via New Cross and New Cross Gate (and also through goods trains until 1962). A temporary closure from March 1995 to March 1998 for tunnel strengthening saw passenger volume, previously 9 million journeys annually, return within eleven weeks of re-opening – showing the vital rôle of the rail tunnel.
- 43 **Six new downstream rail crossings** were proposed and built in the period between the mid-1980s and 2010. The principal objectives for the new investments were:
 - Expansion of Docklands renewal with new housing and new jobs, particularly Canary Wharf, Greenwich Peninsula and the Royals.
 - Regeneration of inner East and South East London, especially 'City Challenge' areas, and Stratford and the Lower Lea Valley. Previously these had been a mix of heavy industries and unimproved housing.
- 44 The re-opened East London Line supported higher density housing in inner London, rail network connectivity, and other regeneration and renewal. During 2007 to 2010, it became a seventh, upgraded rail crossing, by being expanded northwards to the City, Dalston and Highbury along a former rail corridor, and southwards to become the East and South East London cross-river artery for the new orbital Overground network. This was completed in 2012, along with an earlier extension in 2010 via New Cross to Croydon along existing South London railways.
- 45 The six new crossings are:
 - **Jubilee Line extension (JLE) to Canary Wharf, Greenwich Peninsula and Stratford.** Powers were approved in 1990, stimulated strongly by the Canary Wharf development which created a third financial services centre for London's rôle as a World City. It provides two new river crossings, either side of Canary Wharf. The JLE opened in 1999 ahead of the Millennium celebrations, as the Government had also mandated those would be centred on the O2 dome on the Greenwich Peninsula. Rail and bus interchanges were expanded along the route.
 - **Docklands Light Railway (DLR) cross-river extension from the Isle of Dogs to Greenwich and Lewisham.** Powers were approved in 1993, and the line opened in 1999. It connects these South East London rail and bus interchanges, and local catchments, with Canary Wharf, the City's eastern quarter, tube lines and Stratford interchange.
 - **DLR's second cross-river line, to Woolwich,** which gained powers in 2004 and opened in 2009. It joins Stratford, the Royal Docks redevelopment and London City Airport with Woolwich town centre – the major riverside town in South East London. Woolwich is on the North Kent Line and is the main outer South East London bus hub.
 - **The Channel Tunnel Rail Link (High Speed 1).** This is the express railway between central London, Kent and mainland Europe.
 - » A Government-directed change of route in 1991 took the line via the Thames Gateway to support urban regeneration in East London, and economic growth and additional housing capacity. Powers were approved

in 1996, and at Stratford in 2001. However the scheme for intermediate railheads and a local cross-river rail service was subsequently omitted.

- » Commuter trains run non-stop from East Kent via Ashford, and from Medway, via Gravesend and Ebbsfleet, to Stratford and St. Pancras.
- » The line's construction in the Thames Gateway was delayed by funding complexities. It opened to international trains in 2007 and to express commuter trains in 2009.

• **Elizabeth Line, the new West to East express urban metro across London.**

This was approved in 2008 as Crossrail 1. It serves East London via the Stratford-Ilford-Romford-Shenfield railway, and a new route via Canary Wharf and the Royals (at Custom House). It continues cross-river into South East London at Woolwich and Abbey Wood, to serve Greenwich and Bexley boroughs.

Passenger demand on the new cross-river lines

46 Passenger demand for these new and improved rail crossings is considerable. The table below sets out the present estimated volume of cross-river rail use. As noted elsewhere, cross-river usage in East and South East London did not exist on such a scale before the lines were upgraded or newly built, though there was surely much suppressed demand. 95 million cross-river journeys annually by rail, in post-Covid 2023, where before 1999 there were just 9 million on the former East London Line shuttle, is a staggering change in public travel demand.

Authorities	Locations	Cross-River line excludes Jubilee Line ext.	2019 journeys annual 2-way	2023 journeys annual 2-way	Comments (2019 & 2023 TfL flows from TfL 'NUMBAT' data) 2019 was pre-Covid and pre-Elizabeth Line
Tower Hamlets-Southwark	Wapping-Rotherhithe	East London Overground (Windrush Line)	23,500,000	24,600,000	Re-opened in 2010 as part of Overground. Foreseen demand for up to 20 trains per hour each way, with longer peak periods, so towards 40m journeys annually.
Tower Hamlets-Greenwich	Isle of Dogs-Greenwich	DLR Lewisham Line	18,900,000	16,800,000	Opened 1999. Elizabeth Line now direct from Abbey Wood/ Woolwich to Canary Wharf, so fewer journeys in 2023 changing at Greenwich between North Kent Line and DLR. New DLR train fleet has extra capacity, will be more travel with housing growth.
Newham-Greenwich	Royals-Woolwich	DLR Royals & Woolwich Line	14,700,000	8,000,000	East & SE London regeneration and growth line, opened 2011. 2019 volume was pre-Elizabeth Line. Combined cross-river rail volume at Woolwich has already more than doubled with Elizabeth Line arrival, to 33.2 million journeys. Another 2.6m travel on the Free Ferry, so over 35m public transport cross-river journeys annually at Woolwich.
Newham-Greenwich	Royals-Woolwich	Elizabeth Line	0	25,200,000	New strategic express metro, opened May 2022. Already very busy, includes some former DLR cross-river flows.
Newham-(Thurrock)-Dartford/Gravesham	Purfleet-Swanscombe	High Speed 1	22,700,000	20,700,000	Non-stop between Stratford and Ebbsfleet, Passenger volume derived from St Pancras 2016 count and recent HS1 station counts, plus Stratford users to/from Kent. There is a separate analysis. Excludes passenger volume on Eurostar.
TOTAL 2-way rail cross-river annual passenger volume			79,800,000	95,300,000	

- 47 HS1 flows are mainly to and from Central London. Use of the Woolwich rail tunnels is reviewed here to gauge local cross-river travel. Their passenger volume grew from 14.7 million in 2019 to a combined flow of 33.2 million in 2023, despite Covid having limited commuter travel. The rail tunnels benefit a local population mostly originating in Greenwich and Bexley, to a lesser extent in Newham (reverse flow) and North Kent riverside, plus some from distant residential areas via direct rail or bus interchange.
- 48 To gauge the implied rides per head, the catchment origins of cross-river travel via Woolwich have been taken as 75% of Greenwich borough, Bexley 33%, and Newham and Dartford urban each 10%. This is 350,000 people, and suggests a 2023 average of 48 cross-river originating rides per head annually, though probably with greater frequency if closer to the railways and a reduced frequency further away. An equivalent 2019 estimate, pre-Covid and Elizabeth Line, would be 24 rides per head.⁴
- 49 Recent growth in cross-river travel, post-Covid, shows how generative a good local railway offer can be, even after allowing for travel via the Elizabeth Line to central London. This reports uses an order-of-magnitude range of 25-50 originating rides per head as a baseline for potential cross-river rail travel in the Thames Gateway.

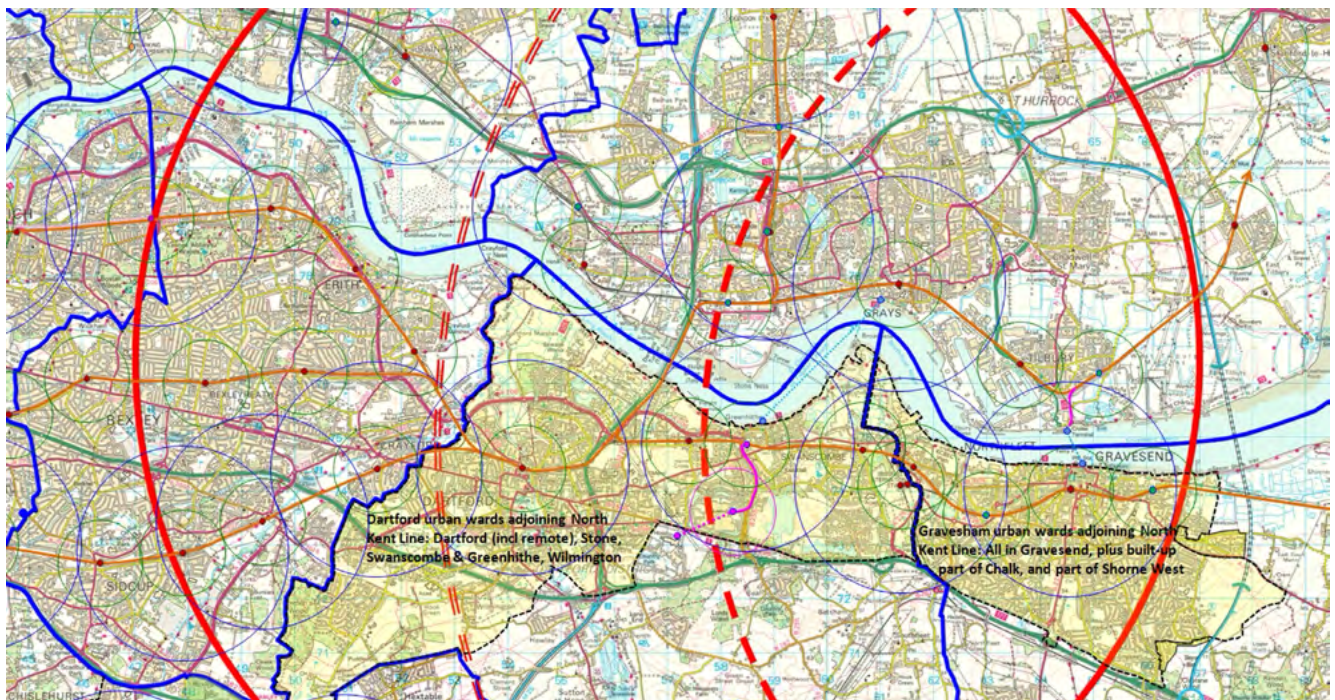


Credit: Craig Russell / Shutterstock.com

⁴ The 2019 estimate includes an estimated 2m annual passengers from the Greenwich and Bexley catchments who then used the Greenwich interchange between the DLR and North Kent Line to reach destinations such as Canary Wharf, but who had transferred by 2023 to the Elizabeth Line.

Corridor options via a Thames Gateway cross-river rail tunnel

- 50 An equivalent comparison will apply to the Thames Gateway, in nearby Essex and Kent. As shown above, there does not have to be an existing cross-river railway, for the case for a new one to be established. We can note the existing travel volume between Ebbsfleet and Stratford International, the two intermediate railheads on HS1 before East Kent, at 2.2-2.3 million journeys annually. However this does not accommodate demand for cross-river travel between the urban populations on both riversides or inland, nor cross-river travel between outer London boroughs in East and South East London.
- 51 The neighbouring catchments for local and regional cross-river travel should be defined around a possible rail (or light rail) alignment which maximises the likely number of passengers, directly and via interchanges.



