

Overground station at OOC

Operational planning workshop

15th May 2014



Agenda

Timetable development and operational planning

- 4.2. Service proposition
- 2.1. Timetable development
- Misc. Performance assessment
- 2.3. Freight impacts

Infrastructure and assets

- 1.4. Turnback facilities
- 2.2. Rolling stock requirements
- 1.3. Stabling locations

Costs

- 4.1. Rolling stock costs
- 4.4. Operating costs

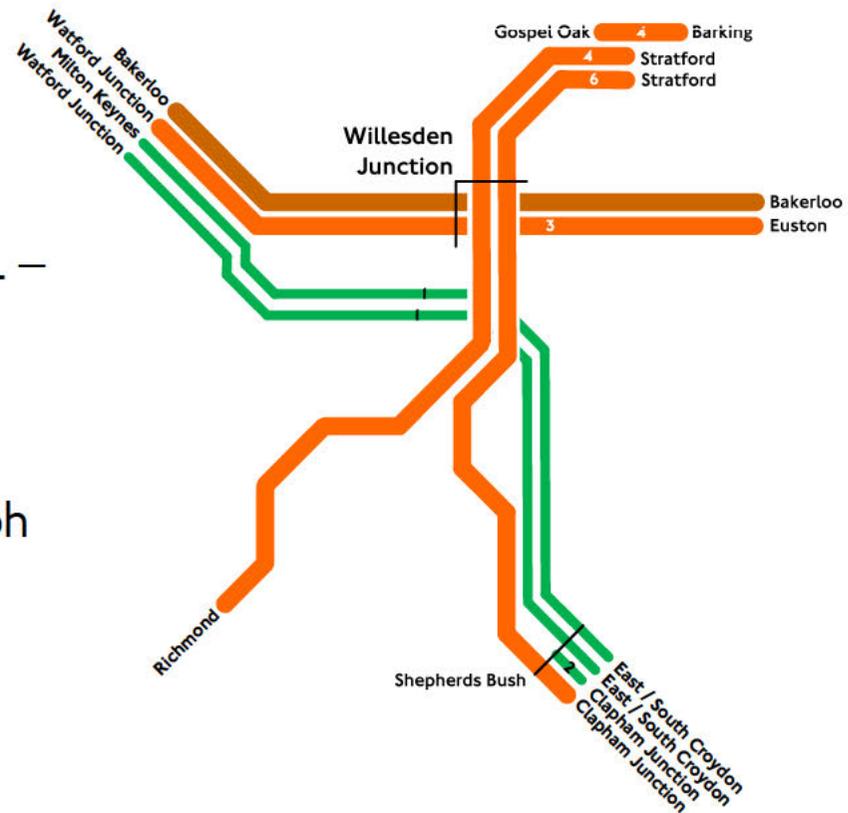
Maintenance

- 1.5. Railway maintenance



Service proposition

- Service proposition has been developed around current service levels and likely committed schemes.
- This includes:
 - Current levels of Overground services on the NLL and WLL – 4tph (peak) on each
 - Enhancements in Southern services consistent with the current Thameslink TSS – 2tph to the WCML & 2tph to Shepherds Bush (peak)
 - TfL's proposals for the introduction of 2 additional 2tph on the NLL and WLL (all day)



TfL will need to demonstrate that the NLL and WLL can accommodate 10tph



Service proposition

Reference case	
Option A (previous Option 8.2)	New viaduct over the IEP depot sidings and a new station at Old Oak Common Lane
Option Bi (previous Option X)	Operation via South West Sidings and a new station at Old Oak Common Lane – service pattern in Bi with trains <u>reversing</u> at Old Oak Common
Option Bii	Operation via South West Sidings and a new station at Old Oak Common Lane – service pattern Bii with trains <u>terminating</u> at Old Oak Common
Option C (new option)	Operation along existing North and West London Lines with two separate stations at Old Oak Common Lane and Hythe Road
Option Biii (sensitivity)	Operation via South West Sidings and a new station at Old Oak Common Lane – Option Biii service specification (station adjacent to OOC Lane) – variation on Option Bii



Timetable development

- Technical Running Times and Estimated Planning Values have been calculated for new alignment and all options to serve OOC
- Existing Timetable Planning Rules and Sectional Running Times will apply to existing infrastructure
- Timetable development will be available over the next four weeks – initial outputs required for station modelling
- Key issues will be;
 - Accommodating freight services
 - Interweaving with passenger services from other routes; District line, Southern services from the Southern and West Coast networks
 - Reducing conflicts on flat junctions
 - Turning back services with a higher frequency (platform capacity likely to be constrained)
- Timetable will be revised to address constraints and will assist with identifying any additional infrastructure to support specification
 - Recessing locations for freight
 - Additional platforms within the OOC station



Performance assessment

- Timetable will be assessed using RailSys
- Key elements will include;
 - Assess headways and margins
 - Identify the operational issues
 - Identify infrastructure constraints
 - Produce a standard hour timetable which will be validated and refined
- Will require the signalling scheme sketches for full assessment to be completed
- To develop and optimised solution, the scheme design and operations need to be integrated
- Output will be fed into the infrastructure design and vice versa over the coming weeks
- Commentary to be provided on findings of timetable development which will feed into final report

