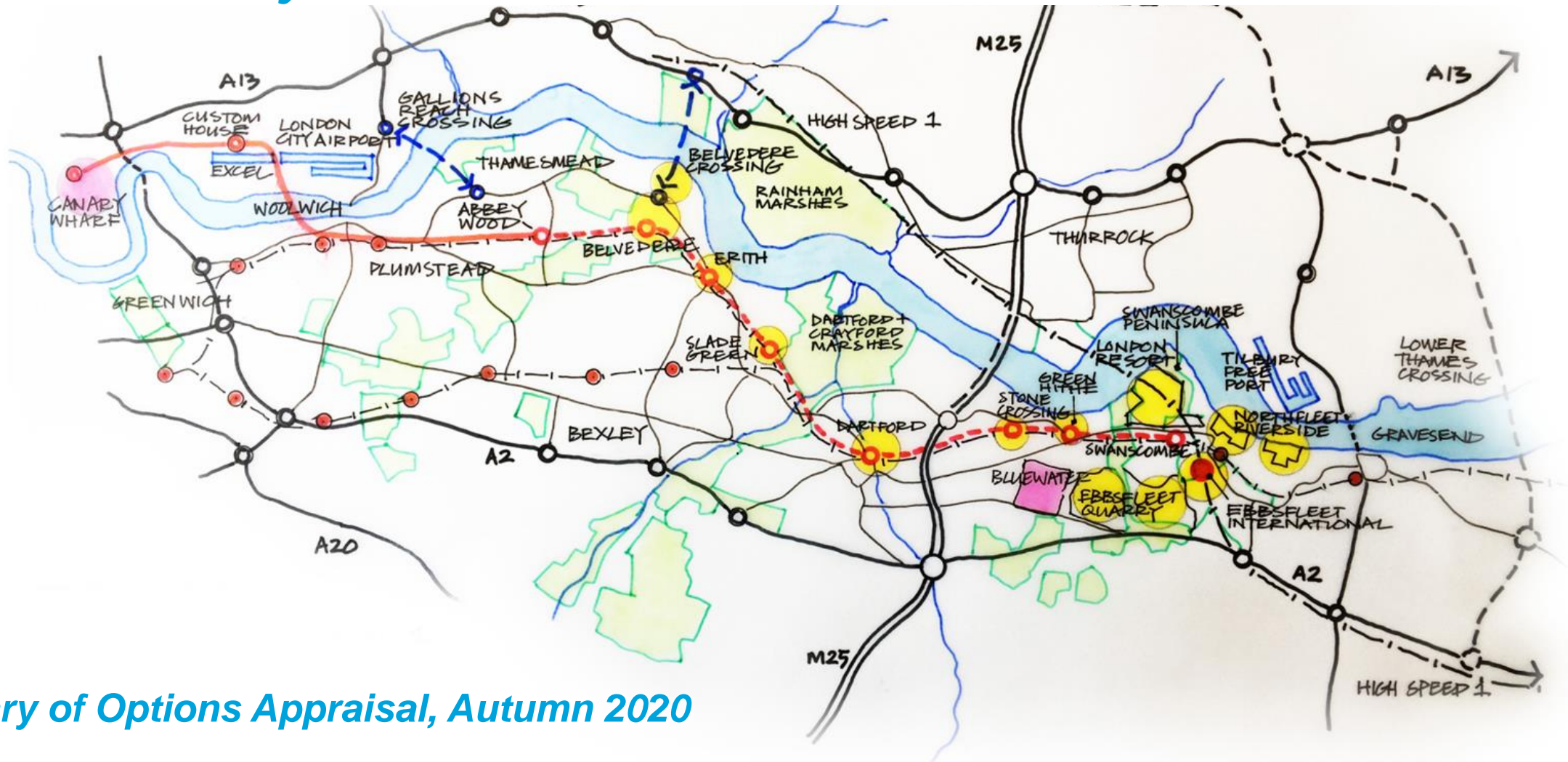


Study into Proposed Transport Enhancement Options between Abbey Wood and Ebbsfleet



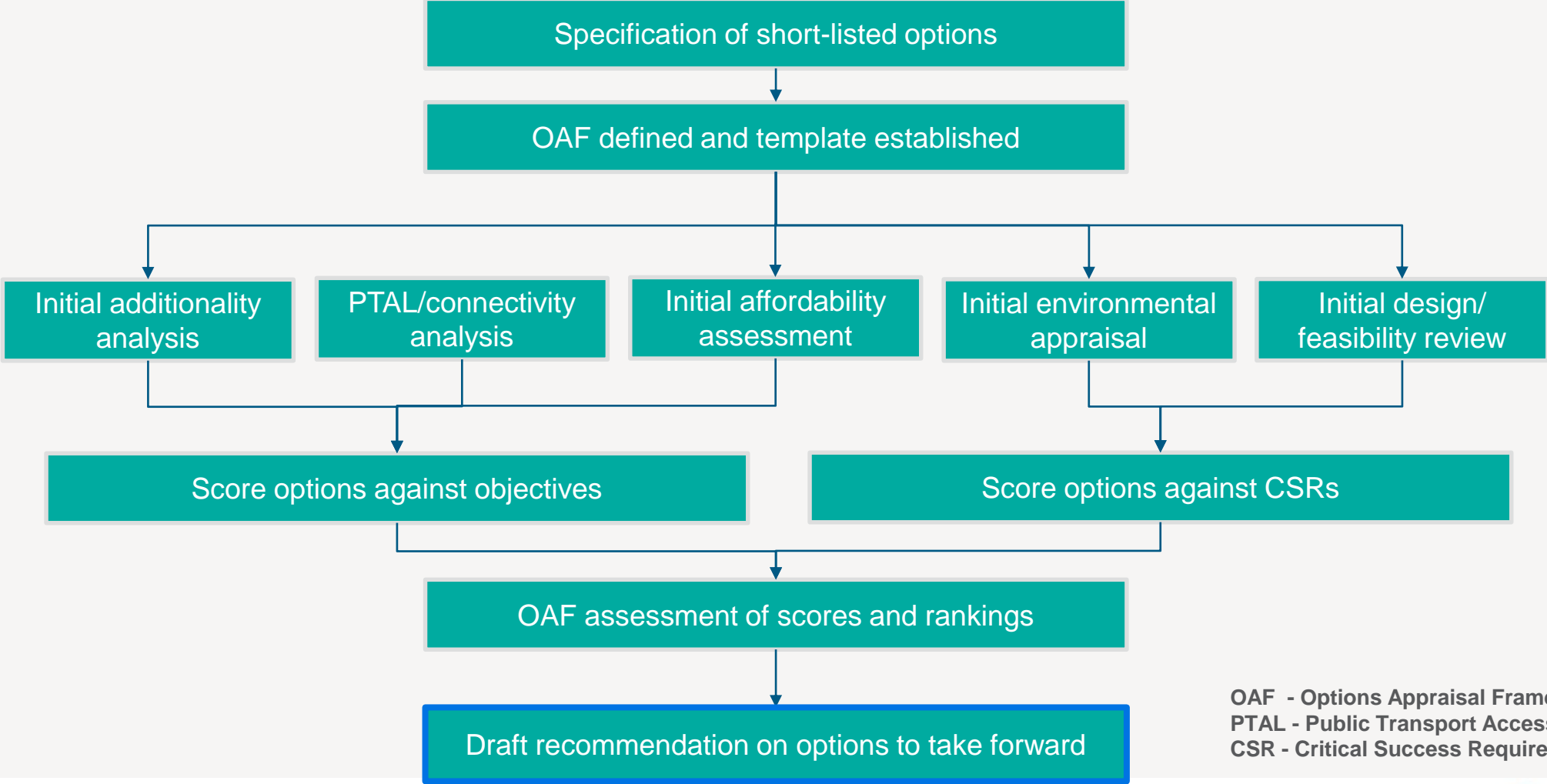
Summary of Options Appraisal, Autumn 2020



Approach to the Appraisal



Options Appraisal Framework (OAF) Work Flow Process



OAF - Options Appraisal Framework
PTAL - Public Transport Accessibility Level
CSR - Critical Success Requirement



How the OAF works

- All short-listed schemes scored against each project objective and Critical Success Requirement (CSR) - **see following slide**
- Some objectives / CSRs divided into components
- All scored on a 5-point scale (1 for the worst performing score, 5 for the best performing score) to allow for consistency and comparability of results
- Mix of quantitative and qualitative (professional judgement-based) scores
- Review of option complementarity to inform scheme definition for subsequent assessment
- **Overall approach in line with DfT Early Assessment and Sifting Tool (EAST) Guidance**

Scoring of development objectives

Score	Description (additional housing/jobs)
1	Very low
2	Low
3	Moderate
4	High
5	Very high

Scoring of transport objectives

Score	Description (connectivity/capacity)
1	No impact
2	Minor impact
3	Moderate impact
4	Significant impact
5	Very significant impact

Scoring of CSRs

Score	Description (risk/cost)
1	Very high
2	High
3	Medium
4	Low
5	Very low



Objectives and Critical Success Requirements (CSR)

Objectives
A. Support ambitious and sustainable housing growth and regeneration in the Bexley Riverside-North Kent Corridor (“the Corridor”) by increasing the deliverability of development sites through improved public transport accessibility.
B. Support employment growth, intensification and productivity , by improving public transport connectivity to major employment centres, services and amenities including Central London’s key employment locations (City, West End and Docklands), and within the Corridor.
C. Deliver an uplift in the quality and capacity of public transport to address current and future travel demands in the Corridor, by reducing travel times (including the impact on the intermediate stations which aren’t served by HS1), to major employment centres, services and amenities; improving service frequency, reliability and resilience; and reducing congestion and crowding.
D. Support climate change and zero carbon goals and targets and environmentally sustainable growth , by incentivising modal shift from private to public transport, providing alternatives to existing and new car-based travel demand within the Corridor (including from established urban areas and new key development sites) and enabling integrated transport and spatial planning in the corridor.
E. Improve connectivity from the Corridor to key strategic and international gateways.
F. Affordability - intervention must be affordable and have realistic funding prospects.