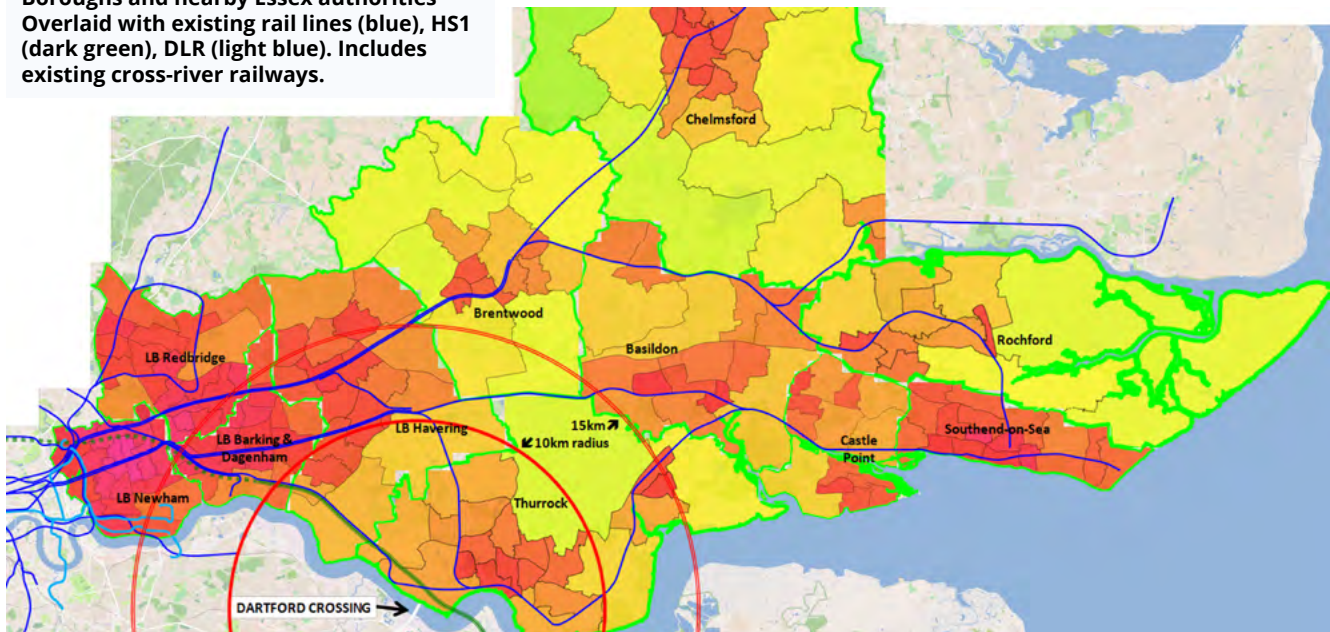
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Thames Gateway local map with 10 km catchment around Dartford Crossing, and 10 km/15 km (hatched) around Lower Thames Crossing, to show probable local cross-river road catchments. Railway station catchments shown as 800 metres (2 km main stns).

- 52 South of the Thames, the reality in the above map is that strong densities are found in Dartford and Gravesend riverside zones, and also in Medway. The North Kent railway corridor already exists, and its capability can be improved and capacity increased. As discussed above, the local urban densities are comparable with much of outer London, so that planning for high capacity public transport can be viable there.
- 53 Cross-river travel pressures faced by the Dartford Crossings provide evidence of the scope for a cross-river rail crossing, providing that is carefully specified in relation to the land uses and interchange potential on both sides of the river:
- A cross-river line can accommodate the orbital travel pressures in neighbouring South London boroughs as well as within Thames Gateway.
 - It can be fed from the three London rail corridors west of Dartford in Bexley and Greenwich with their good population densities and large total populations.
 - The number of commuter trains which terminate at Dartford might provide a train resource for some cross-river extension to riverside Thurrock.

- 54 North of the Thames, dense populations are more dispersed. The largest nearby existing populations are within Thurrock at Grays (44,000), Chafford Hundred (24,000) and South Ockendon (22,000). Stanford-le-Hope (30,000) is also a large population but distant from where a rail crossing and its connections might be constructed most easily, which is close to the existing Dartford Crossings.
- 55 The next map shows population densities in all wards, in relevant East London Boroughs and nearby Essex authorities. The combination of Thurrock's built-up areas (65,000) with the Dartford and Gravesham urban areas, gives a core population base for local cross-river travel of 183,000, possibly 195,000 after ten years' growth. Multiply this by 25-50 cross-river originating rides per head annually (50-100 two-way) gives an annual flow of roundly 10-20 million journeys two-way for a short cross-river link, which is enough to merit a fixed public transport crossing. It would require well-located bus and active travel hubs to maximise rail (or light rail) use.

Ward population densities in East London Boroughs and nearby Essex authorities Overlaid with existing rail lines (blue), HS1 (dark green), DLR (light blue). Includes existing cross-river railways.



Data from www.citypopulation.de

- 56 However such a crossing cannot just rely on the existing volume or future scale of population within Thurrock, to address wider cross-river connectivity in the Thames Gateway. It would be weak in providing direct cross-river services to one or other major urban areas North of the Thames – north-east towards Basildon and Southend-on-Sea, and/or northwards towards Haverling and other parts of Outer East London and via interchanges towards Chelmsford, Basildon and Southend.
- 57 It must be stated that only a heavy rail crossing will have the reach in distance and overall capacity to compete effectively with many car journeys – by using the existing rail corridors on both sides of the Thames and achieving competitive congestion-free journey times.

Options for cross-river rail corridor via a Dartford rail Crossing

- 58 There are two mostly likely onwards rail corridors, shown below:
- Via Grays and Tilbury towards Stanford-le-Hope, Pitsea and Southend-on-Sea.
 - Via Lakeside/Chafford Hundred towards Ockendon, Upminster and Romford.

A third option, to follow the Tilbury Loop line west, does not serve substantial populations until close to Barking.



Thames Gateway with cross-river rail options and potential additional catchment stations

- 59 Scope for a cross-river railway would be enhanced if TfL-style supportive policies were adopted for service quality and passenger travel offers, bus feeder networks and active travel facilities. Infrastructure on its own is part of the whole story but not everything. TfL has a high density of railway stations within the urban parts of East and South East London. Most stations are accessible within a 1 km walking distance or less. A similar policy within the Thames Gateway could stimulate more catchment stations within main urban areas, and the map highlights some possibilities.
- 60 Analysis shows that a northwards corridor paralleling and towards Outer London at Havering – an ‘Outer Overground’ in style – would have greater merit for a rail-based river crossing. The majority of the Outer London catchment is within 20 km of the Dartford Crossings, most within 15 km, while, towards Southend, only Stanford-le-Hope is within a 15 km distance, and Basildon (indirectly) within 20 km. So travel frequency will be stronger with a northwards rail corridor.
- 61 The line from Southend via the Tilbury Loop towards a Dartford rail Crossing is already populated with trains to Central London via Purfleet and via Ockendon, so that the extent of operational overlap (and operational costs) with a crossing service to Southend would be considerable. This diminishes the benefit-cost case for a direct service north-east.

62 In contrast, a northwards rail corridor:

- Overlaps existing rail services only on the Thurrock riverside, and between there and Upminster if using the Ockendon line.
- Serves Lakeside business and shopping centre (with improvements to Chafford Hundred station), and stimulates that to become a strong sub-regional centre for the Thames Gateway.
- Replaces Upminster-Romford trains with a through 'Outer Overground' service.
- Interchanges with:
 - » Radial rail services to and from Southend, via the Tilbury Loop line at Lakeside or West Thurrock; also via Upminster to Basildon and Southend.
 - » Radial rail and Underground services to London urban areas in Barking & Dagenham and Newham, via West Thurrock or Upminster;
 - » Additional catchment access via Romford, to the northern rail corridor to Southend via Billericay, Wickford and Rochford;
 - » Similarly via Romford, to urban areas served by the Elizabeth Line between Stratford and Shenfield, and to the Great Eastern main line towards Chelmsford and further destinations in Essex.
- Relieves orbital traffic flows currently reliant on the local road networks, and the strategic road network and its congested junctions in the Thames Gateway.

63 There would be a higher infrastructure cost to achieve this outcome compared to a local rail crossing just as far as Thurrock, or a through service to Southend. This is because the Ockendon line, and possibly also Upminster-Romford, would need doubling of the existing single track. Grade-separation would be required at Upminster, and improved interchanges at Upminster and Romford.



Pre-Ebbsfleet, the Gateway's most recent opening was 50 years ago: Basildon in 1974

- 64 Overall there would be greater use of interchange, in absolute terms and in proportion to overall flow volumes. However it is only by enabling such interchanges at Upminster and Romford that the overall populations North of the Thames accessible to cross-river rail can reach 1.4 million (~1.5 million in ten years' time). This is more than double the estimated 680,000 benefiting from a through service to Southend-on-Sea, even after excluding about half of Redbridge borough's population (north of Eastern Avenue).
- 65 A passenger travel estimate gives 34-75 million journeys two-way, using the smaller rate of cross-river rail travel for these more distant journeys, at only 25 originating rides per head annually. This is without adding in cross-river rail volumes arising in South East London boroughs or in Medway, so an overall order-of-magnitude for the whole Gateway suggests a potential for 50-100 million cross-river rail journeys two-way, with the right travel stimuli.
- 66 The tables below show the main populations which could make good use of a rail crossing of the river near Dartford.

Populations North of the Thames within cross-river rail catchment	Population (rounded)
Direct service only to Grays and Tilbury	64,000
Via interchange east towards Southend-on-Sea	426,000
Via interchange north / west towards Outer London	190,000
	680,000
Direct service via Tilbury Loop to Southend-on-Sea	410,000
Via interchange N/ W towards Outer London	270,000
(about 80,000 of Basildon would be via interchange)	680,000
Direct 'Outer Overground' to Upminster and Romford	215,000
Via interchange north / west towards Outer London	508,000
Via interchanges east towards Southend-on-Sea	426,000
Via Romford i'change to Elizabeth and Gt. Eastern Line	267,000
	1,416,000

- 67 The operability of cross-river rail services will require careful specification, as some trains will traverse a busy network in South East London. This is not an unusual situation, as inclusion of Overground within inner South London required retiming of existing services in order to accommodate the additional trains. Techniques include greater margins between trains at junctions and extra time at outer termini. Grade separation (ie flyover or flyunder) is suggested at several busy junctions.
- 68 Cross-river trains will transition between 3-rail power supply south of the river, and overhead power supply north of the river. This was addressed with Thameslink by changeover at Farringdon, where trains switch between the different systems. London Overground also incurs several changeovers for through running between north and south of the river. A similar method could be adopted at West Thurrock, before cross-river trains join the northern network.
- 69 It may not be economic to require large-scale fleet replacement for cross-river operations in the Thames Gateway. Options require consideration, such as a partial fleet order to allow through services to Romford and/or to Southend-on-Sea. Track electrification in riverside Thurrock should be specified to meet operational requirements, this might permit short-distance extension of 3-rail trains through to Lakeside or Tilbury.

- 70 A broad scale of capital investment is £1½-2 billion for cross-river rail infrastructure, which contrasts with £10 billion for the Lower Thames Crossing. This is derived two ways, from the top-down gross £800-900 million current estimate for the West London Orbital project for 10½ route miles⁵, then scaled for 13 surface route miles to Romford plus £200 million per mile for a Thames Tunnel, and secondly from a bottom-up estimate of works required on each section of line. This will be good value over a 10 year short-term time-scale or a 60 year business case, when put in the context of a potential for an Outer Overground option of 34-75 million cross-river journeys a year (up to 50-100 million in an expanded catchment), plus more travel on the strengthened rail network north and south of the river.