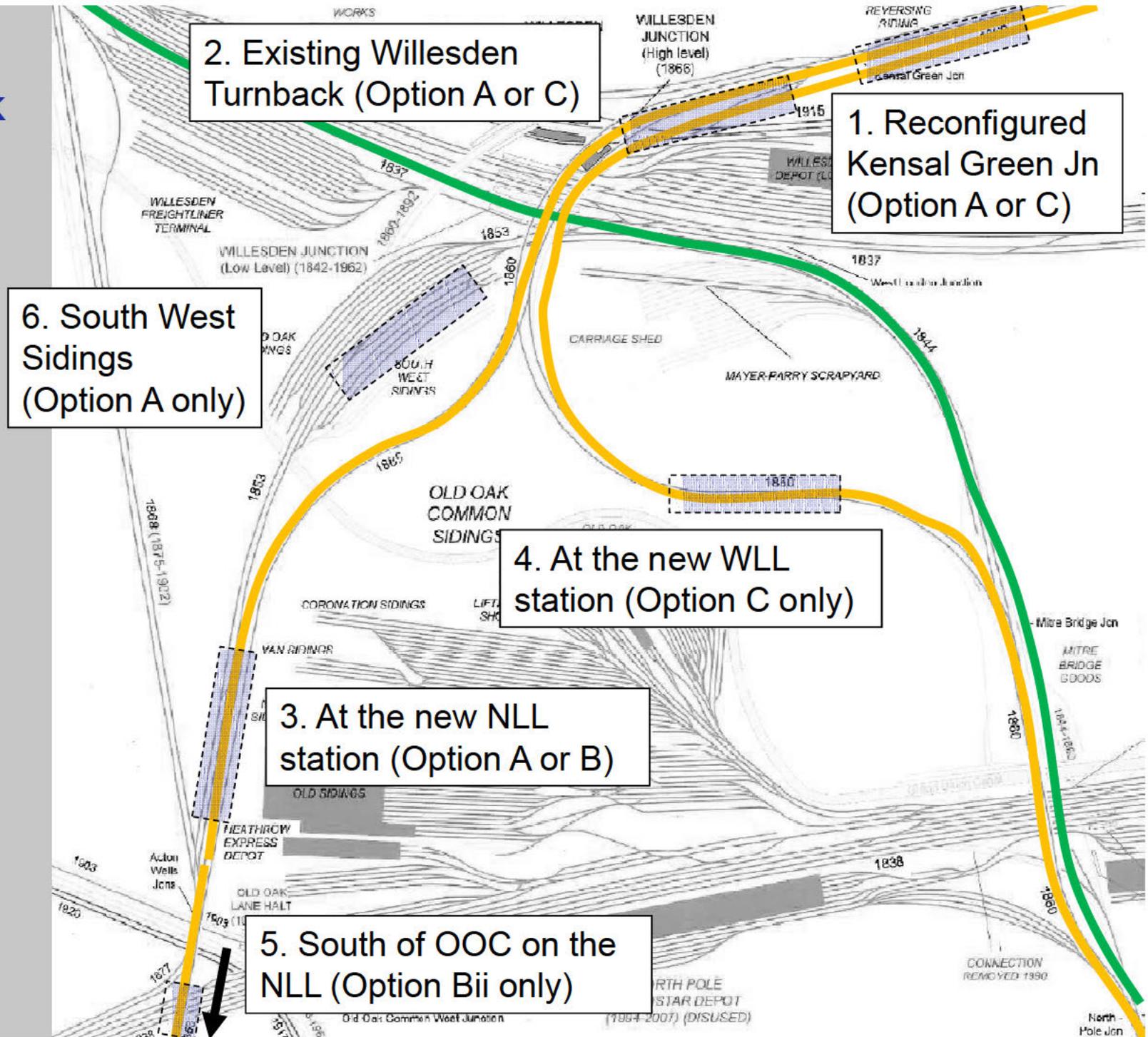


Freight impacts

- Freight forecasts to be used will be in line with Network Rail's Market Studies
- Information on contractual rights on orbital routes has been provided by Network Rail
- WLL designation as a European Rail Freight corridor will need to be considered
- Meeting with the freight operators to be held on the 13th June to discuss station options and identify specific concerns
- Key findings to be drawn from timetable development



Turnback options



Turnback options

- Location 1:
 - Would require remodelling of Kensal Green Jn but could become a turnback location for passenger services (peak) as well as a freight recessing facility (off-peak)
- Location 2:
 - Would involve extending the current facility beyond 5-car units
 - Could not accommodate any trains longer than 6-car without significant investment
- Location 3:
 - Would involve either a 3 or 4 platform station adjacent to Old Oak Common Lane
 - Potentially involves construction outside railway boundary
- Location 4:
 - Would involve either a 3 or 4 platform station adjacent to Hythe Road
 - Potentially involves construction outside railway boundary
- Location 5:
 - Could be used for Option B only – if WLL trains terminated at OOC
 - Turnback siding similar to current Willesden High Level and West Croydon
 - Unclear if there is suitable space provision – could be low cost if so
 - Could potentially extend trains onwards to Hounslow or Richmond (would need to be justified independently of an OOC station)
- Location 6 – added after workshop



Turnback options

- Factors which will determine what the turnback requirements will be;
 - The level of service that will operate on each route (peak and off peak)
 - Investment required
 - Consents and planning issues
 - Consistency with Route Planning
 - Preferred option taken forward as part of single option selection
- Suggested approach to developing turnback options:
 - Turnback locations to be assessed for each of the options
 - Develop timetable to a sufficient level to determine whether there is available capacity within a station platform
 - Determine other factors which will impact optimum location, including'
 - Route capacity and availability
 - Engineering and construction feasibility
 - Integrate identified options into timetable