CSRs
1. Value for Money (VfM) – scheme must offer medium to high VfM to the UK tax payer.
2. Infrastructure delivery – scheme must be considered technically feasible and deliverable at a satisfactory level of risk.
3. Implementation disruption to transport network – should be considered acceptable as defined by the relevant transport delivery body and DfT.
4. Operational delivery – scheme should be defined as operationally feasible and deliverable at a satisfactory level of risk.
5. Resilience to future demands – scheme should offer reasonable resilience to future demands identified in agreement with the relevant transport delivery bodies, in particular with reference to impacts on existing rail and highways network.
6. Environmental impact – scheme must be deliverable at an acceptable level of impact.
7. Land and property impacts – scheme must be deliverable at an acceptable level of impact.
8. Stakeholder acceptability – scheme must have stakeholder support, feasibility/operational risks must be acceptable to stakeholders.



Work Completed since the Initial Long-List Sift in June 2020

- Objectives A and B assessed based on a high level estimate of number of new houses and jobs unlocked by each scheme
- Indicative capital cost ranges developed for all schemes
- Affordability analysis completed by KPMG to inform the assessment of each scheme against Objective F
- Initial carbon assessment undertaken as part of environmental assessment to inform Objective D
- Revisions to CSR feasibility scores based on emerging scheme definitions – professional judgement from study consultant team
- Revisions to transport objective scores (Public Transport connectivity etc) based on emerging scheme definitions – professional judgement from study consultant team
- Scoring reviewed and converted where required, to align with 5-point scale used across all objectives and CSRs
- **NB.** Transport modelling of journey time savings, crowding relief etc part of later stages of assessment (next stage of work commencing in November 2020)



Definition of the Options and Reference Case



Option Development Approach

In summer 2020, a longlist of 30 potential options to improve transport capacity and connectivity were assessed, with eight options chosen to be taken forward for further assessment. The study consultant team reviewed the eight short-listed options from the Summer 2020 longlist and developed service specifications to enable completion of initial options assessment and sifting.

The work has benefitted from liaison with key stakeholders and built upon work previously undertaken by stakeholders.



Option Definitions

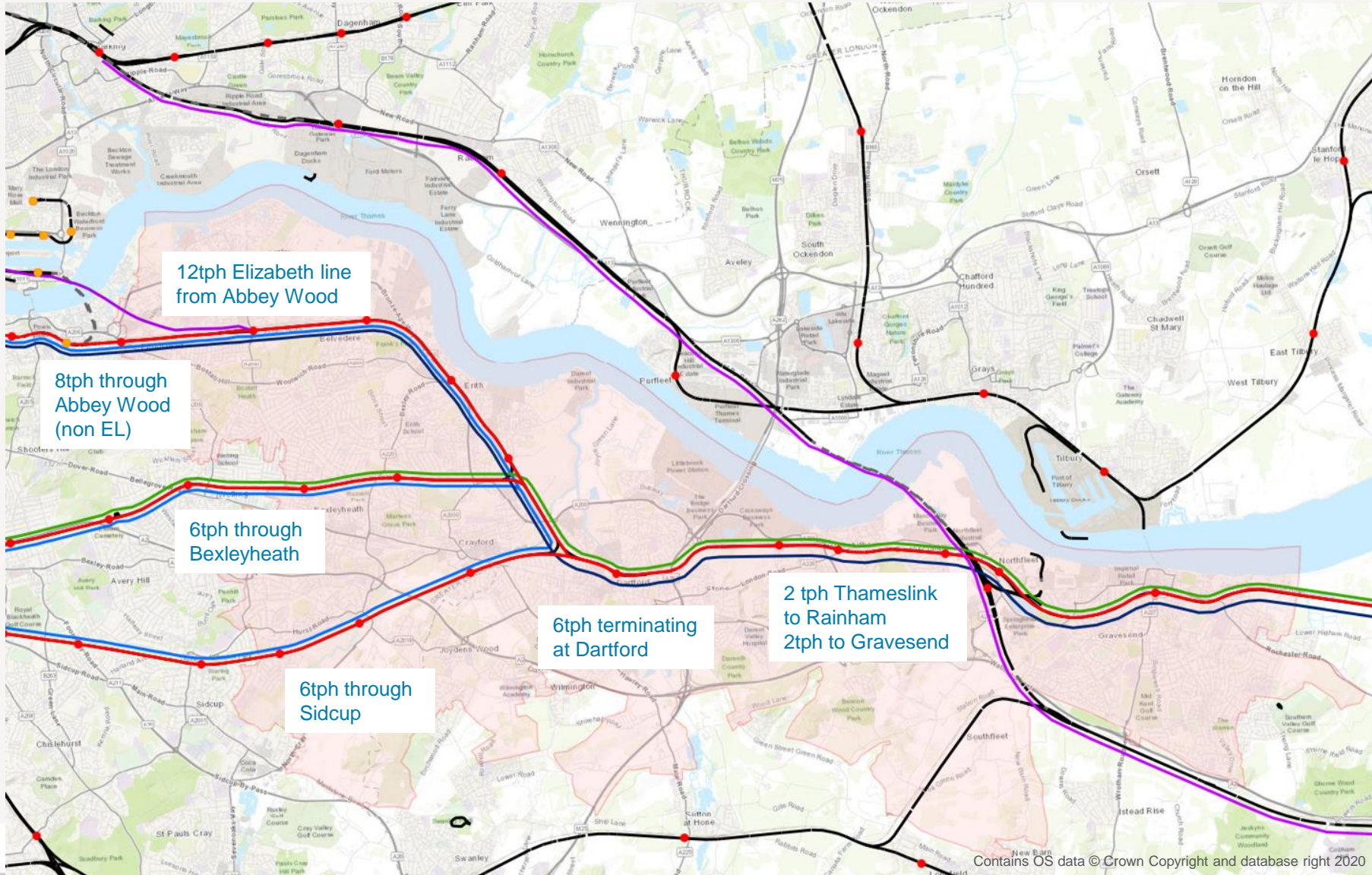
Reference Case & Options



Heavy Rail Options



2031 Reference Case – Assumed Rail Network



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- Study Area
- National Rail Stations
- DLR Stations
- High Speed 1
- Charing Cross Services
- Crossrail/Elizabeth Line
- Thameslink
- Victoria Services
- Canon Street Services
- National Rail
- Tunnels

tph = trains per hour

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Heavy Rail Options

Option Category	Option no.	Option Summary
Low Cost Rail	A1	Extend services to/from Dartford eastwards. Minimal infrastructure investment
	A2	Extend services to/from Dartford eastwards. More significant infrastructure investment
Crossrail Extension	C1	Crossrail extension to Northfleet/Ebbsfleet (all segregated from Abbey Wood)
	C4	Crossrail extension to Northfleet/Ebbsfleet (all mixed running from Abbey Wood)
	C5	Crossrail extension to Dartford (segregated Abbey Wood to Dartford)
“Other Rail Solutions”	E1	National Rail shuttle between Plumstead/Abbey Wood and Northfleet/Ebbsfleet



Heavy Rail Options Summary

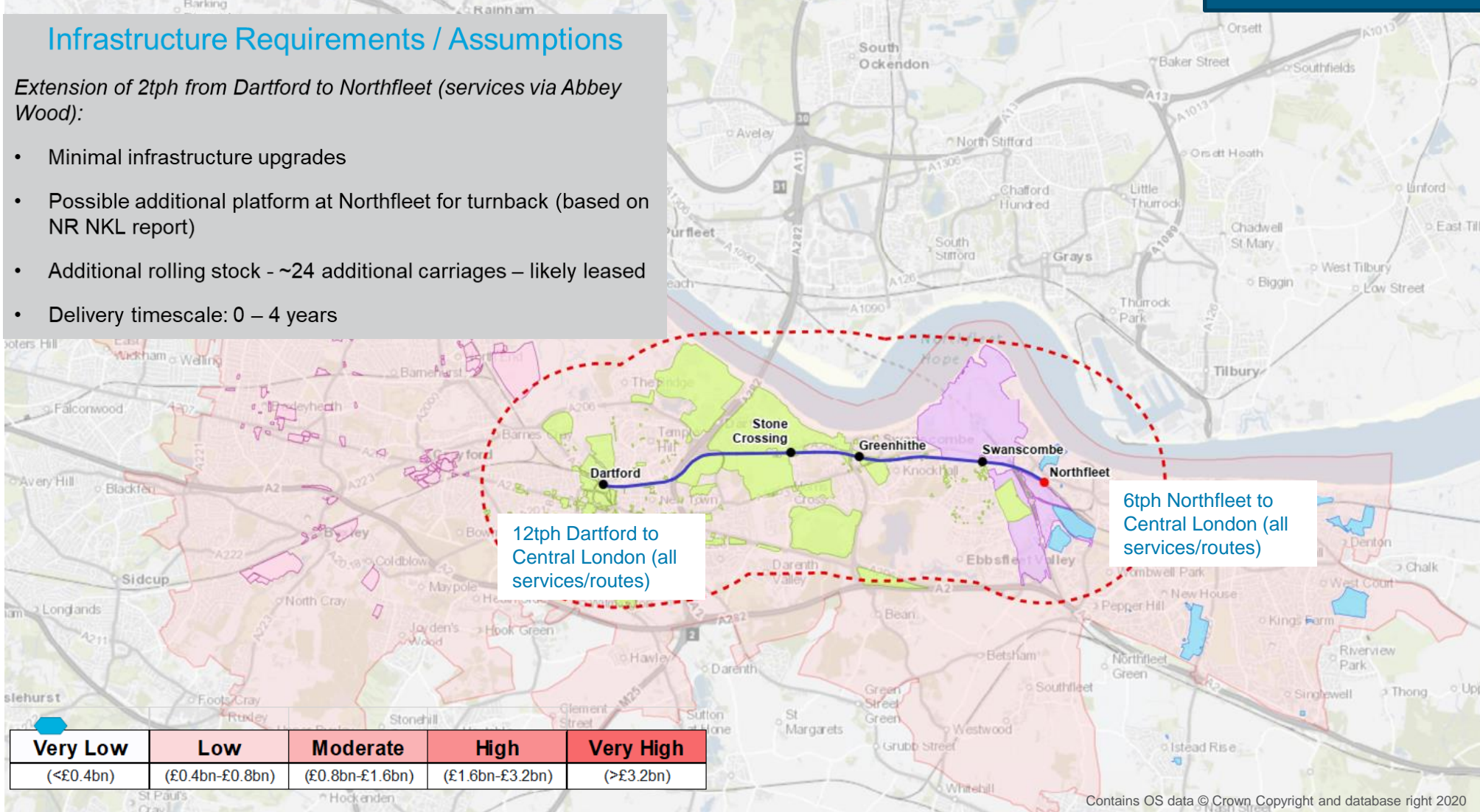
Option Category	Option no.	Option Summary	2031 Reference Case		Service aspirations associated with option	
			Description	Service	Description	Additional Services Introduced
Low Cost Rail	A1	Extend services to/from Dartford eastwards. Minimal infrastructure investment	National Rail services to include longer trains and walk-through carriages as per SouthEastern franchise agreement.	Currently 4-6tph east of Dartford	Minimal infrastructure investment (turnback platform at Northfleet may be required)	Extension of 2tph from Dartford to Northfleet
	A2	Extend services to/from Dartford eastwards. Enabled by infrastructure investment		Currently 4-6tph east of Dartford	Extent of new infrastructure to be determined. For A2 possible introduction of 8tph turnback facility at Northfleet and additional stabling sidings.	Extension of 8tph from Dartford to Northfleet
Crossrail Extension	C1	Crossrail extension to Ebbsfleet (all segregated from Abbey Wood)		N/A east of Abbey Wood	Elizabeth Line has 24tph in core, 12tph to Abbey Wood, 12tph to Stratford. 8-12tph to Northfleet, or potentially 6 to Northfleet and remainder turn back, if new infrastructure provided. Tph to continue beyond Abbey Wood to be influenced by demand and cost of infrastructure, inc. junctions and stations. Exact alignment of new tracks (north or south of existing tracks) depends on options selected for Dartford.	8-12tph extended from Abbey Wood to Northfleet
	C4	Crossrail extension to Ebbsfleet (all mixed running from Abbey Wood)				6tph extended from Abbey Wood to Northfleet
	C5	Crossrail extension to Dartford (segregated Abbey Wood to Dartford)				8tph extended from Abbey Wood to Dartford
“Other Rail Solutions”	E1	High frequency National Rail shuttle 6tph between Plumstead and Northfleet/Ebbsfleet		Currently 4-6tph east of Dartford	Possible infrastructure upgrades include turnback facilities at Northfleet and near Plumstead.	6tph shuttle from Plumstead to Northfleet