Reducing traffic at the Dartford crossings

- 71 Thurrock Council commented in its July 2023 Local Impact Report⁶ (p95 onwards), in para. 8.6.3, that “the decision to proceed with LTC has not reflected key infrastructure and social and economic changes to the local area and across the UK which have occurred since 2009.” These important changes include works on the successful extension of Kent Fasttrack local buses, which Thurrock observes as “showing a latent demand for public transport in the region”.
- 72 In para. 8.6.4, Thurrock notes that: “In the surrounding region, new crossings have been delivered towards central London via rail (the Elizabeth line) and road (Silvertown tunnel is under construction with dedicated HGV and bus lanes), while the Thames Estuary Growth Commission has been established with a vision for improved connections within cities, towns and villages across the region.”
- 73 Subsequent paragraphs set out a series of concerns about the failure to rule in public transport and rail crossings, from a very early date of 2009 (para. 8.6.7) and with rail ruled out because of historic low numbers and having to travel via one or two interchanges in London, with long journey times (para. 8.6.8).
- 74 Thurrock Council notes in 8.6.10 that: “Where there are better public transport connections more commuters use public transport. For example, Thurrock has excellent public transport connections to London and 40% of commuters use public transport. Connections between Thurrock and the rest of Essex are relatively poor but are significantly better than connections between Thurrock and Kent. This leads to a 7.2% mode share for public transport, a 67% increase on the public transport mode share between Thurrock and Kent. This shows that residents either side of the River Thames have an appetite for public transport where there are better connections.”
- 75 The Council concludes in 8.6.12 that: “Tables 8.50 and 8.52 in the Transport Forecasting Package (APP 522) shows that LTC only removes 613 vehicles from Dartford Crossing in the AM peak and 2022 vehicles in the PM peak in 2045, it is hard to see how the scheme itself meets this requirement. If it does, then it is likely that a public transport option could offer equivalent reductions on Dartford Crossing.”

⁵ TfL and Mott MacDonald discuss West London Orbital Overground line as feasibility stage completed | NCE <https://www.newcivilengineer.com/latest/tfl-and-mottsdiscuss-west-london-orbital-overground-line-as-feasibility-stage-completed-20-11-2024/>

⁶ Local Impact Report, Thurrock Council, July 2023 [https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010032/TR010032-003038-Thurrock%20Council_Local%20Impact%20Report%20\(LIR\)_FINAL.pdf](https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010032/TR010032-003038-Thurrock%20Council_Local%20Impact%20Report%20(LIR)_FINAL.pdf)



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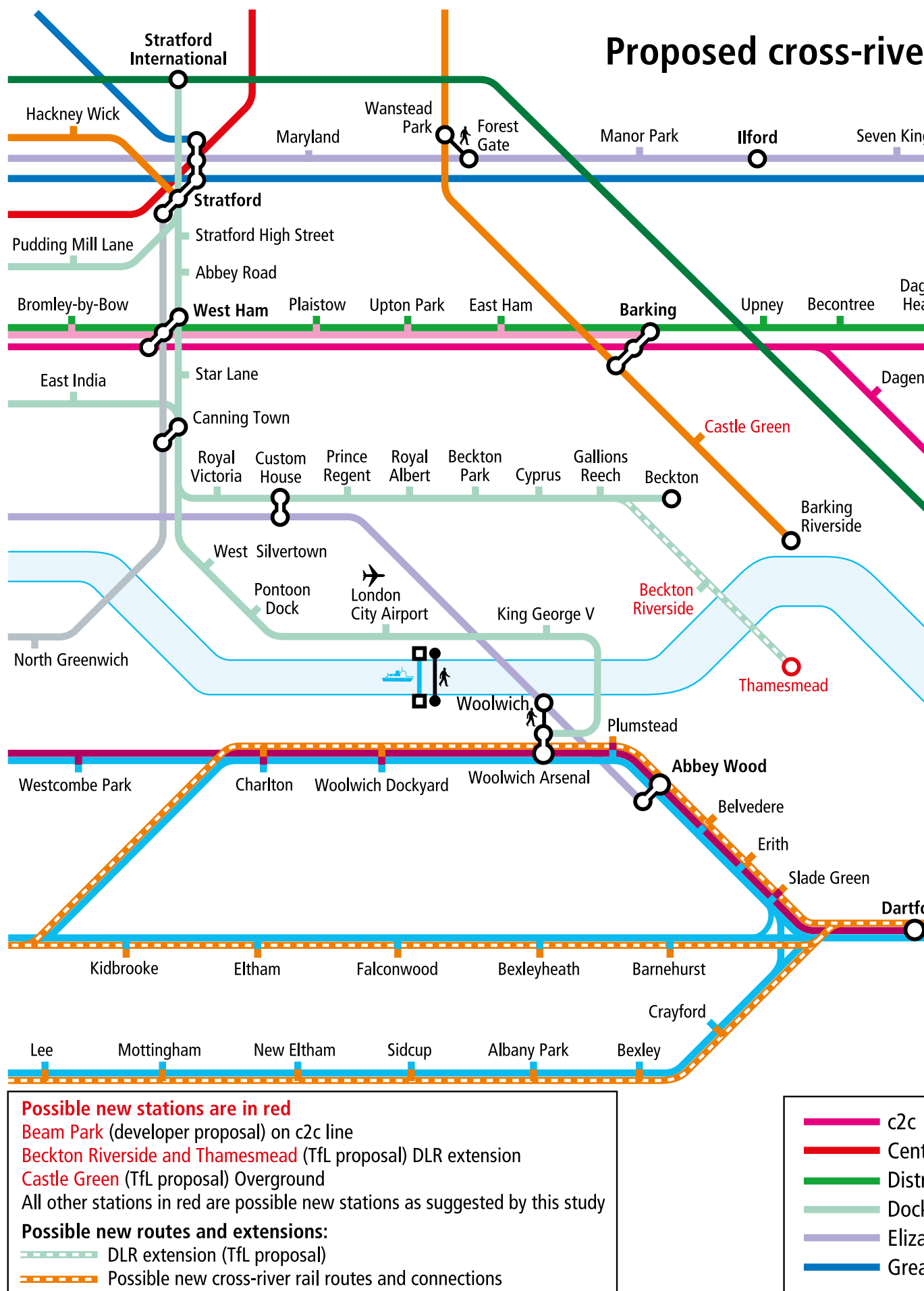
- 76 These car reduction volumes offered by LTC are trivial compared with the scale of diversion to public transport which the JRC report has demonstrated is feasible with a high-capacity cross-river passenger railway. There, the estimated volumes are a minimum of 10 to 20 million passenger a year by rail just for a localised link from Dartford and Gravesham to riverside Thurrock. There could be up to 50 to 100 million cross-river passenger journeys a year across the Thames Gateway and Estuary communities, with a strategic rail 'grid' based on the existing largely radial lines, plus one cross-river railway with well-planned interchanges and transport hubs. This is before considering the benefits of increased rail freight.
- 77 Overall, the current basis of the Lower Thames Crossing stands condemned by its own estimations of traffic relief for the Dartford Crossings, and by its failure, now 15 years after public transport was originally rejected as a policy option, to review the potential for public transport in the light of two decades of real-world experience with rail-based river crossings east of central London, in East and South East London. The impressive outcome of those recent two decades has now been reported in detail in this report. Other public transport options are discussed below.

Other public transport river crossings

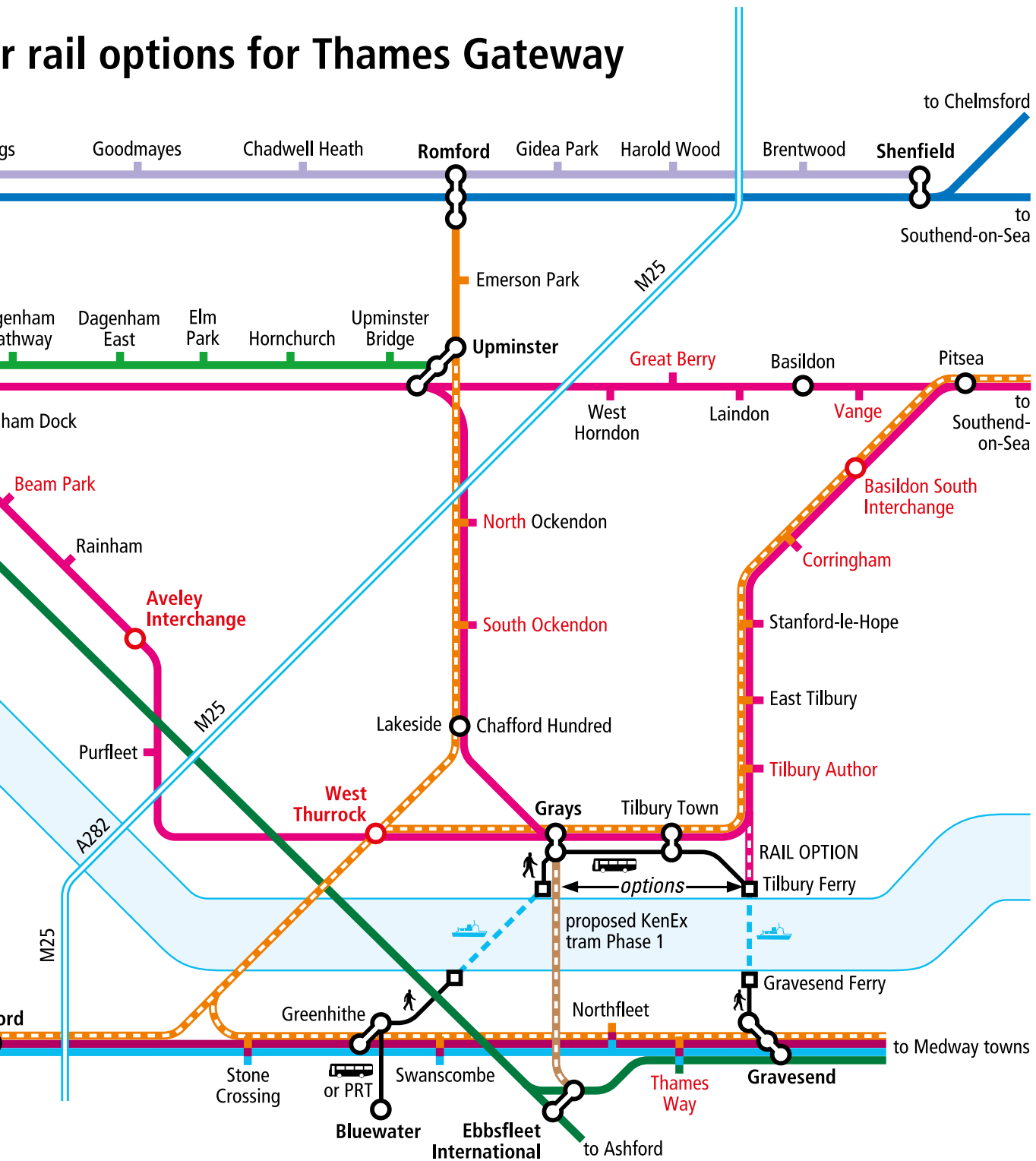
- 78 There is no fixed river crossing east of Woolwich apart from HS1 and the bridge and tunnel at Dartford. Four types of schemes are discussed:
- Ferries.
 - Buses via road tunnels and bridges.
 - Light rail.
 - Extra regional railhead on HS1