Rolling stock requirements

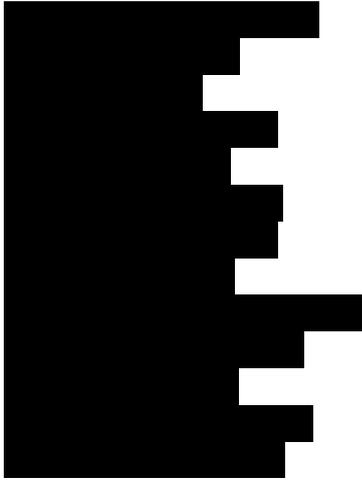
- Rolling stock requirements to be determined by;
 - Increases in distance operated, and thus journey time on orbital routes
 - How much increased journey time can be absorbed by effective timetable planning
 - Train len_thenin_
- Timetable development will assist with understanding the additional rolling stock that is required
- Example from initial outputs:
 - for Option A, it has been calculated that no additional units for 'through services on the NLL and WLL. However, it is likely that extending services from Shepherds Bush to OOC is likely to require at least one additional unit
- Rolling stock requirements to be identified for each option and agreed with Overground Operations team



Overground station – operations workshop

**Wednesday 14 May 2014, 14:00 – 17:00
Windsor House**

Attendees:



Actions from 30/04 meeting				
Number	Issue	Action	Owner	Timescale
01	<p>Timetable development</p> <ul style="list-style-type: none"> Reference timetable has been finalised (based on enhanced orbital frequency work for additional 2tph). Option A – under development and to be circulated once first draft is complete Option B – agreed to have a workshop on identifying specific concerns with the operating of Option B station – Option C – to be developed as a lower priority than Option A and B, but should be a straightforward iteration of reference timetable For station modelling purposes – presentation times of services at OOC in Option A is required by the end of w/c 19th May Due to lack of information, a list of assumptions have had to be made for the work undertaken to date 	<p>High peak hour timetable required for ped modelling</p> <p>█ to arrange for first week of June</p> <p>█ to share assumptions</p>	<p>█</p> <p>█</p> <p>█</p>	<p>23/05</p> <p>Complete</p> <p>23/05</p>
02	<p>Freight impacts: Contractual rights of freight uncertain / not comprehensively understood. In particular, freight providers may not like turnback Option I</p>	<p>█ to provide further information on freight contractual rights for orbital routes</p>	<p>█</p>	
03	<p>Turnback options</p> <ul style="list-style-type: none"> Matrix of locations for each option needs to be produced identifying reasons for locations being discounted on an option by option by option basis. Option A – turnback within the station is not possible when operating 10tph Option B – turnback options to be discussed at the aforementioned workshop Option C – turnback within a two platform station is unlikely to be achievable 	<p>Shortlisted options to be developed by WSP. █ to draft and circulate matrix.</p> <p>WSP should develop an option for three platforms</p>	<p>█</p> <p>█</p>	<p>23/05</p> <p>30/06</p>

	<ul style="list-style-type: none"> - Decision required on preferred turnback for each station option 	<p>to assess feasibility</p> <p>WSP / TfL to work together to arrive at a preferred turnback solution for each option</p>	<p>██████</p>	<p>30/06</p>
04	<p>Operating costs</p> <ul style="list-style-type: none"> · For confirmation if rolling stock should be assumed as leased or purchased, · Need to consider whole life costs for maintenance - Rolling stock costs for purchasing have been established from recent contract 	<p>██████ to contact ██████</p> <p>██████ to share latest rolling stock costs</p>	<p>██████</p> <p>██████</p>	<p>23/05</p> <p>Complete</p>
05	<p>Other points to consider</p> <ul style="list-style-type: none"> · Hours of operation (first and last trains) on HS2. Currently ██████ is assessing this to identify the potential impacts on Crossrail at OOC · 24hr operation on London Underground, and in the longer term, other TfL services · Who will be the infrastructure owner (not just applicable to OOC but arisen on other assets in northwest London. Crossrail may bridge the gap between the ELL and west / northwest London · What regime will apply to maintaining the railway may influence the infrastructure provision. 	<p>██████ to share case of Pudding Mill Lane.</p>		
06	<p>Stabling: initial assessment has identified two potential locations:</p> <ul style="list-style-type: none"> - Willesden SW sidings - Willesden F-sidings (maybe used by HS2 during construction) 			
07	<p>Maintenance:</p> <ul style="list-style-type: none"> - Need to understand who will be responsible for maintaining any new infrastructure. Particularly relevant to Option A viaduct - Need to understand what maintenance windows are likely to be available 	<p>NR / TfL to make working assumption</p> <p>Explore maintenance opportunities in view of CP5/6 works</p>	<p>██████</p> <p>██████</p>	<p>30/05</p> <p>Ongoing</p>
08	<p>Signalling: Information to be provided to Network Rail on assumptions for developing Estimated Planning Values etc. and WSP assumptions on signal locations used within the RailSys model.</p>	<p>██████ and ██████ to provide.</p>	<p>██████</p>	<p>30/05</p>
09	<p>Assumptions: The following assumptions were noted:</p> <ul style="list-style-type: none"> · Freight paths that currently exist will remain in place · WLL can achieve no more than 10tph between Willesden and CJ - Project to assume classic 'lights on sticks' signalling (not in-cab) - 8-car railway to be delivered ahead of Overground station opening - Designs for Old Oak Common station should be 8-car compatible, but should not preclude 12-car 			

	<p>operation</p> <ul style="list-style-type: none"> - Any turnback facility within the station requires more than 2 platform faces - A 10-car turnback will be in place at Hounslow by 2019 (relevant to Option Biii only). If used will be shared with SWT. - Platform 0 at Clapham Junction is NOT assumed to be required as a result of the Overground station at OOC 			
10	<p>AOB</p> <ul style="list-style-type: none"> - WSP have revised Option B layout - WSP to produce land take requirements list 	<p>■ to share latest drawings with group</p> <p>■</p>	<p>■</p> <p>■</p>	<p>23/05</p> <p>16/05</p>