Infrastructure Requirements / Assumptions

Extension of 2tph from Dartford to Northfleet (services via Abbey Wood):

- Minimal infrastructure upgrades
- Possible additional platform at Northfleet for turnback (based on NR NKL report)
- Additional rolling stock - ~24 additional carriages – likely leased
- Delivery timescale: 0 – 4 years



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- Study Area
- Station 2km Catchment (Dartford to Northfleet)
- No / Minimal Infrastructure Planned
- Additional 1 platform for terminating capacity
- Sections of track with additional services with no/minimal infrastructure works.
- Opportunity Sites:
 - Ebbsfleet
 - Bexley
 - Dartford
 - Gravesham

Very Low	Low	Moderate	High	Very High
(<£0.4bn)	(£0.4bn-£0.8bn)	(£0.8bn-£1.6bn)	(£1.6bn-£3.2bn)	(>£3.2bn)

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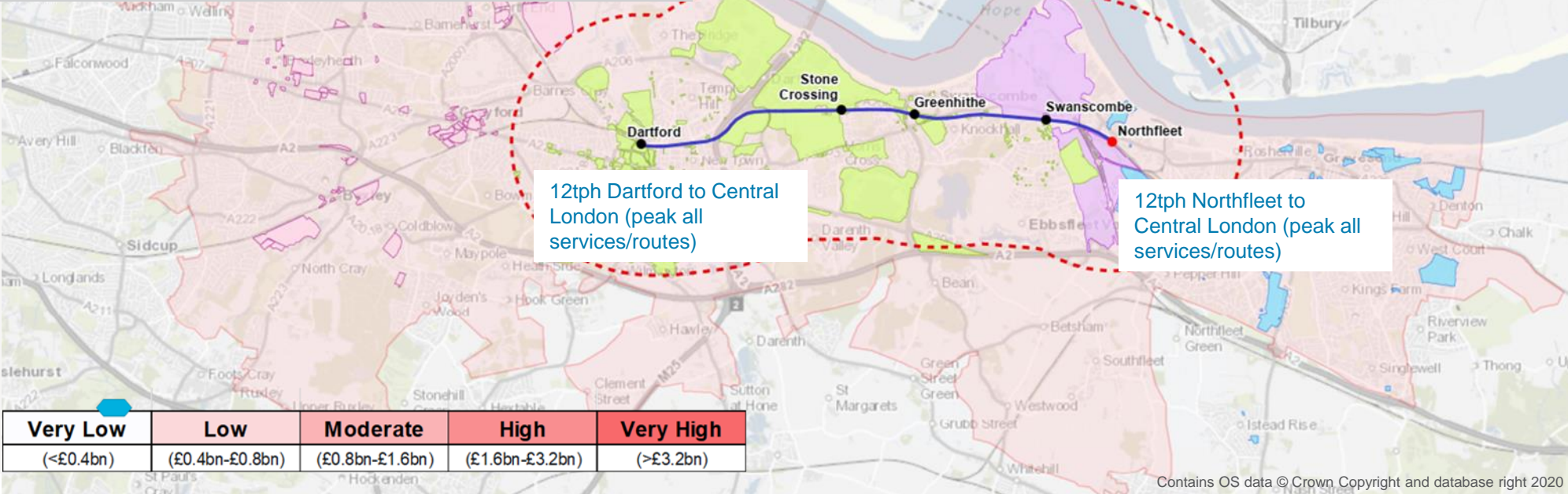
Infrastructure Requirements / Assumptions

Extension of 8 tph existing Dartford ‘starter’ services (to Charing Cross, Cannon Street and Victoria) to Northfleet:

- 8tph turnback facility at Northfleet
- Stabling sidings – up to 4
- Possible DC power supply upgrade
- Additional rolling stock ~48 additional carriages – likely leased
- Delivery timescale: 4 – 7 years

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- Study Area
- Station 2km Catchment (Dartford to Northfleet)
- No / Minimal Infrastructure Planned
- Additional 2 platforms for terminating capacity
- Sections of track with additional services with no/minimal infrastructure works.
- Opportunity Sites:
 - Ebbsfleet
 - Bexley
 - Dartford
 - Gravesham



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C1 – Crossrail Extension to Ebbsfleet (Segregated Running)

Extension of 8-12tph Elizabeth line services from Abbey Wood to Northfleet

Infrastructure Requirements / Assumptions

- 17km new electric track
- 16+ new platforms
- Bridges & structures
- Additional rolling stock
- Large land purchase
- Stabling sidings
- Delivery timescale: 10 - 15 years

20tph Abbey Wood to Central London (peak all services/routes)

20-24tph Dartford to Central London (peak all services/routes)

12-16tph Northfleet to Central London (peak all services/routes)



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- Study Area
- Core Station 2km Catchment (Abbey Wood to Northfleet)
- No / Minimal Infrastructure Planned
- Station Expansion
- New two-track railway alongside/close to existing alignment.
- Opportunity Sites:
 - Ebbsfleet
 - Bexley
 - Dartford
 - Gravesham

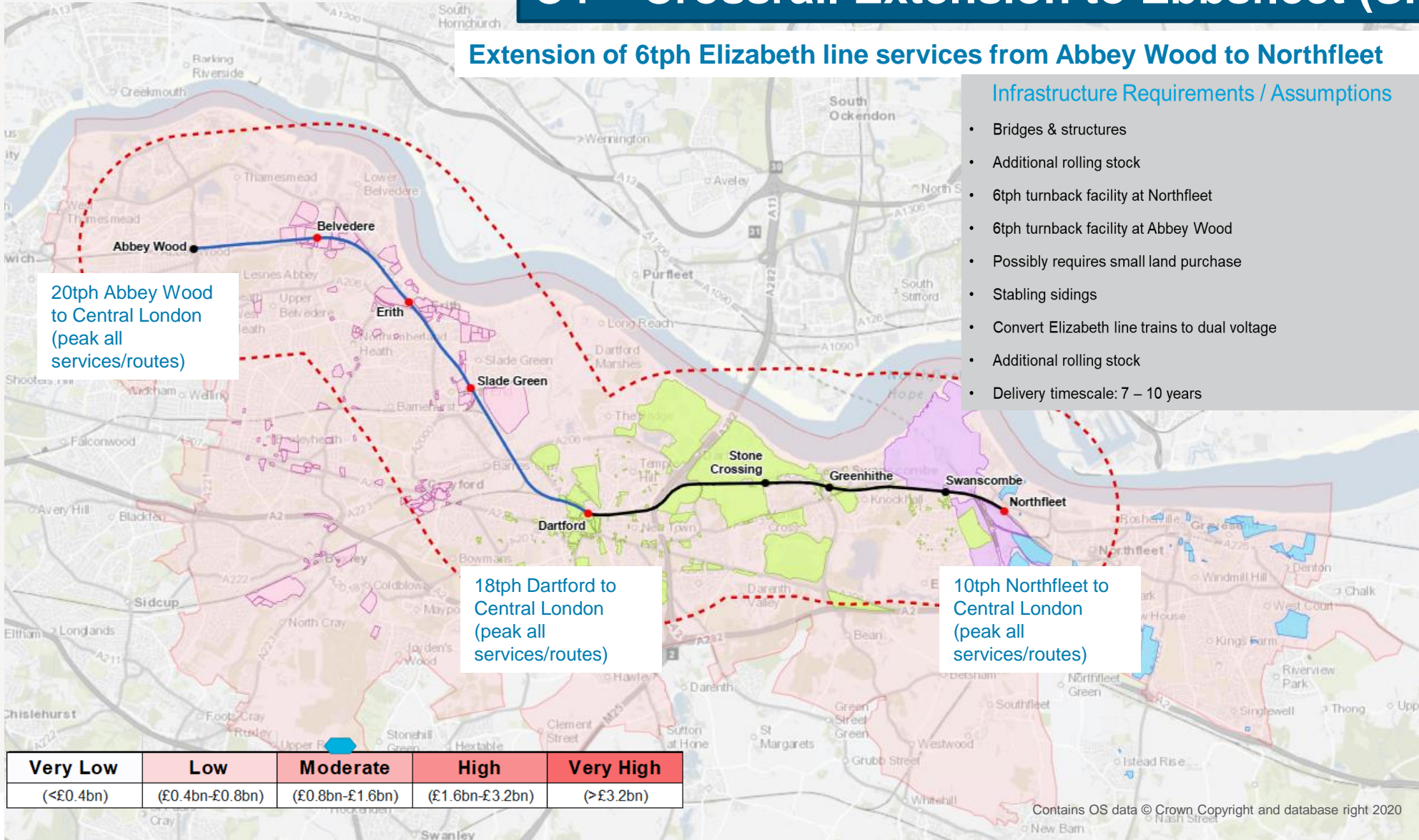
Very Low	Low	Moderate	High	Very High
(<£0.4bn)	(£0.4bn-£0.8bn)	(£0.8bn-£1.6bn)	(£1.6bn-£3.2bn)	(>£3.2bn)