Existing and recent ferries

- 79 In recent years, three ferry services have run. Those have been the historic Woolwich Free Ferry, in operation since Norman times between **Woolwich and North Woolwich**, and available for road vehicles, cyclists and pedestrians; Ford's staff ferry between **Belvedere and the Ford estate at Dagenham**; and the **Tilbury-Gravesend** ferry, run since 'time immemorial', later maintained by the railways, and then operated privately and subsidised by local authorities.



rail options for Thames Gateway

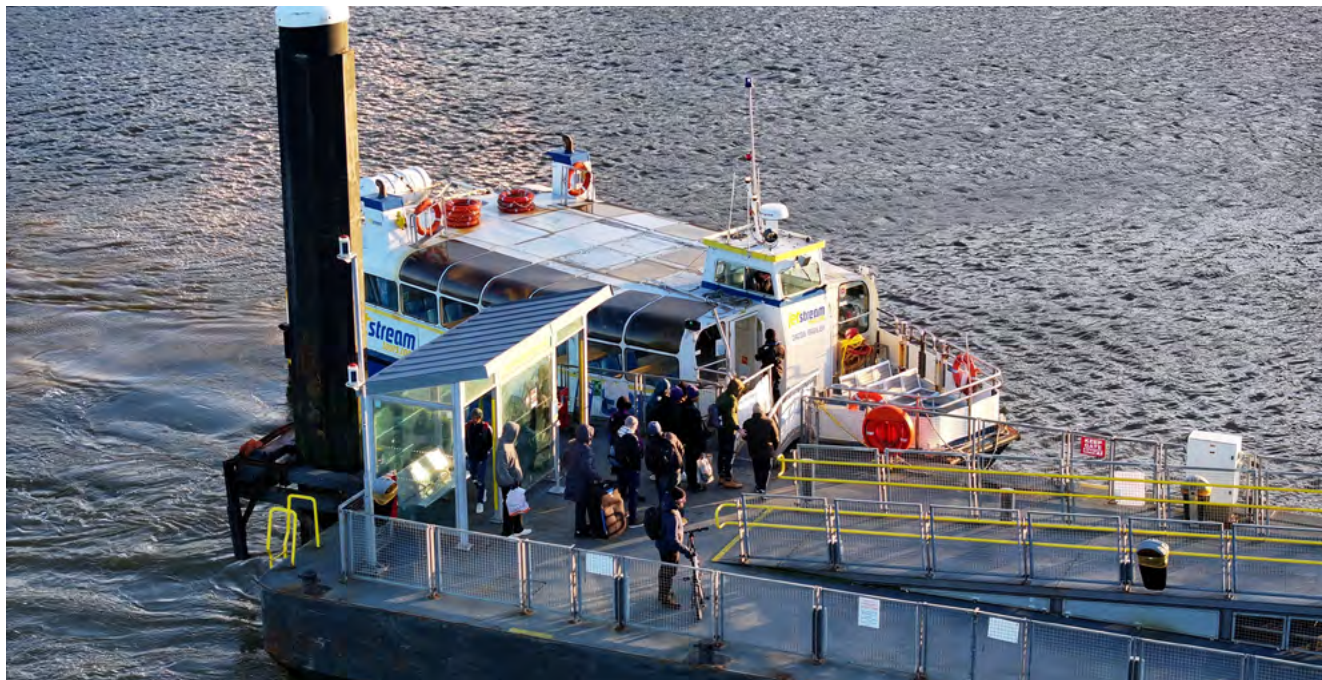


Map Produced by **FWT London** www.fwt-london.co.uk
 Information compiled by JRC Jonathan Roberts Consulting 20.1.2025: www.jrc.org.uk

Central Line
 District Line
 Docklands Light Railway
 Elizabeth Line
 Great Western Main Line

- Hammersmith & City Line
- Jubilee Line
- London Overground
- Southeastern
- Southeastern High Speed (HS1)
- Thameslink

- Bus Link
- Proposed Ferry
- Personal Rapid Transit
- Proposed Tram
- Walking Link

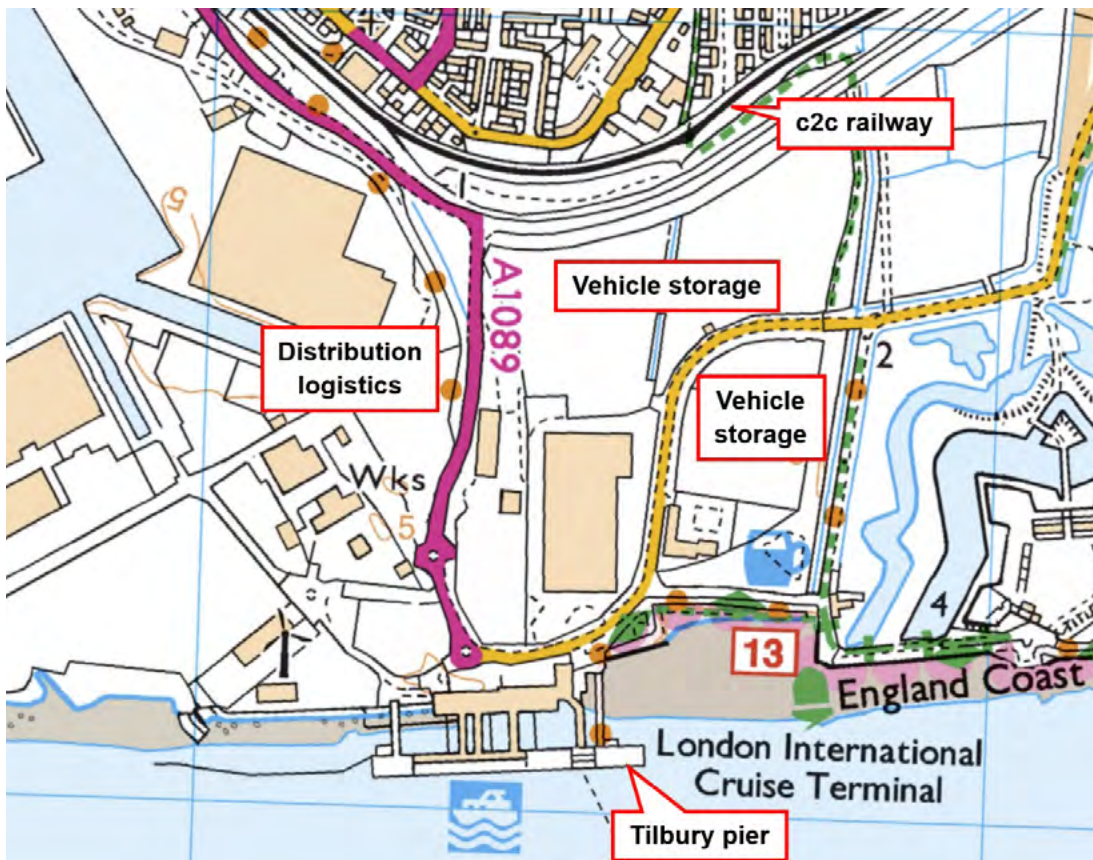


Discontinued Gravesend to Tilbury Ferry

Skyshark Media / Shutterstock.com

- 80 There is a generality, that ferries incur significant operational costs, will always struggle to carry useful numbers because each pier has only a half-catchment (the other half is water), and aren't geared to offer high-volume river crossing capacity.
- 81 Within that context, Transport for London continues to run the **Woolwich Free Ferry** on behalf of the Greater London Authority. Operational hours are 6 AM to 10 PM all week, with a two-vessel service. There are bus routes which connect on both riversides, including Superloop (limited stop) buses for travel North of the Thames.
- 82 The bulk of cross-travel public transport is carried by the DLR and Elizabeth Line, with an estimated 33.2 million passengers annually, while most road vehicles use the Rotherhithe or Blackwall Tunnels or the Dartford Crossings, and will soon be using the new Silvertown Tunnel. However the ferry carries around 20,000 vehicles and 50,000 passengers weekly, which adds up to just over a million vehicles and 2.6 million passengers a year, at no user charge.
- 83 Ford's staff ferry provided direct public transport into **Ford's works at Dagenham** from Belvedere in Bexley borough, from 1974. It continued as a residual service when Ford closed its car plant and changed the uses of its north bank estate, however it was withdrawn in early 2024 after staff consultation.
- 84 The **Tilbury-Gravesend** ferry typically carried over 3 million passengers annually until 1963. This included road vehicle users, as cars, vans and coaches were carried until the Dartford Tunnel opened in November 1963. The vehicle ferry shut in 1964. By the late 1960s passenger numbers were 1.6 million. Service reductions led to fewer passengers, until these were only about 200,000 annually in the mid 1980s.
- 85 British Rail's ferry successor, Sealink, disposed of its interest in the ferry to another private operator in 1991, while Tilbury Riverside station with its direct, electrified rail service from both Barking and Southend was closed in 1992. A bus ran instead from Tilbury Town station. By 2012, no evening or Sunday ferries ran, with Kent County Council having to subsidise the service. By 2017, annual patronage was only 80,000. The service was withdrawn from April 2024 after local subsidy was not renewed.

- 86 While Gravesend Town Pier is still convenient for central Gravesend and the nearby rail and bus interchange at Gravesend station, Tilbury Pier is remote from the town and the c2c railway, and is surrounded by land for logistics and hectares of parking for imported cars, rather than activities contributing to ferry use. This is not a good stimulus to restart a service, and any future operations must address the shortfall.



The 'people catchment' lacking at Tilbury Pier

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A new ferry service?

- 87 A review of local riverside towns, bus hubs and railway interchanges suggests that a possible replacement for the Tilbury-Gravesend service, with lower subsidy, might be achievable by a service operating between piers at Grays and Greenhithe.
- 88 This would be a longer crossing but serve more populous immediate catchments and hinterlands. Both riversides have good high streets and local housing, and public transport interchange is available on both banks.
- 89 At Greenhithe there are Kent Fastway buses, and a shuttle bus between Greenhithe and Bluewater shopping centre. Allied to improved active travel routes to each pier (a new pier is needed at Grays), this would help to stimulate more use of active travel in the catchments. Traffic congestion on the Dartford Crossings would be relieved.

Cross-river buses

- 90 There is a chequered history of cross-river buses using the Dartford Crossings, including an early attempt at a cycle-carrying bus. Because there are no bus priorities, bus operation nowadays faces considerable problems of unreliability, because of traffic congestion and bottlenecks at key junctions with the tunnel roads, which can cause blocking back on the surrounding road network.



Possible Grays - Greenhithe ferry

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- 91 Although the Crossings are operated on behalf of the local authorities, buses are also subject to tolls, so that there is a direct disincentive for operators to run unless there is a prospect of good passenger volume.
- 92 The Dart Charge for buses, coaches, and other goods vehicles with two axles is £3.00 for a one-off payment, or £2.63 with an account. For vehicles with more than two axles, the one-off payment is £6.00, or £5.19 with an account. These charges work out at £35,000 a year for a two way hourly bus service (18 hours a day), rising substantially if the frequency is increased as would need to be to become a more attractive proposition.