OVERGROUND STATION AT OLD OAK COMMON SUMMARY OF TURNBACK LOCATION OPTIONS

DRAFT – MAY 2014

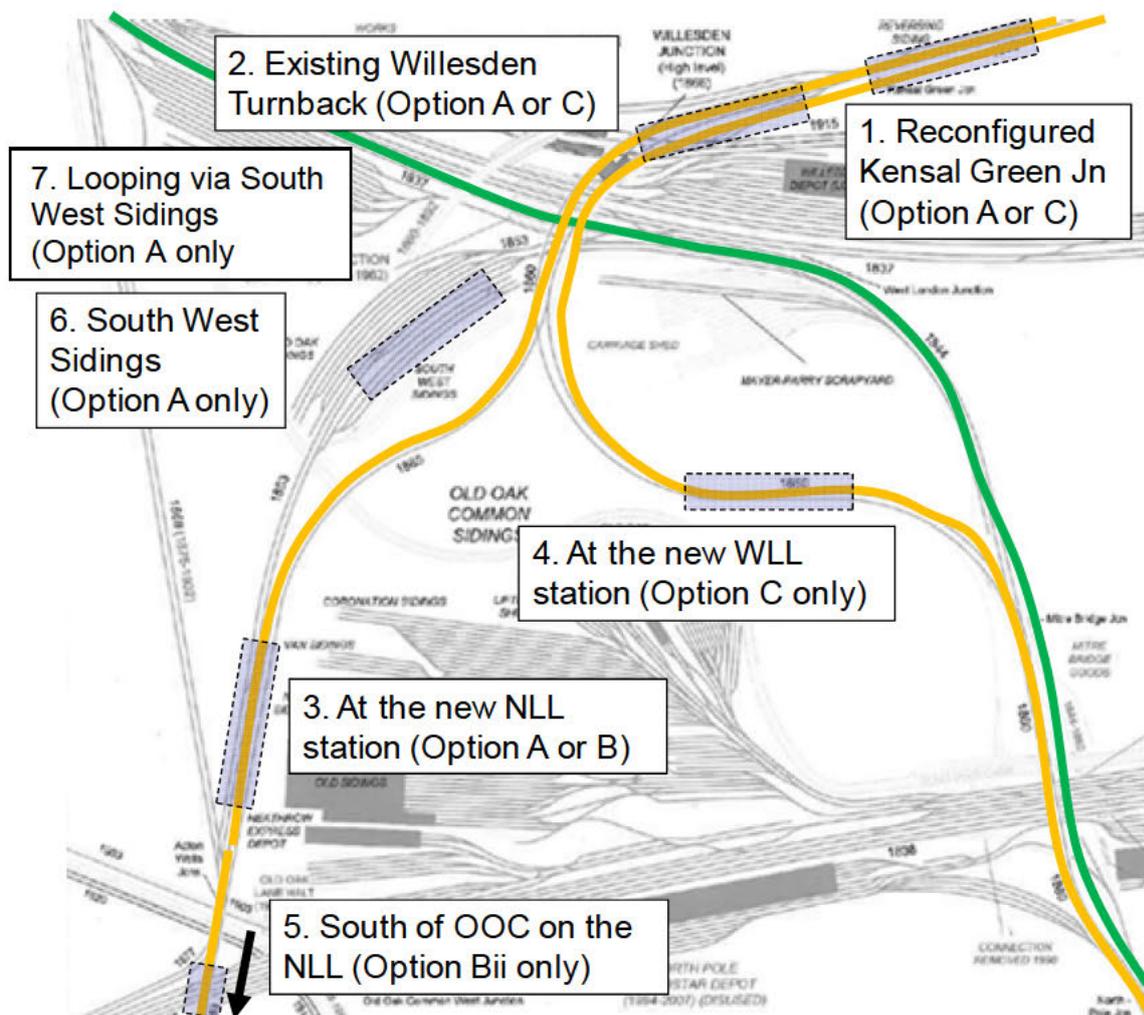
Purpose

This document sets out the options for different identified turnback locations on the North and West London lines (NLL and WLL) in the Old Oak Common area to support the provision of a new station on the NLL and WLL at this location.

It notes the key benefits and drawbacks of each turnback location and makes recommendations for further development of each option.

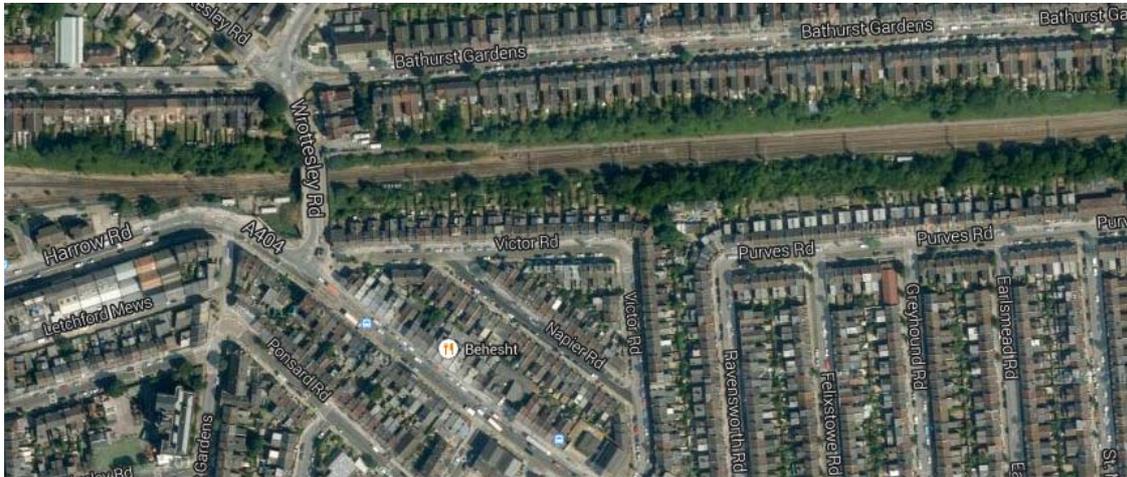
Identified options

The map below summarises the options that were presented at the Operational Planning Workshop on the 15th May 2014.