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C4 – Crossrail Extension to Ebbsfleet (Shared Running)

Extension of 6tph Elizabeth line services from Abbey Wood to Northfleet



20tph Abbey Wood to Central London (peak all services/routes)

18tph Dartford to Central London (peak all services/routes)

10tph Northfleet to Central London (peak all services/routes)

Infrastructure Requirements / Assumptions

- Bridges & structures
- Additional rolling stock
- 6tph turnback facility at Northfleet
- 6tph turnback facility at Abbey Wood
- Possibly requires small land purchase
- Stabling sidings
- Convert Elizabeth line trains to dual voltage
- Additional rolling stock
- Delivery timescale: 7 – 10 years



- Study Area
 - Core Station 2km Catchment (Abbey Wood to Northfleet)
 - No / Minimal Infrastructure Planned
 - Station Expansion
 - Mixed running section likely with additional infrastructure required.
 - Mixed running section with no/minimal infrastructure requirements.
 - Ebbsfleet
 - Bexley
 - Dartford
 - Gravesham
- Opportunity Sites

Very Low	Low	Moderate	High	Very High
(<£0.4bn)	(£0.4bn-£0.8bn)	(£0.8bn-£1.6bn)	(£1.6bn-£3.2bn)	(>£3.2bn)

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C5 – Crossrail Extension to Dartford (Segregated Running)

Extension of 8tph Elizabeth line services from Abbey Wood to Dartford

20tph Abbey Wood to Central London (peak all services/routes)

20tph Dartford to Central London (peak all services/routes)



Study Area

- Core Station 2km Catchment (Abbey Wood to Dartford)
- No / Minimal Infrastructure Planned
- Station Expansion
- New two-track railway alongside / close to existing alignment

Opportunity Sites

- Ebbsfleet
- Bexley
- Dartford
- Gravesham

Infrastructure Requirements / Assumptions

- 8km new electric track
- 8+ new platforms
- Bridges & structures
- Additional rolling stock
- Large land purchase
- Stabling sidings
- Delivery timescale: 10 -15 years

Very Low	Low	Moderate	High	Very High
(<£0.4bn)	(£0.4bn-£0.8bn)	(£0.8bn-£1.6bn)	(£1.6bn-£3.2bn)	(>£3.2bn)



E1 – High Frequency National Rail Shuttle

6th shuttle service between Plumstead and Northfleet



- Study Area
 - Core Station 2km Catchment (Abbey Wood to Northfleet)
 - Possible station enhancements - to be determined
 - Route of high-frequency shuttle - infrastructure requirements to be determined
 - Ebbsfleet
 - Bexley
 - Dartford
 - Gravesham
- } Opportunity Sites

20tph Abbey Wood to Central London (peak all services/routes)

18tph Dartford to Central London (peak all services/routes)

10tph Northfleet to Central London (peak all services/routes)

Infrastructure Requirements / Assumptions

- New bridges and structures
- National Rail turnback in Plumstead area
- Turnback facility at Northfleet
- Possible small land purchase
- Additional rolling stock
- Stabling sidings
- Delivery timescale: 4 – 7 years

Very Low	Low	Moderate	High	Very High
(<£0.4bn)	(£0.4bn-£0.8bn)	(£0.8bn-£1.6bn)	(£1.6bn-£3.2bn)	(>£3.2bn)

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Heavy Rail Options Summary

Option Category	Option no.	Option Summary	Service Uplift	Preliminary cost categorisation				
Low Cost Rail	A1	Extend services to/from Dartford eastwards. Minimal infrastructure investment	Extension of 2tph from Dartford to Northfleet	Very Low (<£0.4bn)	Low (£0.4bn-£0.8bn)	Moderate (£0.8bn-£1.6bn)	High (£1.6bn-£3.2bn)	Very High (>£3.2bn)
	A2	Extend services to/from Dartford eastwards. Enabled by more significant infrastructure investment	Extension of 8tph from Dartford to Northfleet	Very Low (<£0.4bn)	Low (£0.4bn-£0.8bn)	Moderate (£0.8bn-£1.6bn)	High (£1.6bn-£3.2bn)	Very High (>£3.2bn)
Crossrail Extension	C1	Crossrail extension to Ebbsfleet (all segregated from Abbey Wood)	8-12tph Elizabeth Line extended from Abbey Wood to Northfleet	Very Low (<£0.4bn)	Low (£0.4bn-£0.8bn)	Moderate (£0.8bn-£1.6bn)	High (£1.6bn-£3.2bn)	Very High (>£3.2bn)
	C4	Crossrail extension to Ebbsfleet (all mixed running from Abbey Wood)	6tph Elizabeth Line extended from Abbey Wood to Northfleet	Very Low (<£0.4bn)	Low (£0.4bn-£0.8bn)	Moderate (£0.8bn-£1.6bn)	High (£1.6bn-£3.2bn)	Very High (>£3.2bn)
	C5	Crossrail extension to Dartford (segregated Abbey Wood to Dartford)	8tph Elizabeth Line extended from Abbey Wood to Dartford	Very Low (<£0.4bn)	Low (£0.4bn-£0.8bn)	Moderate (£0.8bn-£1.6bn)	High (£1.6bn-£3.2bn)	Very High (>£3.2bn)
“Other Rail Solutions”	E1	High frequency National Rail shuttle 6tph between Plumstead and Northfleet/Ebbsfleet	6tph shuttle from Plumstead to Northfleet	Very Low (<£0.4bn)	Low (£0.4bn-£0.8bn)	Moderate (£0.8bn-£1.6bn)	High (£1.6bn-£3.2bn)	Very High (>£3.2bn)



Light Rail (DLR) Options

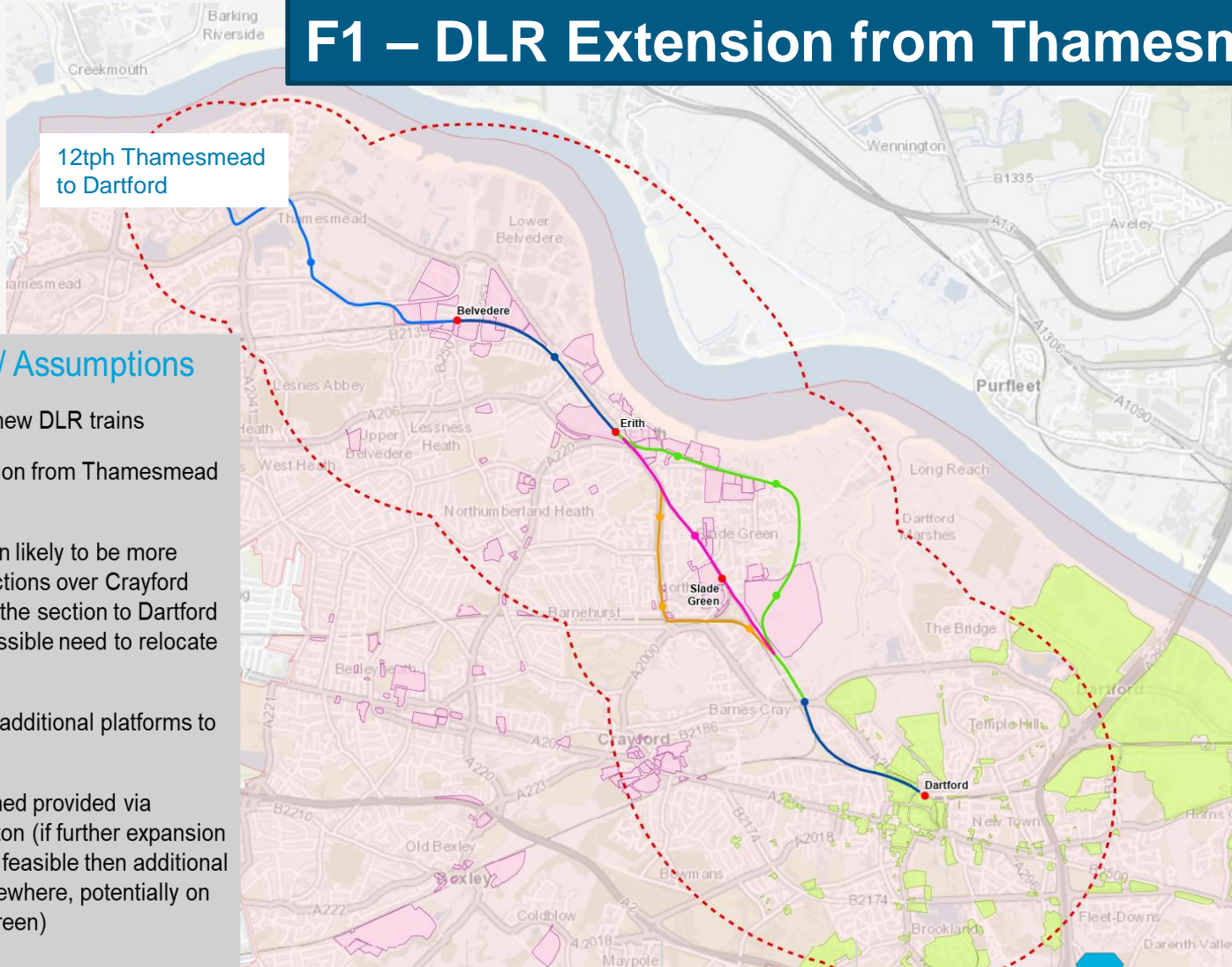


Light Rail DLR Option Service Summary

Option Category	Option no.	Option Summary	2031 Reference Case		Service aspirations associated with option	
			Description	Service	Description	Service
DLR	F1	DLR Thamesmead-Belvedere- “and beyond”	Assume extension to Thamesmead implemented	12tph to Thamesmead	<p>Previous studies have developed a route from Beckton via Thamesmead to Belvedere.</p> <p>It has been suggested that the eastern DLR terminus could be at Dartford to increase accessibility to and from opportunity sites between Slade Green and Dartford. Journey times in excess of an hour to the City and West End weaken the case for extending so far east.</p> <p>There appear to be three route options between Erith & Dartford:</p> <ul style="list-style-type: none"> • Via the Crayford Marshes • Via the existing rail corridor • Via A206 Northend Rd 	12tph assumed (i.e. same as Woolwich Arsenal). The western terminus of these services would be affected by DLR capacity constraints west of Poplar.