The sole cross-river bus route - X80

- 93 Currently there is only one, hourly bus via the Dartford Crossings. This is the Ensignbus X80 between Lakeside Shopping Centre (north bank) and Bluewater shopping centre (south bank).⁷ It does not serve nearby Purfleet, nor Dartford town centre and its bus/rail interchange. However it does serve Greenhithe station.
- 94 Interchange with other buses is also possible at each centre, so some cross-river journeys are feasible, but it is not a car-competitive high-capacity public transport offer.
- 95 There is one London Bus operating at TfL frequency through the **Blackwall Tunnel** downstream of Tower Bridge, some 18½ km/ 11½ miles to the west of the Dartford Crossings. This is the 108 between Stratford and Lewisham via Blackheath. There is currently no bus via the **Rotherhithe Tunnel**, as that would duplicate the East London (Windrush) Line. TfL's recent introduction of express buses for orbital and Outer Borough travel has included a 'Superloop' service to North Woolwich. However there is then a disconnect until the Loop resumes south of the River at Thamesmead.
- 96 It is London Mayoral policy to complete Superloop with cross-river capability when the new **Silvertown Tunnel** opens shortly. The tunnel is due to open on 7 April 2025 following the completion of construction and testing. This and the Blackwall Tunnel (currently free) will be tolled for car, van and lorry traffic, with the rate variable by period of the day to reflect road congestion impact:

Vehicle type	Auto Pay off-peak charges Applies at all other times between 06:00-22:00, including weekends	Auto Pay peak charges Monday to Friday only Northbound 06:00-10:00 Southbound 16:00-19:00
Cars and small vans	£1.50	£4.00
Large vans	£2.50	£6.50
Heavy goods vehicles	£5.00	£10.00

- 97 Buses crossing the Thames are expected to increase from six per hour (the 108 service via Blackwall Tunnel) to 21. For the first 12 months, new cross-river bus routes serving Greenwich, Newham and Tower Hamlets - including the new Superloop SL4 running from Grove Park to Canary Wharf - will be free of charge. However, this will still be 17 km/10½ miles west of the Dartford Crossings.
- 98 There will also be a zero-emission cycle shuttle service, with new shelters and cycle racks. It has been specifically designed to accommodate cyclists and differentiate it from the regular bus network. This has shades of the original Dartford Tunnel cycle-carrier bus.
- 99 There is a stark difference in public transport policy and services, between the London area and nearby Essex and Kent, for cross-river travel. What would be the impact on the already poor BCR case for a road-based Lower Thames Crossing, if TfL-type policies and practices familiar to East and South East London were adopted for the Thames Gateway, and introduced different types of cross-river transport supply?

⁷ <https://www.mylondon.news/lifestyle/travel/only-bus-route-use-dartford-23366503>

Cross-river possibilities for Light Rail



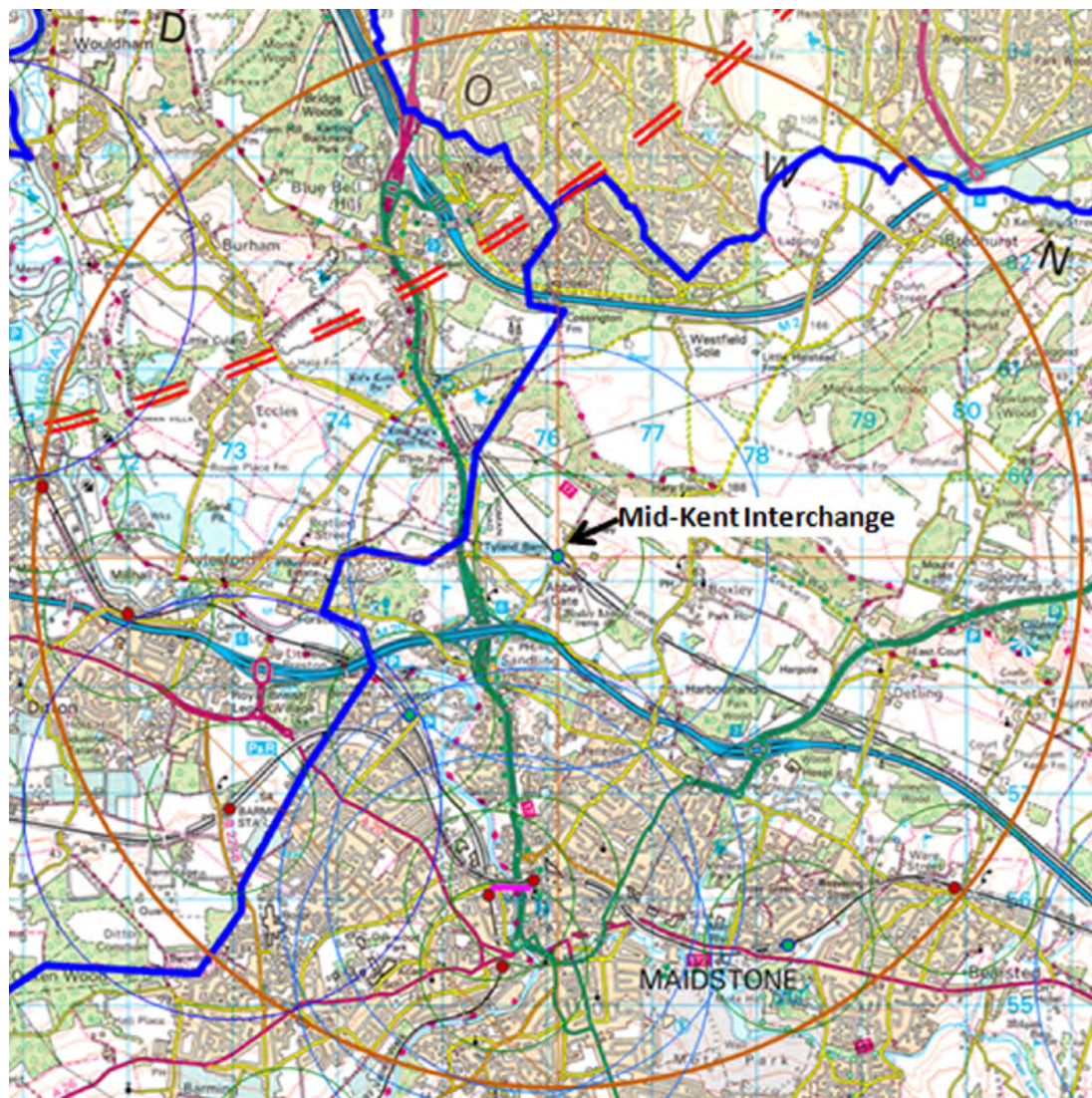
Phasing of KenEx Tram proposals: www.kenextram.co.uk

Credit: Thames Gateway Tramlink

- 100 The cross-river success of light rail in London Docklands has been noted by others. There are now private proposals for a tram scheme, 'KenEx', using a 1.2 km immersed tube for a river crossing north from Ebbsfleet to Grays. This is intended to provide a transport solution for local people who have no access to a car, cannot drive or who prefer to use a sustainable means of transport.
- 101 The promoters aim for an environmentally sound solution, with the Dartford Crossings often congested and being a major contributor to locally poor air quality. They observe that the Ebbsfleet residential city on the south bank has developments with limited car parking provision, making them public transport dependent. A significant passenger flow is across the river to Grays and Thurrock for employment. However there is no local public transport provision to meet cross-river demand.
- 102 The cross-river tram and the Ebbsfleet southern rail link (part of the Kent County Council rail strategy) are seen as elements to support Ebbsfleet's further growth. A tram is proposed as a first phase of a wider 18 km network within the Thames Gateway urban area, to serve the hinterland of Thurrock, and reach Basildon and major employment centres such as Tilbury and London Gateway. A direct line into isolated Canvey Island is proposed.

Cross-river possibilities for HS1 passengers

- 103 Government decisions in the 1990s meant that proposals for intermediate stations in East London and the Thames Gateway, between Ebbsfleet and Stratford on the Channel Tunnel Rail Link (HS1), were set aside and are not now possible. However, one station option remained, for a 'Mid-Kent' express station, located between Maidstone and the southern half of Medway urban area which is distant from the local North Kent Line stations.
- 104 This station wasn't taken forward, and the design of HS1 led to railway gradients which may inhibit re-insertion of a station. However there is still a location north of the North Downs Tunnel, close to the M20/A229 Maidstone-Medway junction 6, which gives the possibility of an interchange, with a direct road spur and feeder buses. A 5 km local bus catchment is shown.



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- 105 This could enable commuter flows not just to central London, but also to Stratford in about 15 minutes where passengers could change for services to Outer East London and towards Southend-on-Sea. It would help travel further than central London, for example to M25 destinations in Hertfordshire and to the Midlands. Overall, a 'Mid-Kent' Interchange could help to reduce cross-river car volume via Dartford.

Conclusions

General background of rail travel demand and population growth

- 106 This report has researched the past two decades of railway use in local authority areas in East and South East London, and in nearby parts of Essex and Kent. The data have been derived from time series of station use during the period 2001-2023. This has been correlated with population changes during the same period. The conclusions are that within London:
- New railway schemes, and marketing and service development by Transport for London such as Oyster ticketing, creation and expansion of Overground, and Docklands Light Rail, have been highly successful in growing public demand for rail travel, well ahead of population growth. Rail is now much more relevant for area replanning and future travel development.
 - An improved and busy network has been both a cause and a consequence of large-scale London population growth, including in major development and renewal zones.
 - The pandemic savaged public transport use. Recovery has been varied, with less use of season tickets for commuting with fewer working days in the office. However there is greater demand for non-work travel, while general travel volume in East and South East London still greatly exceeds population growth.
 - A strategic railway network 'grid' has now been established with key investments including Thameslink and the Elizabeth Line/Crossrail. So the core railway is in a good position to achieve much more in subsequent years.
- 107 Pre-Covid, in nearby Essex and Kent, the radial commuter services also grew their patronage when compared against the baseline local population growth. They benefited from London's strong economy and from railway improvements. The Channel Tunnel Rail Link (HS1) was a gain for riverside Kent.
- 108 There was been some retrenchment post-Covid in the Thames Gateway, with only limited TfL-type marketing and ticketing, and a general lack of pro-active local authority policies to retain and stimulate public transport use. Exceptions are where there has been investment driven by high-level strategic priorities, such as HS1 in riverside Kent, the Elizabeth Line/Crossrail in Essex, and Kent Fastrack in Gravesend and Dartford.
- 109 Station data when assembled by rail corridor shows the greater impact of positive policies and initiatives on rail travel demand. A TfL-type approach is more likely to stimulate strong uptake of new and improved rail corridors.

Cross-river rail travel demand

- 110 It has been amply demonstrated that there does not have to be an existing cross-river railway, for the case for a new one to be established. Prior to 1999, the only rail crossing downstream of Tower Bridge was the East London Line shuttle carrying about 9 million passengers annually.
- 111 An analysis of current passenger travel volumes on five rail crossings downstream from Tower Bridge (excluding the Jubilee Line tube extension), shows gross passenger use over 95 million journeys annually, two-way in 2023. Individual line volumes now range from 8 million to 25 million.
- 112 The lines closest to the Thames Gateway, at Woolwich, carry 33 million passengers annually post-Covid. This implies a cross-river travel rate of nearly 25-50 journeys one-way per year, where TfL-type policies and practices are adopted. An analysis limited just to urban areas in riverside Thurrock, Dartford and Gravesham suggests

a potential local cross-river rail demand of 10-20 million journeys annually. This is a sufficiently strong baseline to consider a new rail corridor.