High-level assessment of identified options

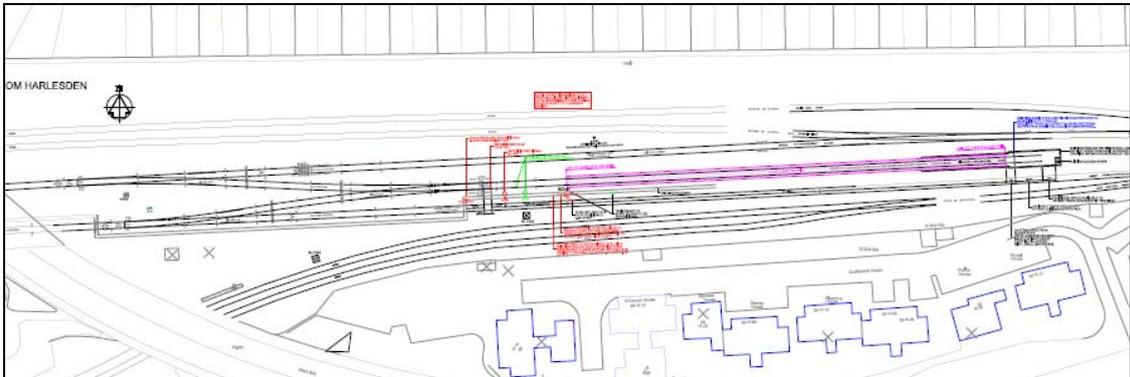
Location 1: Kensal Green Junction *Options A and C*



Benefits	Drawbacks
<ul style="list-style-type: none"> • Could accommodate maximum length of rolling stock (8-car units) • Could be used as a freight facility during off-peak periods, maximising investment • Units would be able to serve Willesden Junction High Level (for interchange with the Bakerloo line) before turning back 	<ul style="list-style-type: none"> • Would require redesign of Kensal Green Junction • Substantial investment likely to be required • Capacity beyond Willesden High Level Junction is likely to be constrained (to interweave with Richmond paths and traverse a flat junction) • Unclear if turnback can be constructed within the railway boundary

Conclusion: Fallback option - Flat junction and interweaving with NLL Richmond to Stratford services likely to be key constraints and scheme considered outside of the scope of this study. Location to be progressed only if other alternatives are not proven viable.

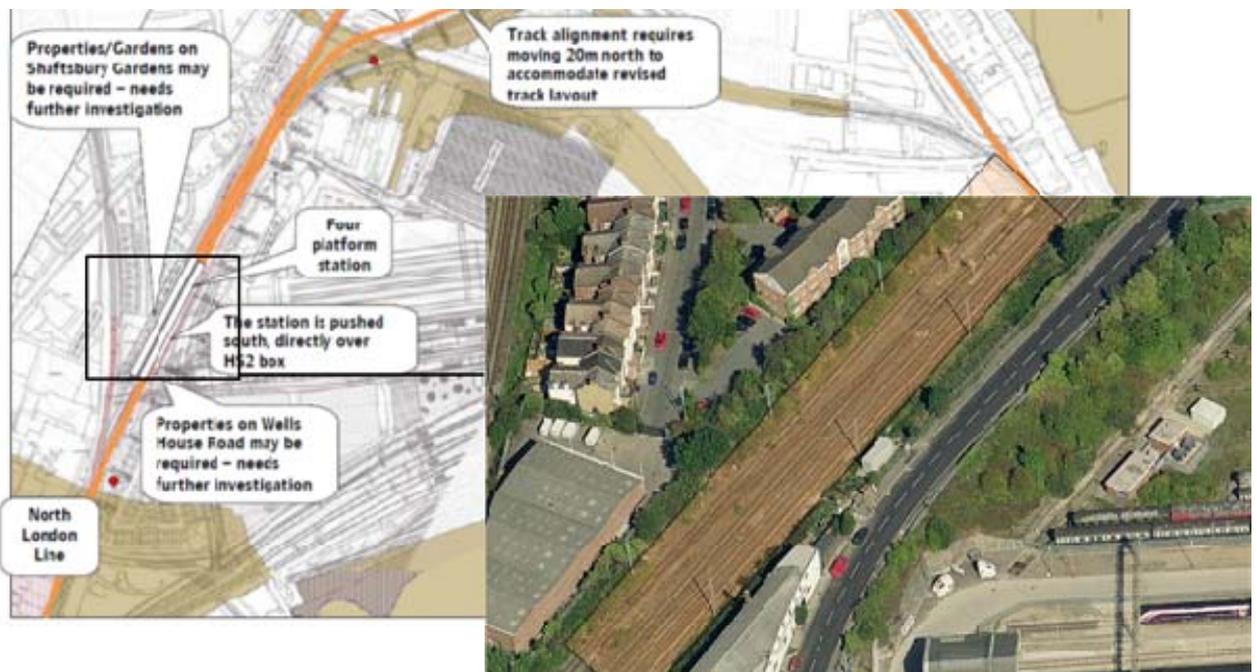
Location 2: Existing centre turnback north of Willesden Junction station
Options A and C



Benefits	Drawbacks
<ul style="list-style-type: none"> • Facility already exists so no investment / consents are required • Minimum investment required to extend it to 6-car capability • Units would be able to serve Willesden Junction High Level (for interchange with the Bakerloo line) before turning back 	<ul style="list-style-type: none"> • Unclear if using turnback would be feasible with increased service frequencies operating on the NLL / WLL • Unable to accommodate 8-car units

Conclusion: Fallback option – Flat junction and interweaving with NLL Richmond to Stratford services likely to be key constraints and not considered a long term solution due to length constraints.