F1 – DLR Extension from Thamesmead to Dartford



12tph Thamesmead to Dartford

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- Study Area
- Station Catchment for DLR
- DLR Route Option via Erith and Crayford Marshes
- DLR Route Option via Northend Road
- DLR Route Option via Slade Green Depot
- Potential DLR Route to Belvedere
- Potential DLR Route to Dartford
- Ebbsfleet
- Bexley
- Dartford
- Gravesham

} Opportunity Sites

Infrastructure Requirements / Assumptions

- Additional route length of circa. 8km; 16 new DLR trains
- Need for viaduct structures on route section from Thamesmead Central-Belvedere
- Route from Belvedere-Erith – construction likely to be more complex, particularly in respect of the sections over Crayford Marshes, through Erith Town Centre and the section to Dartford station along the existing rail corridor (possible need to relocate existing rail infrastructure)
- Likely requirement for expansion works / additional platforms to serve the DLR at Dartford station
- Additional stabling & maintenance assumed provided via expansion of existing DLR depot in Beckton (if further expansion of Beckton found through study to be not feasible then additional DLR stabling would need to be found elsewhere, potentially on the Dartford extension (possibly Slade Green))
- New turnback required
- Delivery timescale: 10-15 years

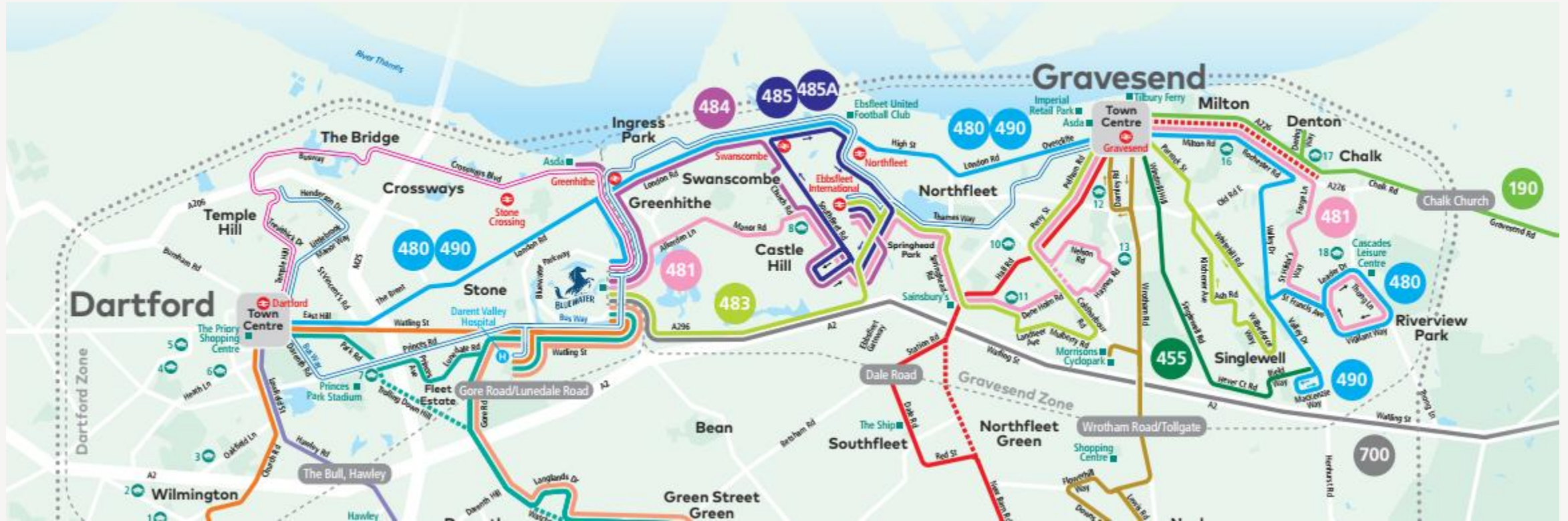
Very Low	Low	Moderate	High	Very High
(<£0.4bn)	(£0.4bn-£0.8bn)	(£0.8bn-£1.6bn)	(£1.6bn-£3.2bn)	(>£3.2bn)



Bus Rapid Transit (BRT) Options



Arriva Kent Thameside Local Bus and Fastrack Network in the Study Area (2020)

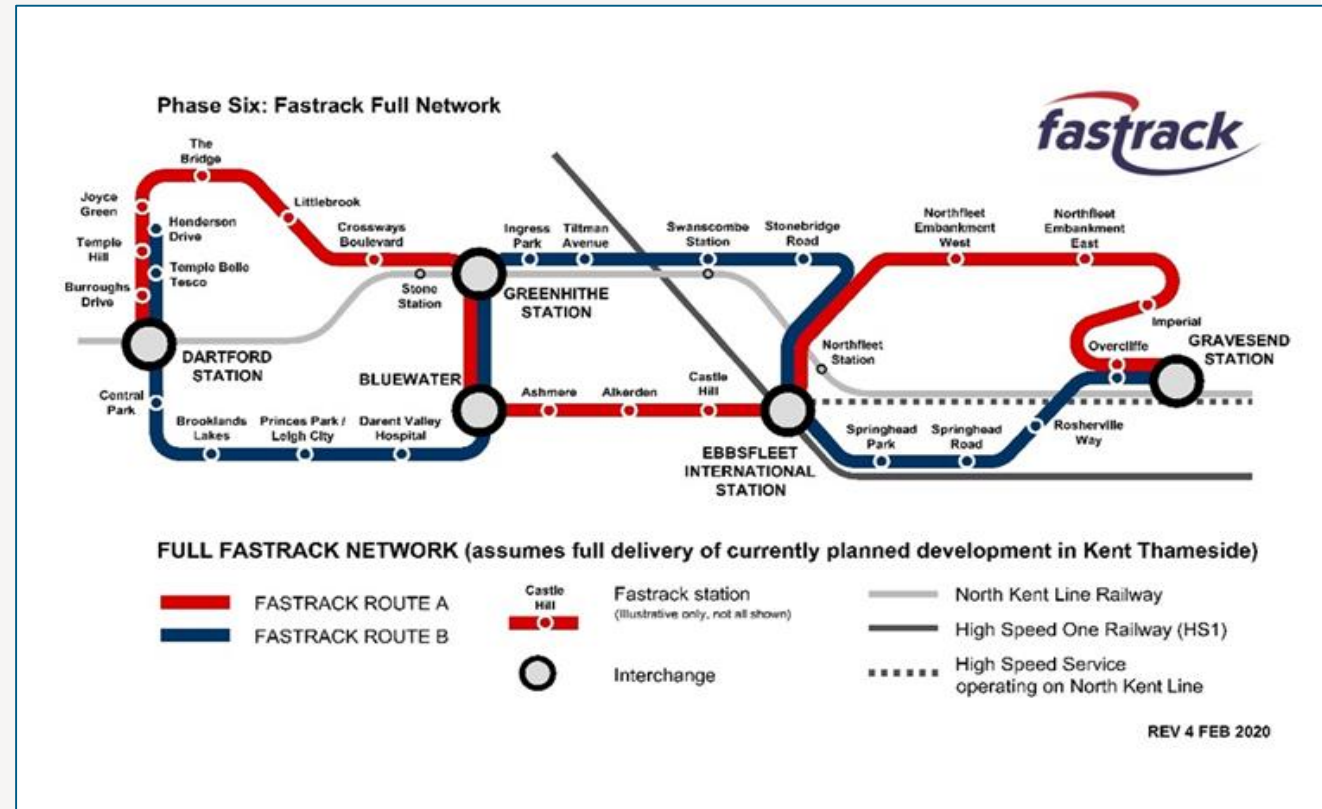


2031 Reference Case - Bus Rapid Transit

Base case = BRT (Fastrack) Dartford - Bluewater – Gravesend

- Existing routes A and B, plus committed BRT infrastructure between Bluewater and Ebbsfleet via Eastern Quarry. On completion route A extends from Bluewater via Eastern Quarry to Ebbsfleet then Gravesend via Northfleet Embankment, expected by end 2022
- Fastrack is part segregated, part on street with priority;
- 6 buses per hour on each of routes A and B (as at present). This is considered appropriate for a “turn up and go” service. 40-seat buses: seated capacity is 240 seats / hour / direction
- Current average journey times to nearest rail station = 5-7 minutes
- Current operating speed c. 25 kph
- Average spacing between stops c. 500 metres
- BRT frequency can be scaled up to meet demand. The current frequency of 6bph could comfortably increase to 12 or 18 using existing infrastructure

Fastrack ‘Do Minimum’ Network



BRT Option Service Summary

Option Category	Option no.	Option Summary	2022 Base Case		Service aspirations associated with option	
			Description	Service	Description	Service
Bus Rapid Transit	G1 / G2 hybrid	BRT Abbey Wood – Dartford	Existing Fastrack routes A and B, plus committed BRT infrastructure between Bluewater and Ebbsfleet via Eastern Quarry and on Northfleet Embankment. On completion route A extends from Bluewater via Eastern Quarry to Ebbsfleet then Gravesend via Northfleet Embankment	6 buses per hour on each of routes A and B. 40-seat buses: seated capacity is 240 seats / hour / direction. Current average journey times to nearest rail station = 5-7 minutes	Provides faster and more frequent bus journey times from Bexley Riverside to Dartford, with potential to extend eastwards using existing Fastrack infrastructure.	Abbey Wood – Erith – Slade Green - Dartford on new BRT infrastructure / existing highways. Service extends to Darent Valley Hospital and Bluewater Shopping Centre via existing Fastrack infrastructure. Minimum frequency 6 buses per hour.

Notes:

1. Some strategic links e.g. Dartford – Gravesend, are quicker by conventional local bus while, in places, Fastrack infrastructure could be further developed to provide more bus priority. Cases for this should be developed to further improve local connectivity.
2. It may be that expansion of BRT in the study area emerges as a “complementary” option to be paired with one or more others. This will be looked at in the next stage.