- 113 The demand would be considerably greater if embracing a entire sub-regional catchment, from Outer East and South East London to Basildon, Chelmsford, Southend and Medway. Cross-river rail demand could then reach 50-100 million journeys annually (two-way), using only the lower rate of annual rides per head. This has the potential to relieve the traffic pressure at Dartford considerably more than the proposed Lower Thames Crossing. That is before considering the positive impact of higher volumes of rail freight considered in Part 2 of this report.

Options for a cross-river rail corridor

- 114 Corridor options should look at a broad catchment that could be enabled by a cross-river railway. This will then achieve the greatest impact on modal travel split across the zone as a whole. The main sub-regional options are:
- A through line from Dartford interchange towards Southend-on-Sea via riverside Thurrock, using the existing c2c railway east of Grays.
 - An 'Outer Overground' line via Dartford to riverside Thurrock, with the main route continuing northwards and orbitally to Lakeside, Upminster and Romford, with interchanges there for commuter lines.
- 115 Trains could originate from the South East London suburban network and, with a new chord, from Gravesend and Medway. The operability of cross-river rail services will require careful specification.
- 116 With the second rail option, the population served north of the Thames grows from nearly 700,000 to over 1.4 million (not counting Kent and South East London), with much of the rail catchment expanded via new and improved interchanges. There would be traffic relief on the M25 motorway and the Dartford Crossings with this orbital rail corridor, as well as stronger stimulation of travel demand which should strengthen the business case for a cross-river railway. A further 1 million people could be served south of the river, in Greenwich and Bexley Boroughs, and in the urban parts of Dartford, Gravesham and Medway. Cross-river rail would have a combined catchment population of 2.5 million, which is a strong demand base to reinforce the area's public transport connectivity and accessibility, and reduce excess traffic and congestion on local and regional roads.

Other cross-river travel options

- 117 Ferries, buses and light rail have been reviewed. The underlying test is whether these are capable of offering a quality, high-capacity cross-river link.
- There are now no ferries downstream below Woolwich (though the Free Ferry exists there, and Riverbuses provide such links upstream). Their economics and effective carrying capacity are unfavourable. However there is the potential for a respecified ferry in the Thames Gateway, such as between the urban centres and interchanges at Grays and Greenhithe.
 - There is a single, low-frequency cross-river bus which uses the Dartford Crossings. This contrasts with TfL-type policies and practice, which will see 21 buses per hour using the new Silvertown Tunnel from April 2025. Something better must be possible at Dartford. However, without large loss of road carriageway capacity to achieve adequate bus priority, bus services will continue to be unreliable. They cannot offer a strong alternative for high-capacity travel across the sub-region.

- A 'KenEx' proposal for a cross-river tram has been promoted recently, partly to address the public transport gap between the new residential developments in Kent at Ebbsfleet and jobs in Thurrock. A 1.2 km immersed tube tunnel is proposed as the first stage in a local tram network. KenEx is explicitly for local mobility across the Thames Gateway urban areas. It can help to unlock congestion at junctions on the area's major road corridors, by reducing the reliance on cars.
- 118 London Docklands developments show that light and heavy rail proposals can co-exist, providing that there is sufficient population volume in a densely developed area, with related requirements to travel for work, education, health and leisure.
 - 119 'KenEx' proposes a light rail network which is complementary to this report's preference for a cross-river 'Outer Overground', directed northwards towards Upminster and Romford with principal interchanges with radial main lines. Taken together, the proposals could offer a full network for the Thames Gateway.
 - 120 Review of the case for a 'Mid-Kent' Interchange station will be worthwhile, to gauge the potential business case and traffic relief achievable with an additional HS1 stop.

Recommendations

- 121 Detailed modelling and business case assessment are recommended for these cross-river public transport options. This should be part of a comprehensive new travel analysis embracing all travel modes, not just the road-only option previously considered for the Lower Thames Crossing. The potential exists to adopt TfL-type policies and practices, which are shown to have achieved a strong public transport outcome in the development and renewal areas of East and South East London.
- 122 Timing of each cross-river project should be considered. Planning, authorisation and construction will all take time. Scheme modelling and optimisation should consider, within affordable costs, which elements can make the greatest impact within one and two decades, on road traffic flows locally and regionally.
- 123 These could be parallel to Government adoption of a new requirement, for there to be a co-ordinated transport delivery authority for the Thames Gateway, to embrace key catchments across the Thames Estuary. This might sit alongside possible local authority amalgamations and other reforms for Essex and Kent, with active engagement by the Sub-national Transport Bodies – Transport for the South East, and Transport East.
- 124 It is proposed that no decision should be taken on the Lower Thames Crossing scheme until results are available from new all-mode cross-river transport modelling, with opportunities for area reorganisation and policy management and delivery. It is recommended that new action should be targeted, to raise the combined BCR of existing transport networks and future river crossings serving Outer London and the Thames Gateway, by bringing high capacity public transport into centre stage.

Part 2: Rail options for heavy freight: Practical rail alternatives for selected trunk freight flows

Multiple flows

- 125 Freight flows in London and Home Counties are most noticeable where the Heavy Goods Vehicles (HGVs) predominate. There is a constant volume of vans for multiple purposes, however HGVs reflect large scale freight flows with specific journey requirements. They include materials in to manufacturers and production despatch outwards, flows to and from national and regional distribution warehouses, and volumes related to Airports, Ports and the Channel Tunnel for trade from and to mainland Europe and other continents.
- 126 The larger vehicles and flows cluster on the motorway and trunk roads, including the M25 hub and its 'spokes' which include main origins and destinations, particularly the import and export traffic which is a visible manifestation of how the UK economy fares. Flows from and to the Ports and the Channel Tunnel, and national distribution, are the key elements of this commentary, as rail freight and coastal shipping are already dominant on domestic raw materials flows such as aggregates. Rail freight routes mirror the main motorway and trunk road flows, although the railways aren't always parallel.

The geography of freight flows

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- 127 **Felixstowe** is Britain's biggest and busiest container port handling around 40% of the UK container trade, with 9 berths across 2 container terminals. It handles more than 2½ million containers each year. This is equivalent to 4 million standard TEUs (twenty-foot equivalent container units), or over 15,000 miles of containers laid end to end, and 6½ times the length of Britain's motorways.
- 128 Felixstowe has 4 berths able to dock the latest generation of 24,000 TEU mega-ships, 3 rail terminals, and a spread of rail container services to all main UK regions. It is served by the A12 trunk road from London and A14 from the Midlands, plus the M25 round London. Rail routes are the Great Eastern main line from London, cross-country via Ipswich to the Midlands through Peterborough and Leicester, and via the London orbital railways to reach other trunk lines.
- 129 **Harwich** is primarily a North Sea ferry port for road and rail passengers, and Ro-ro freight. It has rail freight sidings. Towards London, its road and rail access relies on the A12 and the Great Eastern line. Towards the Midlands there is the A120 which joins with the M11 thence A14, while rail freight can use a spur towards Ipswich and the cross-country line. The main ferry user at the port is Stena Line which runs twice daily passenger and freight services to the Hook of Holland. There are freight only services to Rotterdam Europort.

- 130 London Gateway, north of Tilbury, is catching up with Felixstowe in scale of capacity. It saw more than 2 million containers in 2023, opened its fourth berth in Autumn 2024 and can now handle the equivalent of 3½ million TEUs. It has a £1 billion expansion programme to create 2 more berths by 2028.
- 131 **London Gateway** is served by the A13 from London and the M25. By rail, it is reached via the London orbital lines and the Tilbury Loop line. It has one rail terminal and a second has been authorised. Once completed, the 2½ km-long quayside will be able to dock 6 vessels at once, each more than 400 metres long. Freight operators such as Maersk are reorganising their international flows to respond to this new availability.⁸
- 132 There are other harbours serving more localised freight markets, such as Ipswich. Four in this ports group are within the Thames Gateway:
- The **Port of Tilbury** (16 million tonnes annually) is also served by the A13. It is a Ro-ro, container and bulk materials port, and is rail served. Its expansion is centred on handling of construction materials aggregates, jointly with Tarmac, on a 152 acre site.
 - Across the Thames, the **Port of Dartford** close to the Dartford Crossings is similar but smaller in scale than Tilbury. It too is served by rail. Its cargo flows include construction materials, aggregates, and bulk products.
 - Further upstream along the A13, and also rail served, are the **Port of Purfleet** (2-3 million tonnes annually, mainly bulk cargo), and the **Port of Dagenham** (4 million tonnes annually) which used to serve Ford's vehicle factories and now handles bulk goods, aggregates and liquid products.
- 133 With the exception of Dartford, these ports do not rely on the Dartford Crossings for any flows past London to the Midlands and beyond. A proportion of destinations in South London and Southern England may be reached via the Dartford Crossings, however there are also South Coast ports which may be more convenient for some flows. Most of the smaller ports will serve local destinations on either side of the Thames, so will use the Dartford Crossings as a local distributor. Rail is unlikely to be relevant for local flows.
- 134 Most relevant to the Lower Thames Crossing project is that large scale HGV container flows from Felixstowe and London Gateway, and Ro-ro from Harwich, may well use the M25 on its north-east and northern sector between the A12 / A13 and the A1(M) / M1 / M40 and other trunk roads. **Growing road freight volume at these ports will constrain the M25's ability to accommodate additional traffic via any further road-based river crossing, except during evenings and night-time.** The Lower Thames Crossing could lead to the need for extensive motorway widening round the M25 from Upminster and elsewhere. If these costs were added to its business case, they would further diminish its already poor value for money.

⁸ Complexities behind the switching of international container services between different freight operators and different ports are illustrated by the accompanying blog: Maersk moving from Felixstowe to London Gateway, which has several extensive commentaries. Consequential impact on Britain's inland freight flows then has to be taken into account. The changes illustrate that market preferences are a big influence on inland routes and flows, and that the best option for inland freight operators, including rail, is to be as flexible as possible in how the flows can be rearranged.
<https://www.railforums.co.uk/threads/maersk-is-moving-from-felixstowe-to-london-gateway.277237/>



Kent and Channel Ports Group

- 135 Dover is the primary Ro-ro Port in this group, and handles the largest lorry flows. Similarly the Channel Tunnel (Eurotunnel/Getlink) at Cheriton is a high volume operation for Ro-ro and trailers. When counted as competing operators, Getlink can claim it is the leader at 36% of the 'Short Straits' freight market (Dover/ Cheriton <-> Calais/Dunkerque), as Dover has its 64% volume split between three main operators.
- 136 Ports such as Folkestone and Ramsgate do not have ferry services now, while their commercial operations are limited. Peel Ports Group owns Medway and Sheerness ports, and is to invest £30m during 2025 in a new Ro-ro berth at Sheerness. The port generally handles automotive flows (new vehicles, recently 300,000 vehicles in a year), and other general cargoes.
- 137 Taking Cheriton and Dover together, these locations handled 3.4 million freight vehicle movements in 2023, despite difficult trading conditions post-Brexit and post-Covid. Not all these were HGVs, as vans and other light goods vehicles (LGVs) were also counted. However an estimate is that 4,000 large-size trucks per weekday (one-way) were conveyed, and that many of those, plus other South East of England flows, used the Dartford Crossings. This is a significant volume to seek to attract to rail.
- 138 The preceding paragraphs summarise the ports element of major road freight flows passing through or near the Thames Gateway. As noted, not all flows need to use the Dartford Crossings, as the M25 circles London also on its south and west sectors. It is the Short Straits flows which rely most on Dartford.