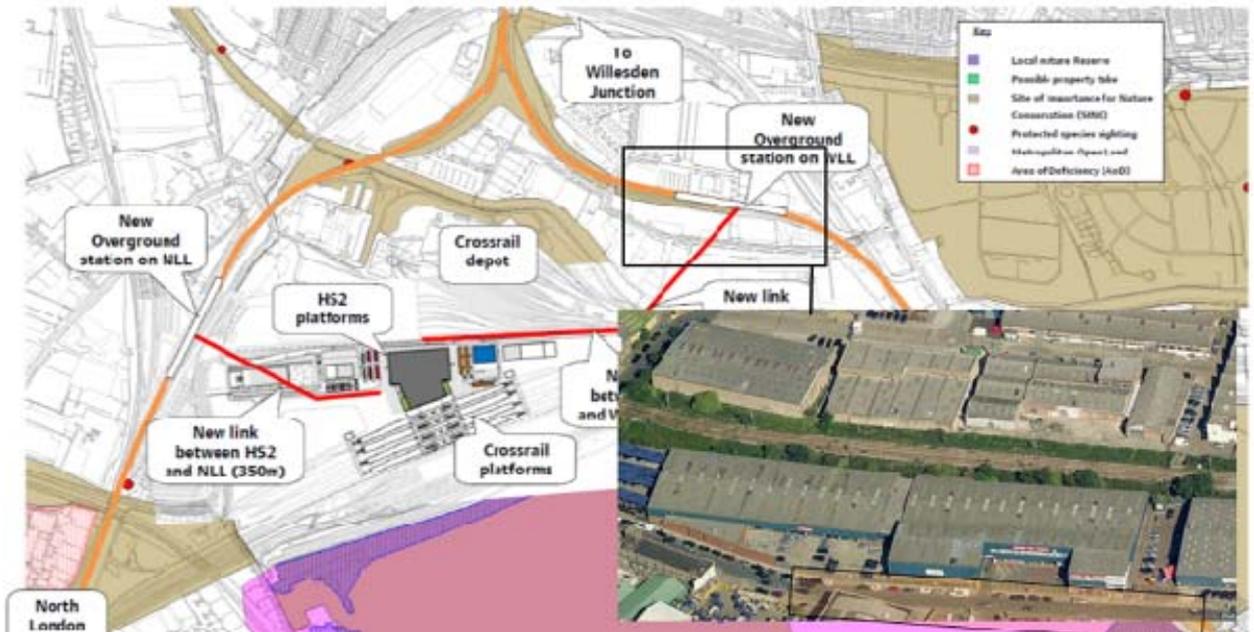
Location 3: Platform turnback at Old Oak Common Lane
Option A and B



Benefits	Drawbacks
<ul style="list-style-type: none"> • Ability to terminate trains at OOC arriving from the north or south • Likely to provide the greatest flexibility for operating the passenger train service • Would result in low operating costs due to reduced empty running to access turnback • Could provide 1 or 2 turnback sidings, as required 	<ul style="list-style-type: none"> • Unlikely that turnback can be constructed within the railway boundary • Introducing a third or fourth platform face is likely to require additional track work – unclear if there is space available for this • Requires interweaving with NLL Richmond services • Unclear what impact additional platform faces and track work will have on operating freight services through Acton Wells Junction • Considered the only feasible location for reversing trains for Option Bi

Conclusion: Taken forward – Likely to be space constrained and potentially may create issues for operating freight services, however this option provides a higher degree of flexibility in operating passenger train services.

Location 4: Platform turnback at Hythe Road
Option C



Benefits	Drawbacks
<ul style="list-style-type: none"> • Allows WLL shuttle services to operate independent of the NLL • Potentially allows services to turnback from the north or south 	<ul style="list-style-type: none"> • Unclear if turnback can be constructed within the railway boundary • Unclear if gradients on this section of the WLL will constrain feasibility • May require embankment works to support wider rail corridor • Signals required on approach and departure are likely to be on horizontal curves which could create safety issues

Conclusion: Taken forward – Greatest likelihood of supporting the train service for Option C however there are a number of engineering feasibility issues which need to be resolved.