In relation to the London Resort, Fastrack proposals to serve that development have been identified (G6) but this falls outside the Step 6 option appraisal and sift process.



G1/G2 – Bus Rapid Transit

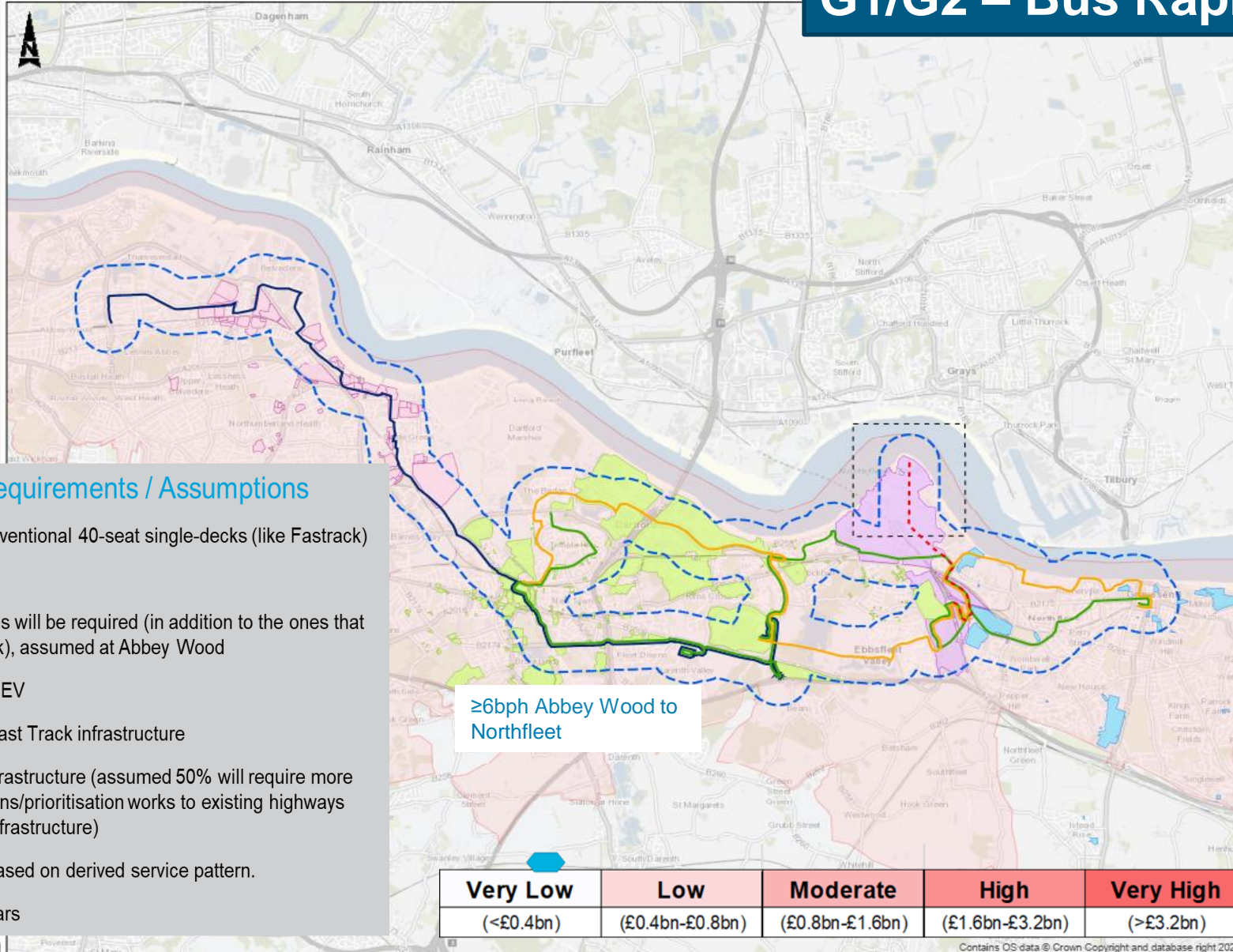


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- Study Area
- Abbey Wood-Dartford (G1/2 Hybrid)
- Fastrack Route A (G3)
- Fastrack Route B (G3)
- London Resort (G6)
- G6 delivered in connection with London Resort or alternative development on Northfleet peninsula
- 500m catchment
- Ebbsfleet
- Bexley
- Dartford
- Gravesham



Infrastructure Requirements / Assumptions

- Vehicles assumed to be conventional 40-seat single-decks (like Fastrack)
- Assuming electric vehicles
- Opportunity charging stations will be required (in addition to the ones that will be delivered for Fastrack), assumed at Abbey Wood
- Depot expansion / fit out for EV
- 5.5km of route on existing Fast Track infrastructure
- Remaining 12km on new infrastructure (assumed 50% will require more major infrastructure alterations/prioritisation works to existing highways and 50% new segregated infrastructure)
- 11 new vehicles assumed based on derived service pattern.
- Delivery timescale: 4 – 7 years

Very Low	Low	Moderate	High	Very High
(<£0.4bn)	(£0.4bn-£0.8bn)	(£0.8bn-£1.6bn)	(£1.6bn-£3.2bn)	(>£3.2bn)

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Assessment Results for each Objective and CSR



Key Elements of Scoring (Objective A - Housing)

- Component of **Objective A** linked to new *additional housing* forecast, using following scale:
 - 1 = Very Low
 - 2 = Low
 - 3 = Medium
 - 4 = High
 - 5 = Very High

Low Cost Rail		Elizabeth Line Extension			Other Rail	DLR	BRT
A1	A2	C1	C4	C5	E1	F1	G1/G2
Extend services from Dartford to Northfleet. No infrastructure investment.	Extend services from Dartford to Northfleet. Enabled by infrastructure investment.	Crossrail Extension Abbey Wood to Northfleet (segregated).	Crossrail Extension Abbey Wood to Northfleet (shared running).	Crossrail Extension Abbey Wood to Dartford only (segregated).	National Rail shuttle from Abbey Wood to Northfleet/ Ebbsfleet (shared running).	DLR Thamesmead - Belvedere "and beyond", (with three route options between Erith & Dartford).	G1/G2 Hybrid - North Greenwich / Abbey Wood / Dartford / Darent Valley Hospital & Bluewater via existing Fastrack.
Score	Score	Score	Score	Score	Score	Score	Score
1	2	5	5	3	3	2	1

- Objective also includes qualitative scoring of *socio-distributional (regeneration)* impacts (with reference to PTAL scores and Index of Multiple Deprivation) and *land value uplift* by property consultants



Key Elements of Scoring (Objective B - Employment)

- Component of **Objective B** linked to **additional jobs from development unlocked** (note, this is not an assessment of wider economic impact, which will be undertaken at the next stage)
 - 1 = Very Low
 - 2 = Low
 - 3 = Medium
 - 4 = High
 - 5 = Very High
- In certain cases, schemes unlock residential sites occupying current employment land, hence negative forecast

Low Cost Rail		Elizabeth Line Extension			Other Rail	DLR	BRT
A1	A2	C1	C4	C5	E1	F1	G1/G2
Extend services from Dartford to Northfleet. No infrastructure investment.	Extend services from Dartford to Northfleet. Enabled by infrastructure investment.	Crossrail Extension Abbey Wood to Northfleet (segregated).	Crossrail Extension Abbey Wood to Northfleet (shared running).	Crossrail Extension Abbey Wood to Dartford only (segregated).	National Rail shuttle from Abbey Wood to Northfleet/ Ebbsfleet (shared running).	DLR Thamesmead - Belvedere "and beyond", (with three route options between Erith & Dartford).	G1/G2 Hybrid - North Greenwich / Abbey Wood / Dartford / Darent Valley Hospital & Bluewater via existing Fastrack.
Score	Score	Score	Score	Score	Score	Score	Score
2	3	5	5	2	2	1	1

- Objective B assessment also includes qualitative assessment of **impact on London labour catchment**, based on transport connectivity analysis (see subsequent slides)



Objective F Scoring

Component	Scoring description	Low Cost Rail		Elizabeth Line Extension			Other Rail	DLR	BRT
		A1	A2	C1	C4	C5	E1	F1	G1/G2
Capital cost range	Use following scores: 5 = Lowest capital cost 4 3 2 1 = Highest capital cost	5	5	1	3	2	3	1	5
Overall Affordability	Use following scores: 5 = Most affordable 4 3 2 1 = Most challenging	5	3	1	3	1	3	1	3



Key Elements of Scoring (Transport and Environment / Mode Shift Objectives)

- Objectives C, D and E scored using following scale:

- 1 = No Impact
- 2 = Minor Impact
- 3 = Moderate Impact
- 4 = Significant Impact
- 5 = Very Significant Impact

- Connectivity and capacity scores estimated from Public Transport Accessibility Levels (PTALs) and Journey Time (JT) change estimates to central London calculated from key station locations and development sites

- Note analysis *not* based on transport modelling at this stage – estimated from timetable assumptions

		Low Cost Rail		Elizabeth Line Extension			Other Rail	DLR	BRT
		A1	A2	C1	C4	C5	E1	F1	G1/G2
c) Deliver an uplift in the quality and capacity of public transport to address current and future travel demands in the Corridor	Assessment of strategic PT connectivity?	1.2	2.0	4.0	3.6	2.4	2.0	1.6	1.2
	Assessment of local PT connectivity?	1.7	3.0	4.7	3.7	2.3	3.7	2.7	3.3
	Specific PT capacity Implications?	1.0	1.3	2.3	2.0	2.0	1.7	2.0	1.3
d) Support climate change and zero carbon goals and targets and environmentally sustainable growth	Modal shift potential?	1.3	2.1	3.7	3.2	2.3	2.4	2.0	1.8
	What are the likely carbon impacts of the scheme?	2.0	2.0	5.0	4.0	4.0	3.0	3.0	3.0
e) Improve connectivity from the Corridor to key strategic and international gateways	Enhancement to key gateways - Change PT connectivity to HS1 (Ebbsfleet), central London, LHR?	1.3	2.3	4.2	3.7	2.2	2.3	1.5	1.3



CSR Scoring (feasibility: CSR2, 3, 4 and 7)