Domestic distribution flows

- 139 Domestic distribution flows are also important for the M25 and Dartford Crossings. For these flows, relief of the Dartford Crossings is a desirable outcome, more so than a 'further east' orbital via the Lower Thames Crossing as that would be more mileage just to continue orbitally past Dartford's congestion.
- 140 Two examples are Sainsbury's distribution warehousing in southern England at Basingstoke, and Waitrose/John Lewis's at Bracknell. They will use the M25 then Dartford Crossings for deliveries to destinations in East London, Essex and East Anglia. There is potential redirection of such flows via the M25 north and north-east sectors, or for those to continue via Dartford if congestion were reduced.
- 141 Relief of passenger car volumes, by modal shift of some local and sub-regional personal travel to trains through a cross-river rail tunnel, could be a greater benefit to freight distribution flows than any road-based Lower Thames Crossing.
- 142 There is a similar situation in respect of the Short Straits flows. 4,000 vehicles per weekday sounds a lot, but is less of a capacity problem when converted to hourly flows with a 24 hour freight working day. Indeed much HGV freight travels during evenings and overnight as roads are less busy and journey times more predictable. So, on an hourly basis, 'every little helps' when it comes to relief of traffic congestion. It is continuous hourly diversion of a proportion of local and sub-regional travel to public transport which can benefit cross-Channel road freight, by tackling the Dartford Crossings' congestion overload.
- 143 There is also the potential for rail to improve its offer directly to the international freight markets. This requires a detailed understanding of the groups of freight flows which exist, their constraints and desires for an improved transit, and rail's strengths and weaknesses which need to be tackled, in order to make a successful offer to the freight operators. As observed above in paragraph 131 (footnote 7), freight operators react to significant changes in market conditions, because freight costs are a key competitive factor. Freight delays through congestion or other reasons are a significant cost particularly for 'just in time' and perishable goods.

Rail freight constraints and solutions in London and Home Counties

- 144 Rail freight routes mirror the main motorway and trunk road flows, although the rail network's local geography is rather different. Rail's big selling points are:
- Ability to have a lower operational and environmental cost with reduction in trunk lorry fleets and vehicle emissions, driver costs, etc.
 - Freedom from external congestion, and predictable journey times.
 - Faster times on long haul.
- 145 Rail freight's immediate costs and penalties are:
- Need for trans-shipment if goods are not direct from loading to end destination.
 - Limited hourly slots on the rail network to fit within passenger train timings and frequencies.
 - Rail network bottlenecks.
 - Availability of the right wagon fleets for the freight flow.
 - Cost and time increases if traction has to change between diesel and electric.
- 146 Additionally, within the London commuting area, and affecting use of specific main lines and orbital lines, there is reduced or nil capacity for freight trains in the peaks. Train length or weight limitations also exist on sections of line, and at junctions where spur tracks and their signalling may limit the ability to hold long freight trains without blocking back onto the main tracks.
- 147 A constant limitation is the size of the British railway loading gauges (within tunnels and bridges, and alongside platforms and other structures). This limits the size of containers and swap-bodies which can be carried. There is also the cost of a new siding and signalling installation if a new access is required.
- 148 The Channel Tunnel Rail Link (HS1) was built between Cheriton and London to a larger European loading gauge and could be used for larger freight as far as yards at Dagenham and Barking, however it has been subject to high user charges and penalties. This is discussed below.

Prioritising improvements to rail freight's offer

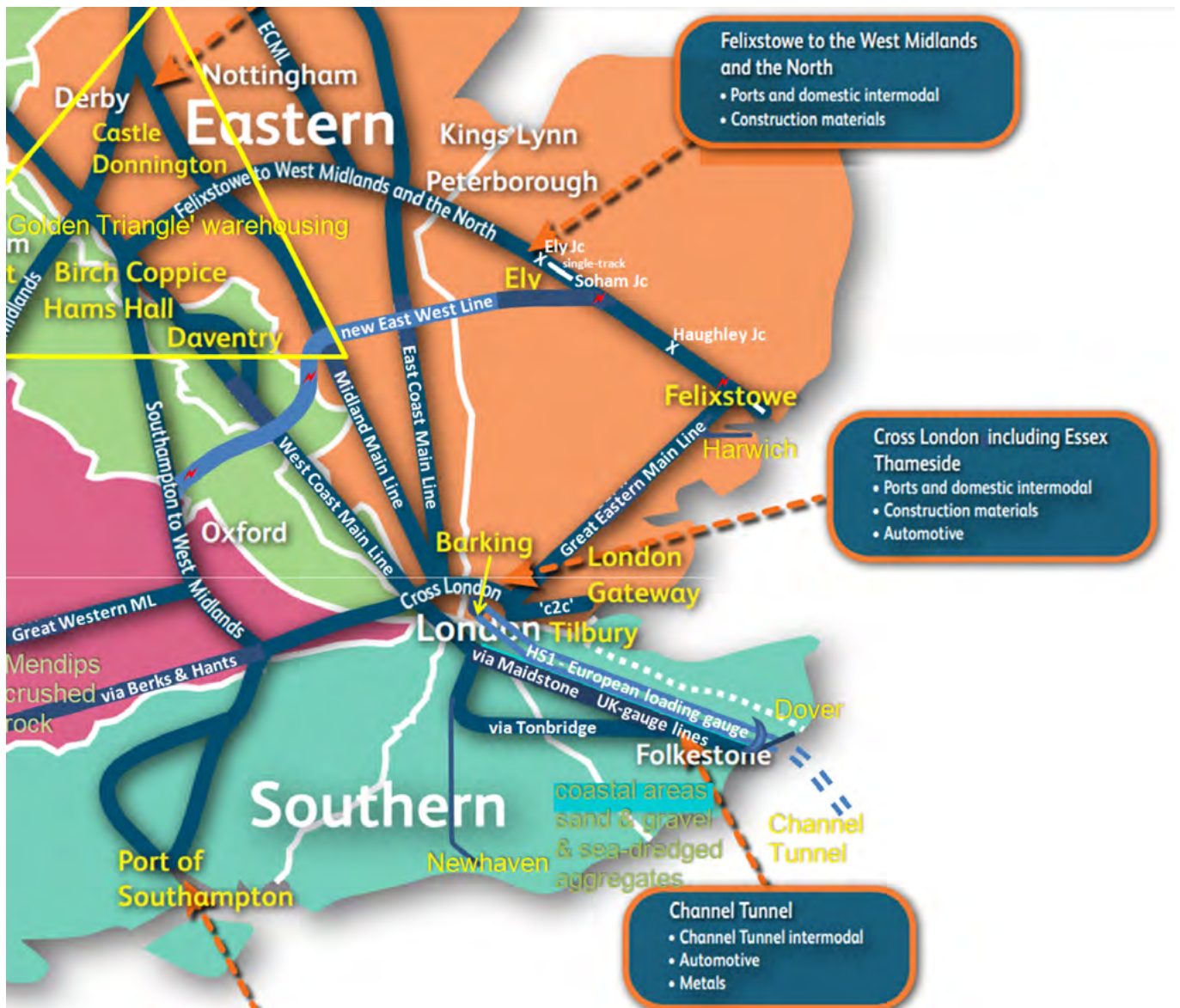
- 149 A swathe of upgrading 'across the board' is not needed in order to make rail freight easier to use. The key is to identify the individual freight flows and routes which require attention, and what the specific opportunities are to improve the rail freight offer. In terms of the timescales and costs involved, a structured sequence will go from quickest and easiest, to more complex and higher cost:
- Availability of timed slots during the operating day.
 - Changes to pricing and operating methods on each relevant route.
 - Review of traction or freight wagon equipment.
 - Availability of rail loading and unloading yards, or improvements to those, or new specialist sidings.
 - Junction and line upgrades, and new local route electrification.
 - Significant new line construction and its potential for electrification (a electrified freight railway using modern locos is generally the cheapest to operate, and gives enough power to haul the heaviest loads).

150 A summary map below highlights some of rail freight's potential. This draws attention to:

- Scope for greater use of HS1 with its European loading gauge.
- Works needed to improve the cross-country line from Felixstowe.
- Freight opportunity with the new East-West Line particularly if it is fully electrified.
- Rail freight access to England's 'Golden Triangle' of centralised warehousing.

151 Expansion of rail freight capability for these flows will reduce long distance HGV volume on the principal motorways and trunk roads in the London and Home Counties.

152 Following the same geographical sequence as above, we shall look first at the Estuary Ports flows.



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- 153 The dominant volumes are from and to Felixstowe and London Gateway Ports, and are primarily container traffic which is accommodated on freight 'flats' – a flat frame on wheels. Rail's main shortcomings (and solutions) are:
- Lack of short-distance electrification on the single-track Felixstowe and London Gateway branches. Longer and heavier trains could be handled via London with continuous electrification. Possible timescale: within two years when given the go-ahead.
 - Line and junction capacity limitation on the orbital lines round London and on the cross-country line to the Midlands and North (tackling these would also benefit the rail offer at Harwich):
 - » Via the London orbitals, increased intensity of signalling to enable more freight trains to fit between the frequent London Overground trains. Digital signalling may be the solution for that, during the next decade.
 - » Via the cross-country line through Ely, Peterborough and Nuneaton, enlargement of capacity at Haughley and Ely Junctions in East Anglia is the top priority, as also is doubling and upgrading of the partially single-tracked and waterlogged line across the Fens between the Newmarket area and Ely. This is a 3-5 year scheme depending on project phasing.
 - » The opening in the 2030s of the new East-West Railway between Cambridge, Bedford (Midland Main Line - MML), Bletchley (West Coast Main Line – WCML) and Oxford (towards the Great Western and South Western Main Lines), will also relieve capacity constraints via Ely and provide a partial freight bypass to London. The EWR project team now recognises the line's potential to carry major freight flows.⁹
 - Larger volumes of container traffic emerging on the West Coast Main Line (WCML) also depend on resolution of a future capacity constriction where the truncated HS2 railway rejoins the WCML north of Lichfield, from 2030 or later.
 - The Government hasn't committed yet to any of these projects, though gross costs and timescales are significantly below the equivalent costs and timescales of the Lower Thames Crossing, and with a higher BCR.

Kent and Channel Ports Group

- 154 The starting position is the considerable volume of accompanied Ro-ro and trailer flows arriving on the Short Straits routes from mainland Europe. In round numbers, the bulk of the daily 4,000 vehicles comprises:
- ~1,000 trailers from Spain and Southern France carrying fresh produce, fruit and vegetables, which is time-critical perishable traffic in refrigerated bodies.
 - ~1,000 trailers from Benelux and Northern France with manufactured goods and 'just in time' delivery requirements within Britain.
 - Another two groups, each ~500, mostly swap bodies and some trailers, from Italy and from Eastern Europe.
 - Also there are piggyback flows from Spain to Britain, where entire road trailers (including wheels) are put on a European-gauge train to Calais.