Location 5: A location south of Old Oak Common
Option Bii

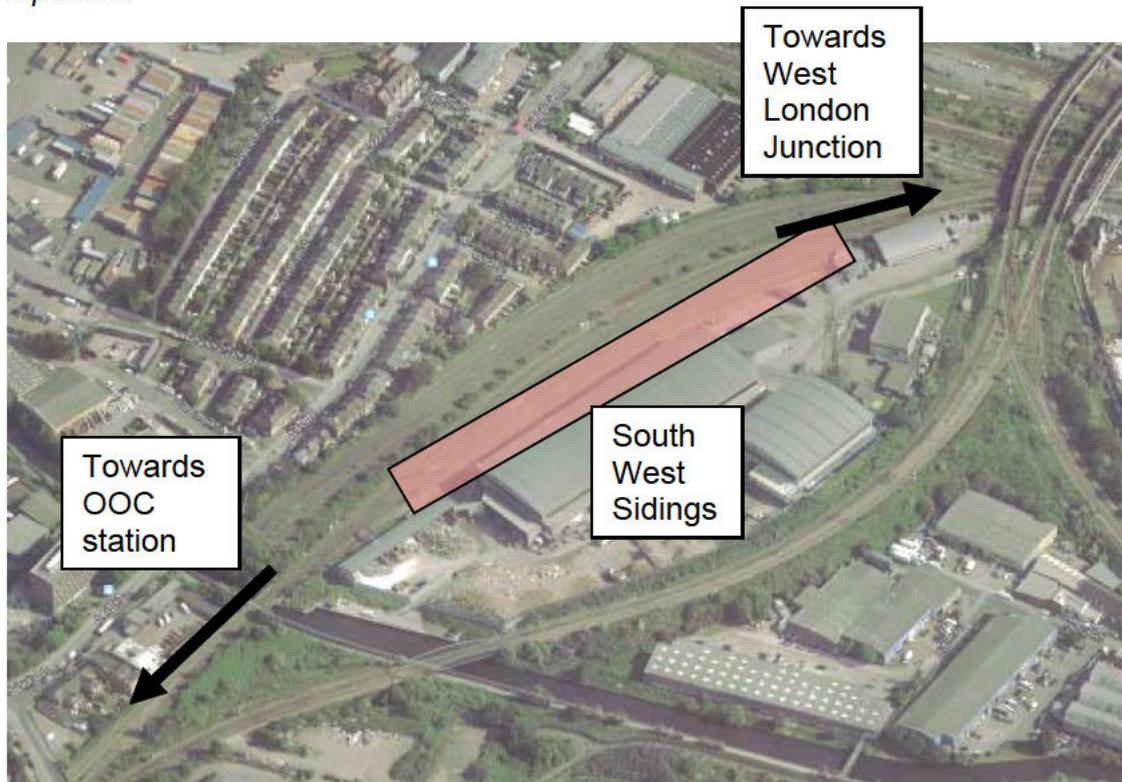


Benefits	Drawbacks
<ul style="list-style-type: none"> • Allows WLL shuttle services to terminate away from Acton Wells Junction in Option Bii, reducing conflicts with freight • If able to construct within the railway boundary, it could be a low cost solution 	<ul style="list-style-type: none"> • Need to assess if there is sufficient route capacity to operate WLL shuttles, NLL passenger services and freight south of Acton Wells Junction • Unclear if turnback can be constructed within the railway boundary • Only supports service pattern Bii

Conclusion: Taken forward – Potential to support the train service of Option Bii with a low cost solution, although assessment of operational feasibility and space provision is required.

Location 6: Willesden South West Sidings (SWS)

Option A



Benefits	Drawbacks
<ul style="list-style-type: none">• Could accommodate maximum length of rolling stock (8-car units)• Would only require a two platform facility at OOC station• Turnback could also function as a stabling location	<ul style="list-style-type: none">• Would require additional S&C to the north of OOC station• May conflict with freight paths / freight regulation points around SWS• Would require investment to electrify the SWS• May not be consistent with OAPF proposals for the area

Conclusion: Taken forward – High investment costs and interaction with freight services via the SWS are likely to be a key constraint, however this should be balanced against the need for only two platforms at the OOC station adjacent to Old Oak Common Lane.

Location 7: Looping via Willesden South West Sidings (SWS)
Option A



Benefits	Drawbacks
<ul style="list-style-type: none"> • Could accommodate maximum length of rolling stock (8-car units) • Would only require a two platform facility at OOC station • Would reduce empty running and dwelling to empty rolling stock at OOC station • Not anticipated to require doubling of West London Junction 	<ul style="list-style-type: none"> • Would require additional S&C to the north of OOC station • May conflict with freight paths / freight regulation points around SWS • May not be consistent with OAPF proposals for the area

Conclusion: Taken forward – Understood to be a low cost options but operational feasibility will depend on interaction with freight as well as being able to get a clear path from WLL onto the NLL and back to the WLL.