- Qualitative scoring by study consultant team – professional judgement based on knowledge of option specification and benchmarks from other schemes – all CSRs scored using following scale based on risk:
 - 5 = Very Low Risk
 - 4 = Low Risk
 - 3 = Medium Risk
 - 2 = High Risk
 - 1 = Very High Risk
- Risks assessed based on current option specification
- CSR3 ‘implementation disruption to transport network’ scoring included consideration of likely length of disruption
- Feasibility studies to refine scoring during subsequent stages**

Option	Plausible start date for development / delivery programme start	Design /feasibility to start of consents process	Consents process to approvals / agreements	Procurement	Infrastructure mobilisation / detailed design / construction / commissioning	Indicative plausible start year for operation	Step 6 OAF assessment band
A1	2021	1 year	1 year	1 year	1 year	2025	0-4 years
A2	2021	1 year	1 year	1 year	3 years	2027	4-7 years
C1	2022 (post EL opening and bed down)	2.5 years	3 years	2 years	5 years	2035	10-15 years
C4	2022 (post EL opening and bed down)	2 years	2 years	2 years	4 years	2032	7-10 years (as works required are more straightforward and planning consents required anticipated to be less onerous)
C5	2022 (post EL opening and bed down)	2.5 years	2 years	2 years	5 years	2034	10-15 years (similar challenges in scope, consents / agreements and construction to C1 and F1 expected)
E1	2021	1 year	1 year	1 year	3.5 years	2028	4-7 years
F1	2024 (post a positive commitment decision on DLR extension to Thamesmead extension)	2.5 years	2 years	2 years	5 years	2036	10-15 years (similar to C5 in terms of scale of challenge but with a less certain other scheme dependency that may delay progression)
G1/G2	2021	1.5 years	1 year	1 year	2 years	2027	4-7 years



CSR2, 3, 4 and 7 Summary Scores

Objective / CSR	Low Cost Rail		Elizabeth Line Extension			Other Rail	DLR	BRT	Commentary
	A1	A2	C1	C4	C5	E1	F1	G1/G2	
Infrastructure delivery [CSR2]	5	4	1	3	2	3	2	4	<ul style="list-style-type: none"> C1 involves some complex challenges to provide four-track along length of route. 17km new electric track, 16+ new platforms, bridges and structures, stabling sidings. C5: similar challenges as C1 but over less distance: 8km new electric track, 8+ new platforms, bridges and structures.
Implementation disruption to transport network [CSR3]	5	4	2	4	3	4	3	4	<ul style="list-style-type: none"> F1: Belvedere to Dartford section in particular likely to be complex (particularly over Crayford Marshes, through Erith town centre and the section to Dartford station). Additional stabling & maintenance facilities potentially required.
Land and property impacts [CSR7]	5	4	2	4	3	4	3	4	<ul style="list-style-type: none"> C1 / C5: substantial permanent land take required (including residential and commercial properties) across multiple plots between Abbey Wood and Ebbsfleet. F1: some acquisition of residential properties adjoining existing rail corridor. Wider redevelopment programme could minimise need for additional demolitions.
Operational delivery [CSR4]	4	4	5	2	5	3	4	5	<ul style="list-style-type: none"> C4: Risk to reliability due to shared running of services, particularly to Elizabeth line core section, but overall line utilisation within industry norms - design will aim to reduce/remove flat crossing between Slade Green and Dartford. Conversion of Class 345 trains to dual voltage adds additional complexity. E1: Probable requirement to reduce national rail services on corridor to provide space for shuttle.



CSR Scoring (CSR5 and CSR6)

CSR5 – resilience to future demands

- Linked to 5-point PT capacity scores that also inform transport objective scoring (see earlier slide)
- Three elements considered:
 - impact on local PT capacity
 - ‘knock-on’ impact on PT capacity in central London
 - ‘knock-on’ impact on PT crowding in central London

CSR6 – environmental impacts

- Impact of delivery (mode shift potential captured in Objective D)
- Potential in-combination effects / locations based on infrastructure assumptions (land acquisition, enabling works, mitigation design measures etc) – accounts for:
 - distinct features associated with each option
 - common features that will be directly lost / effected
 - comparative embodied carbon assessment

Score	Environmental impact (CSR6)
Very Low Risk (5)	<ul style="list-style-type: none"> • Potential beneficial construction effects on any feature; or • No/neutral effects; or • Potential adverse effects within buffer distance of low sensitivity/ locally designated features • Causing very low levels of in-combination effects requiring very low mitigation and compensation efforts.
Low Risk (4)	<ul style="list-style-type: none"> • Potential adverse effects within buffer distance of medium sensitivity/nationally designated features; or • Potential direct effect of low sensitivity/locally designated features • Causing low levels of in-combination effects requiring low mitigation and compensation efforts.
Medium Risk (3)	<ul style="list-style-type: none"> • Potential adverse effect within buffer distance of high sensitivity/internationally designated; or • Potential direct effect of medium sensitivity/nationally designated features; or • Potential direct loss of low sensitivity/locally designated features • Potentially causing medium levels of in-combination effects, requiring medium mitigation and compensation efforts.
High Risk (2)	<ul style="list-style-type: none"> • Potential direct effect of high sensitivity/internationally designated features; or • Potential direct loss of medium sensitivity/nationally designated features; or • Potentially causing high levels of in-combination effects, requiring high mitigation and compensation efforts.
Very High Risk (1)	<ul style="list-style-type: none"> • Potential direct loss of high sensitivity/internationally designated features • Potentially causing very high levels of in-combination effects, requiring very high mitigation and compensation efforts. Route deemed unacceptable and undeliverable.



CSR6 Environmental Impact Summary Scores from Construction

Low Cost Rail				Elizabeth Line Extension				Other Rail		DLR		BRT			
A1		A2		C1		C4		C5		E1		F1		G1/G2	
Extend services from Dartford to Northfleet. No infrastructure investment.		Extend services from Dartford to Northfleet. Enabled by infrastructure investment.		Crossrail Extension Abbey Wood to Northfleet (segregated).		Crossrail Extension Abbey Wood to Northfleet (shared running).		Crossrail Extension Abbey Wood to Dartford only (segregated).		National Rail shuttle from Abbey Wood to Northfleet/ Ebbsfleet (shared running).		DLR Thamesmead - Belvedere "and beyond", (with three route options between Erith & Dartford).		G1/G2 Hybrid - North Greenwich / Abbey Wood / Dartford / Darent Valley Hospital & Bluewater via existing Fastrack.	
Score	Rationale / comment	Score	Rationale / comment	Score	Rationale / comment	Score	Rationale / comment	Score	Rationale / comment	Score	Rationale / comment	Score	Rationale / comment	Score	Rationale / comment
5	No construction effects as no new infrastructure is required. Minimal effects will occur during the operational stage.	4	In-combination effects possible around the A282 and Greenhithe (flood zone, LWS, AQMA, NIA, historic landfill). Effects will predominantly occur during the operational stage. Construction impacts around Northfleet station. No direct loss / effects anticipated at Northfleet.	2	In-combination effects possible just out of Northfleet station and Swanscombe, Greenhithe the A282 and Barnes Cray (AQMA, flood zone, LWS, historic landfill, priority habitat, NIA). Direct effects due to construction and operation of new two-track between Abbey Wood and Northfleet and eight stations. However, construction should be kept alongside / close to existing railway, which will limit potential effect.	3	In-combination effects possible just out of Northfleet station and Swanscombe, Greenhithe the A282 and Barnes Cray (AQMA, flood zone, LWS, historic landfill, priority habitat, NIA). Direct effects due to construction and operational of five station expansions and additional infrastructure between Abbey Wood and Dartford. However, construction should be kept alongside / close to existing railway, which will limit potential effect.	3	In-combination effects possible around Greenhithe, Barnes Cray and Thames Road Industrial Estate (AQMA, flood zone, LWS, historic landfill, priority habitat, NIA). Direct effects due to construction and operation of four station expansions and new two-way track between Abbey Wood and Dartford. However, construction should be kept alongside / close to existing railway, which will limit potential effect.	3	In-combination effects possible just out of Northfleet station and Swanscombe, Greenhithe the A282, Barnes Cray and Thames Road Industrial Estate (AQMA, flood zone, LWS, historic landfill, priority habitat, NIA). Direct effects due to construction and operation of nine station expansions and additional infrastructure to allow for high frequency shuttles between Abbey Wood and Northfleet. However, construction should be kept alongside / close to existing railway, which will limit potential effect.	2	In-combination effects possible around Thamesmead and Thames Road Industrial Estate, due to potential direct loss of South East London Green Chain site (LBB), Priority Habitat, SINC (LBB), Historic Landfill Sites, waste sites, conservation area, AQMAs, and NIAs. Direct loss and effects due to construction and operation of new DLR infrastructure (in parts in open fields / not within existing rail/road corridor) from Abbey Wood to Dartford with 6-8 new DLR stations and 3-4 existing stations requiring enhancement.	4	In-combination effects possible around Dartford, Barnes Clay, Slade Green and Abbey Wood (ancient woodland, conservation area, priority habitats, NIAs, APAs, historic landfills, scheduled monument, SINC) Direct effects due to the construction and operation of additional BRT infrastructure between Abbey Wood and Bluewater. However, new infrastructure should be kept alongside / close to existing road network and construction effort will be less than that for rail infrastructure.