⁹ CEWR's proposed discontinuous electrification may be adequate for passenger trains which can switch to battery power, however battery power is insufficient for heavy haul freight at speed, and full electrification is desirable.

Opportunities with HS1

- 155 HS1 was designed in the style of French 'Grande Vitesse' lines, with steep gradients, special digital signalling, and limited facilities for freight trains. UK wagon weights with maximum loadings up to 25 tonnes per axle (100 tonnes per wagon) were not welcomed on tracks designed for about 18 tonnes per axle. HS1 track availability was priced highly, compared to Network Rail's long-run marginal costing method for most rail freight.
- 156 Nevertheless, HS1 now provides the core opportunity for rail freight to carry a share of these flows within Britain, providing that what is carried per wagon is less weighty – such as boxes, and HGV trailers. Network Rail is HS1's track manager, and pricing rules and haulage potential for HS1 have now changed radically. Britain's rail regulator, the Office of Rail and Road, ruled in 2024 that rail freight charges on HS1 should be halved. Also supplementary charges for freight trains causing delays to express passenger trains on HS1 which were previously penal, may now reduce. Another change is that Eurotunnel/Getlink pricing is now more flexible, as the Short Straits ferries have become more price-competitive.
- 157 HS1 can take the same size road trailers and swap-bodies as on the lines through France, and bring them, unaccompanied, at least as far as Dagenham and Barking yards which are both accessible from HS1. This reaches within the London region, which is a major destination in its own right. Greater use of the Channel Tunnel for through rail freight flows is now also possible. Extra rail handling capacity is an objective, e.g. on the former Ford's lands at Dagenham.
- 158 A review of HS1's train timings and train paths shows that during the quieter hours for express passenger train services, between 7PM and 7AM, it should be feasible to allocate 2 paths per hour for freight use. European freight flows can also take advantage of the hour's difference between UK and continental times, so that freight flows arriving from the continent can have efficient utilisation and return without undue time penalties, including a three hour turn-round time in East London. This will also help to justify the business case for a new fleet of electric freight locos for HS1, which are likely to be tri-voltage (for parts of Europe as well as UK) and powerful enough to haul weighty inbound trains up steep HS1 gradients.¹⁰
- 159 Flows of goods are heavier inbound into Britain, as the volumes in and out of the UK are unbalanced. An additional inbound freight passing loop on HS1 north of Purfleet could enable an additional hourly path throughout the day. Outbound, freight trains can be scheduled with a shorter time because of the lighter loads. Overall, up to 50 freight paths per day may be feasible, which with a trainload accommodating ca. 50 units of freight would enable a serious rail freight offer to carry more than half of those 4,000 Short Straights vehicles.

Managing UK's loading gauge constraints

- 160 At Dagenham and Barking, suitably gauged swap-bodies could be transferred, train-to-train, onto UK-gauged freight flats, for onward rail haulage elsewhere in Britain. Works to improve Ripple Yard are costed at £20m. Separately, new UK-gauged 'well wagons' could be built with a drop-down area close to the rails to accommodate lorry wheels, to avoid infringing the loading gauge of tunnels and bridges.

¹⁰ Locomotive designs could be similar to the new Class 99 freight loco, including digital signalling capability which is required on HS1.

- 161 A well-structured UK rail freight offer can also anticipate further changes in European and cross-Channel freight flows which are geared to decarbonisation. This looks to rail as the prime mover for time-sensitive flows, with a preference for 'Combined Transport', putting trailers and swap-bodies on trains to ports such as in Denmark and the Netherlands, then onto freight ferries designed for double stacking to maximise use of deck space. The time sensitivity of these flows will require UK to order and have ready new fleets of freight flats and well wagons, to attract the markets to rail.
- 162 Meanwhile, the loading gauge on 'classic' British main lines has been slowly enlarged, project by project, towards a consistent capability to accommodate the international standard (ISO-gauge) for containers and swap-bodies. This is a height and width of 9ft 6ins high, and up to 40ft. long. Some lines via Kent still have a limiting loading gauge. There a small-scale rebuild of critical structures would achieve an interim gauge enhancement at a cost of about £10m, and assist with diversion of ISO flows during line maintenance. A larger-scale upgrade all the way from Cheriton (Dollands Moor yard) to North West London, to meet the West Coast Main Line at Wembley yard, would cost £50-60m.

Other rail initiatives influencing capacity planning for freight modes

- 163 Another initiative for the Short Straits sector is to use the small existing fleet of UK-gauge rail wagons fitted also to run to continental destinations, on short dedicated UK-Europe logistics flows (eg, Benelux, Ruhr and Northern France), to ensure intensive use of these vehicle assets. If successful, more of these wagons can be ordered. This is a greater possibility because of more flexible pricing now possible via Eurotunnel/Getlink.
- 164 Similarly, there is a growing list of schemes which show that rail freight within Britain is becoming more competitive for higher value freight flows. A stronger rail freight sector can compete more effectively for HGV-dominated distribution volumes to and from the centralised warehousing 'Golden Triangle' in the South-West-East Midlands. Examples include:
- Tesco expansion of bulk rail haulage from its central warehousing to UK regions, particularly for heavy ambient goods. Other supermarket chains may follow suit. This will lead to changes in local HGV and LGV distribution routes, geared to where regional rail-served terminals are intended to be located. Bulk rail will in general reduce or contain the growth of supermarket-related HGV volumes on motorways and trunk roads networks, so that forecasts of future road traffic will be out-of-date.
 - As a Thames Estuary example, Transport for the South East supports the development of an intermodal terminal at Sittingbourne in Kent, near to the Medway Towns and beyond the river crossings. The terminal will also support the local industrial zone around Sittingbourne and Sheerness.
- 165 Better understanding of the markets for other specialist flows can also support an improved rail freight offer, even for materials where rail already does much. For example, awareness of specialised aggregate flows around London and the Home Counties has been led by the Mineral Products Association. There is an annual shortfall of 42m tonnes of sand and gravel regionally. Different blends of aggregate are required for construction purposes. Greater use of rail is the key to solving this logistics gap, avoiding wasteful and costly use of HGVs on the main roads and river crossings.¹¹

¹¹ Crushed rock generally comes by rail from quarries west and north of London, while sea-dredged gravel is transhipped at ports and to make construction-strength concrete must be mixed with 3 tonnes of sand for each ton of gravel. Specialist depots are required across London and the Home Counties. Using rail removes the heavy-haul transport burden until the last leg – the delivery to site. Rail freight, typically with 20-26 wagons, is the most efficient and lowest carbon option; electric haulage is desirable and gives quicker acceleration so less line occupation than use of diesel locos.

Domestic intermodal freight

- 166 The largest emerging opportunity for rail freight in Britain, potentially relieving many HGV flows on motorways and trunk roads, is domestic intermodal freight, supporting regional distribution from national-scale warehousing. Rail can then haul not only high volume import flows from ports to central warehousing, but also from such national warehousing (such as the English warehousing 'Golden Triangle' triangle in the South, East and West Midlands) to regional centres. Tesco is a current company-specific example.
- 167 The scale of warehousing is astonishing. There is 690 million sq.feet of warehouses in Britain (64.1 million sq. metres), most with multi-level stacking.¹² There are 28.4 million households, and domestic household demand for on-line direct deliveries is currently encouraging that element of warehousing capacity to grow at an annual rate of over 20%. Warehouse sizes over 1 million sq.ft. are now common. This is seriously high volume, so rail freight is highly relevant. To take matters even further would require several freight forwarders to share capacity on trains serving the same directional flow, and this may happen in the future, to help keep down costs within a managed delivery specification.
- 168 Clearly, many opportunities will exist in Outer East and South East London and the Thames Gateway to apply such delivery principles to existing distribution flows. This will reduce the pressures of long distance road freight on the Thames Gateway's motorways, trunk roads and river crossings. Because freight management is quick to respond to cost and volume factors, changes can be projected within 5-10 years, subject to rail freight being quick off the mark to respond.¹³ The last government had a 75% growth target for rail freight; more may be desired by the current government.

¹² Savills UK | UKWA Report 2024: The Size and Make-Up of the UK Warehousing Sector https://www.savills.co.uk/research_articles/229130/358461-0

Also: <https://www.savills.co.uk/insight-and-opinion/savills-news/358276-0/online-retail-warehouse-occupation-jumps-813--over-the-past-decade>

¹³ See the CILT report on the scope for electrification of rail freight. Also Modern Railways, February 2024: 'Rail freight's growth opportunity'. https://ciltuk.org.uk/Portals/0/RailElectrification_Spreads.pdf?ver=2023-03-01-101049-347

Conclusions

- 169 Rail freight is already handling a third of the large-scale container flows from Estuary and nearby North Sea Ports such as Felixstowe and London Gateway. This rail volume, over 1½ million containers a year, can be expanded to match planned growth in the handling capacity of those ports, and to take a higher percentage of flows to principal warehousing and distribution destinations.
- 170 This requires selective investment in key rail freight corridors via London and cross-country, which are already specified. Top priority to tackle these greater flows is greater capacity, on the London orbital lines and at critical junctions (Haughley and Ely) on the cross-country route, plus track doubling towards Ely. Additional wagon investment is needed, and further electrification would assist.
- 171 Such rail relief of container volumes will benefit M25's capacity on its north-eastern and northern sectors, likely to be negatively impacted by the Lower Thames Crossing, and assist freight economics and sustainability. Failure to invest in additional rail capacity would hinder the M25's effectiveness in accommodating long-haul and distribution HGV flows which have no practical alternative route. This would lead to additional motorway congestion.
- 172 Ro-ro trailer and swap-body flows are the main volumes via the Short Straits, through Dover and Cheriton. One-way flows are estimated as 4,000 large vehicles a weekday, and many use the Dartford Crossing. To relieve and reduce these HGV flows, targeted actions should be directed to:
- Rail freight taking advantage of changes in HS1 and Eurotunnel/Getlink pricing.
 - Reviewing and re-specifying how European-gauge intermodal trains can operate as far as London yards via HS1.
 - Investment in handling transfer in London between European and British-loading gauge trains, for trailers and swap-bodies.
 - Supporting loading gauge and freight capacity enhancement projects within Britain, through investment in routes and rolling stock.
- 173 Other rail freight capabilities can be prioritised, to target specific materials and commodities, and to expand rail handling of high-volume domestic intermodal flows. The timescale for authorising projects and getting results can be within 5-10 years, because there is a strong commercial stimulus for freight operators to keep on top of their cost base.
- 174 The Government can help by supporting quick rail project authorisation, as part of the national objective for 75% growth in rail freight volume. Investment offers a good rate of return and fast payback, and can be genuine progress towards decarbonisation.

Recommendations

- 175 An action list of rail freight projects do-able within the next 3-10 years should be compiled as a matter of urgency, plus a check list of what authorisations and financial commitments are required to achieve progress with each scheme.
- 176 The contribution of each project towards decarbonisation and congestion reduction on major road corridors should be identified.
- 177 The Government can include such outcomes in its own project prioritisations, including the consequences for pending reviews such as the Lower Thames Crossing.

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- technical project advice in transport and local government sectors
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Proposed cross-river rail options for Thames Gateway