CSR Scoring (CSR8 – stakeholder acceptability)

	Low Cost Rail		Elizabeth Line Extension			Other Rail	DLR	BRT
	A1	A2	C1	C4	C5	E1	F1	G1/G2
Stakeholder acceptability risk	GREEN	GREEN	GREEN	AMBER / RED	AMBER	GREEN	AMBER	GREEN
Infra risk acceptability	GREEN	GREEN / AMBER	AMBER / RED	AMBER	AMBER	AMBER	GREEN	GREEN
Operational risk (promoting authority)	GREEN	GREEN / AMBER	GREEN	AMBER / RED	AMBER	GREEN	GREEN	AMBER
CSR8 summary (5-pt scale)	5	4	4	2	3	4	4	4



Summary of Assessment Outcomes & Recommendations



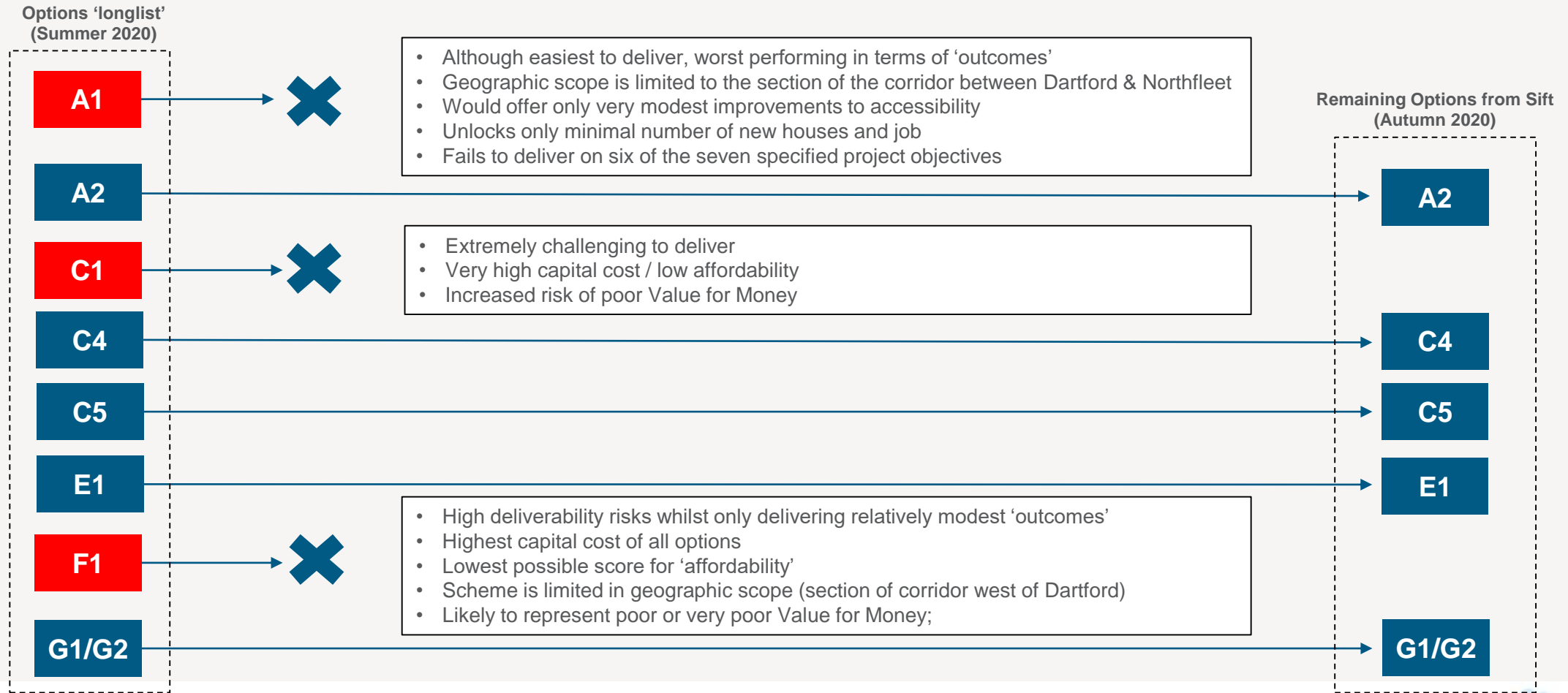
Summary of Assessment Outcomes

- Based on analysis of combined ‘unweighted’ scores:
 - **Options C1, C4, C5** (the three Crossrail (Elizabeth Line) extension options) produce the highest combined outcome scores, in particular C1 and C4 – C1 scores a maximum +5 for both Objective A (housing growth and regeneration) and CSR5 (resilience to future demands) – C5 performs more modestly, primarily due to its limited geographic scope;
 - **Option A1** (low-cost rail with minimal infrastructure) is the worst performer by some margin across all ‘outcomes’ with scores of +2 or less across the board – this reflects its very limited impact on connectivity across a very limited geographic area, consisting of an additional 2 trains per hour between Dartford and Northfleet;
 - **Option E1** (National Rail shuttle, Plumstead to Northfleet) returns a moderate overall score across all outcomes – while it would not provide the same return as the Crossrail options in terms of unlocking development, its corridor-wide coverage would result in improved outcomes when compared with the other non-Crossrail options;
 - All the other options (A2, F1, G1/G2) generally returned low to moderate ‘outcome’ scores overall, albeit notably better than A1 – in broad terms, these options were hampered by relatively modest strategic connectivity benefits to key central London employment and service hubs.
- Sensitivity tests were undertaken involving the application of weightings to the different objectives (increasing the weighting of housing and employment growth objectives) - this did not change the relative ‘ranking’ of options compared to ‘unweighted’ combined scores.



Recommendations for Options to 'Sift Out'

- Based on the assessment and sift process outcomes and comparative performance analysis at this stage, it was recommended to 'sift out' (i.e. not progress any further) the following options, for the key reasons stated:



Remaining Options – Further Analysis

- Following the sifting out of the lowest performing options, the assessment outcomes for the remaining options were further reviewed by the study consultants and the C2E Partnership, to identify key risks/issues and where the characteristics of the remaining options could be further improved, to potentially further increase the performance against the scheme objectives at the next stage:
 - **Option C5** - performed relatively poorly in terms of outcomes in the context of **high capital costs and poor affordability** – the key ‘outcome’ issue was its curtailment at Dartford, largely limiting its benefits to the western section of the corridor – this suggests that it **could perform better if a relatively low-cost solution was identified to extend its benefits to the east**, for example either by introducing mixed-running Crossrail and National Rail services (similar to the C4 option) or by pairing it with another scheme that would improve accessibility and connectivity in this area (for example A2);
 - **Option A2** - performed modestly in absolute terms against ‘outcomes’ – as with C5, its main issue was its limited geographic scope, restricted to service frequency enhancements at stations between Dartford and Northfleet – this indicated that in isolation, although it performed significantly better than A1 and marginally better than G1/G2, **it is unlikely to deliver project objectives to a satisfactory degree** – however, given its relatively high ‘deliverability’ and affordability scores, **it could bring significant value as a complementary measure to another option** focused on the section of the corridor west of Dartford, for example C5;
 - **Option G1/G2** - also **performed modestly in absolute terms against ‘outcomes’**; as with A2, this indicated that it is unlikely in isolation to deliver project objectives to a satisfactory degree. However, unlike A2, **it offers a significant degree of flexibility** in terms of route options and integration with existing and planned Fastrack services in the eastern end of the corridor to **provide something approaching a holistic corridor solution**. It is also recognised that **further assessment of its overall accessibility and connectivity benefits is required** to form more robust conclusions on ‘outcomes’ – in this regard, G1/G2 has been subject to the lowest level of assessment of all the retained options to-date;
 - **Option C4** - provided the **best overall performance in terms of strong ‘outcome’ scores set against moderate delivery risks** – however, there are **recognised challenges with respect to the operational risks (to the Elizabeth Line service west of Abbey Wood) of a mixed/shared running solution**. The assessment undertaken during this stage was in advance of the commencement of feasibility studies and more work is therefore required to quantify risks around operational feasibility associated with this option.
- Based on the above, it was recommended to progress two ‘variants’ of Option C5: one option combining C5 with A2 and one effectively combining with C4. **The final five options recommended for progression to the next stage of assessment are summarised on the next page.**



Summary of Options to Progress to Next Stage

- The outcomes of the first stage of the study assessment process have led to a recommendation to progress the following five options for further assessment during the next stage of the study:

	Elizabeth Line (Crossrail) Options			National Rail Option	Bus Rapid Transit (BRT) Option
Ref.	C4	C5+Shared*	C5+A2	E1	G1/G2
Description	Crossrail mixed running, Abbey Wood to Ebbsfleet/Northfleet	Crossrail segregated running Abbey Wood to Dartford; with Crossrail mixed running east of Dartford to Ebbsfleet/Northfleet)	Crossrail segregated Abbey Wood to Dartford, with lower cost National Rail service improvements between Dartford and Ebbsfleet/Northfleet	Increased service frequency of National Rail services between Abbey Wood and Northfleet	BRT Abbey Wood to Dartford
Notes	Broadly as assessed during this stage, with potential incremental adjustments to the service specification as transport modelling and design workstreams are progressed. The requirement to address concerns about operational feasibility will be a priority during the next stages of the study.	Alternative adaptation of C5 should provide a more holistic corridor solution than C5 alone, and at a lower overall cost than C1, though significantly higher than C4. As with C4, the operational challenges around mixed running east of Dartford will need to be considered at the next stage of assessment. <i>*[NB: This option was previously described as C3 in the initial options longlist (summer 2020); however it was previously sifted out for performing sub-optimally relative to C4. The primary reason for considering it appropriate to re-introduce the option at this stage is the availability of updated additionality analysis, which has highlighted the potential for housing growth east of Dartford, which an option such as this could unlock.</i>	Combination of C5 & A2 to determine whether they would provide a more holistic 'corridor-wide' solution than either would on their own, addressing the key issues with both schemes identified on the previous page. Based on the initial estimates of capital cost at this stage of the study, this paired option would be anticipated to provide a corridor-wide solution at significantly lower overall capital cost than C1.	Option broadly as assessed during initial stage of study, with potential incremental adjustments to the service specification as transport modelling and feasibility workstreams are progressed.	Broadly as assessed during this stage, with potential incremental adjustments to the service specification as transport modelling and feasibility workstreams are progressed. The assessment at this stage indicated that this option is less likely to deliver against project objectives to a satisfactory degree than other options and it may consequently be paired with other options as a complementary measure during later stages of the study. However, it will be retained as a stand-alone option to determine performance more conclusively based on transport modelling and other considerations during the next stage.



Next Steps



Next Steps

- The study will progress to the next stage of assessment (TAG Stage 1, Step 7)
- The key areas of focus and evolution in terms of assessing the five remaining options will be as follows:
 - Completion of initial design/feasibility studies focused on operational specification / performance risk analysis and infrastructure requirements and deliverability;
 - Refinement of timetable and service assumptions for each scheme reflecting feasibility analysis;
 - Initial forecasting of the transport outcomes of each scheme (based on assumed timetables) through transport modelling – this will produce estimates of journey time savings and crowding impacts on the public transport network;
 - Refinement of capital cost estimates (based on the feasibility work to be undertaken for each option), the development of preliminary operating, maintenance and renewal costs and revenue forecasts facilitating updated affordability analysis;
 - Further ‘additionality’ (housing and economic growth) analysis;
 - Production of initial quantified Value for Money estimates for each scheme;
 - Completion of the first phase of public consultation and stakeholder engagement, informing the next stage of assessment.