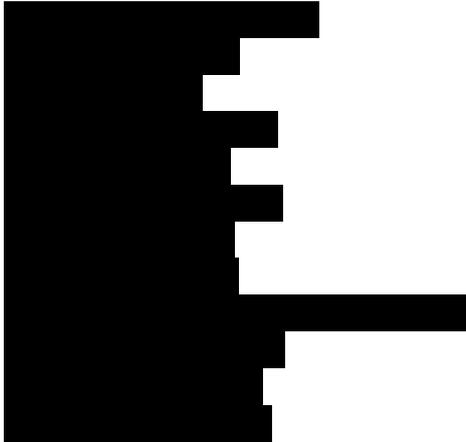
Summary of turnback locations

	Location 1: Kensal Green Jn	Location 2: Willesden HL turnback	Location 3: Within the Old Oak Common station	Location 4: Within the Hythe Road station	Location 5: South of Old Oak Common station	Location 6: South West Sidings	Location 7: Loop via South West Sidings
Option A: Old Oak Common viaduct solution	Fallback – high cost and potential capacity issues	Fallback option – too short and potential capacity issues	Fallback – support TSS, although ops and eng issues exist	n/a – Hythe Road station would not be open in Option A	n/a – not operationally feasible	Fallback – support TSS and require only two OOC platforms	Taken forward – support TSS and require only two OOC platforms
Option Bi – Old Oak Common station with <u>terminating</u> services	n/a – not operationally feasible to serve OOC station	n/a – not operationally feasible to serve OOC station	Taken forward – could be a low cost, low risk solution	n/a – Hythe Road station would not be open in Option B	Discounted – operationally conflicts	n/a – services arriving from the wrong direction	n/a – viaduct would not be constructed to loop round
Option Bii – Old Oak Common station with <u>reversing</u> services	n/a – not operationally feasible to serve OOC station	n/a – not operationally feasible to serve OOC station	Discounted – not operationally feasible to accommodate all services	n/a – Hythe Road station would not be open in Option B	n/a – not operationally feasible – would split WLL services	n/a – services arriving from the wrong direction	n/a – viaduct would not be constructed to loop round
Option C: Two stations at Old Oak Common and Hythe Road	Fallback – high cost and potential capacity issues	Fallback option – too short and potential capacity issues	n/a – not operationally feasible	Taken forward – reduce train conflicts but needs engineering study	Discounted – not considered operationally feasible	n/a – WLL services would be operating through Hythe Road station	n/a – viaduct would not be constructed to loop round
Option Biii – Extending WLL services to Hounslow	n/a – not operationally feasible	n/a – not operationally feasible	n/a – not operationally feasible	n/a – Hythe Road station would not be open in Option B	Taken forward – extending to Hounslow	n/a – services arriving from the wrong direction	n/a – viaduct would not be constructed to loop round
Summary	Fallback option	Fallback option	Taken forward	Taken forward	Taken forward	Fallback option	Taken forward

Overground station – operations workshop #2 (Option B assessment)

**Tuesday 3 June 2014, 14:30 – 16:30
Windsor House**

Attendees:



Actions from 30/04 meeting				
Number	Issue	Action	Owner	Timescale
01	Drawing 1 – 4 platforms with greatest flexibility (2 island platforms) <ul style="list-style-type: none"> - Considered most likely option to support service Option Bii (reversing) - 18 crossing moves per hour to the north end of the station seen as most significant risk but should be assessed to identify if it can support the TSS - Potentially requires land take towards Midland Terrace and represents worst case - If found to support TSS, then point work would be scaled back - If Option Bii cannot operate on this infrastructure then it can be discounted and revert to Bi (shuttle) - Signalling diagram for Drawing 1 tabled 	High peak hour timetable required to demonstrate high level feasibility	█	13/06
		Planning assumptions to be shared	█	13/06
		Soft copy of signalling diagram to be shared	█	09/06
02	Drawing 2 – 4 platforms with reduced flexibility (1 island, 2 side platforms) <ul style="list-style-type: none"> - Considered sub-optimal compared to drawing 1 layout as reduced infrastructure was highly unlikely to be able to support Option Bii - Considered overprovision of platforms at OOC Lane to support Option Bi or Biii - Conclusion - drawing 2 layout was discounted for these reasons 			
03	Drawing 3 – 3 platforms (1 island platform, 1 side platform) <ul style="list-style-type: none"> - Fewer than 4 platforms is unable to support Option Bii - Considered able to support Option Bi at a high level but believed a preferred solution would be to operate shuttle services past OOC Lane to a dedicated turnback siding towards Acton Central 			

	(see assumptions below) <ul style="list-style-type: none"> - Drawing 3 would therefore be considered a fallback option for Option Bi 			
04	Drawing 4 – 2 platforms with access to SWS <ul style="list-style-type: none"> - Previous Option A drawing for a two platform station at OOC Lane could support Option Bi, allowing shuttle services to continue towards Acton Central to turnback - Conversely, this could also support Option A with shuttle service reversing in the SWS 	WSP to produce drawing of 2 platform OOC Lane station with access to SWS	█	13/06
05	Option C <ul style="list-style-type: none"> - Three platform options to be circulated by WSP 	TfL to produce benefits drawbacks table of options WSP / TfL / NR to fill in gaps	█ █	09/06 11/06
06	West London Junction drawing <ul style="list-style-type: none"> - █ tabled drawing of double tracking of West London Junction double tracking required for Option B (all variants) - For the purposes of assessing timetable feasibility of Option B, signal location for current bi-directional working will be assumed 	WSP to circulate drawing	█	11/06
07	Maintenance: <ul style="list-style-type: none"> - Need to understand who will be responsible for maintaining any new infrastructure. Particularly relevant to Option A viaduct - Need to understand what maintenance windows are likely to be available 	NR / TfL to make working assumption Explore maintenance opportunities in view of CP5/6 works	█ █	30/05 Ongoing
08	Assumptions: The following assumptions were noted and should be used by the project going forward: <ul style="list-style-type: none"> - Option Bii would be progressed as this is the most difficult of B variants to accommodate operationally. - Option Bi is to be treated as a fallback option if Bii is not found to be feasible to timetable although it is noted that this option has substantially more disbenefits to passengers - Option A – 2 platform station at OOC Lane, with a turnback at location 7 looping via SWS, location 6 turnback at SWS is fallback - Option Bii – 4 platform station at OOC Lane, with a turnback at location 3 in the OOC Lane Overground station - Option C – 3 platform station at Hythe Road, with a turnback at location 4 in the Hythe Road Overground station - Designs for Old Oak Common station should be 8-car compatible, but should not preclude 12-car operation –AGREED TO REMOVE ASSUMPTION - Double tracking of West London Junction is only required for Option B. Option A routing of shuttles via SWS does not require doubling of 	Turback location 7 to be tested	█	20/06

	West London Junction			
09	<p>AOB</p> <ul style="list-style-type: none"> - ■ to set up meeting on Kensal Green turnback options - ■ to set up meeting with CP5 electrification Sponsor to discuss how space provision could be made in electrification project of West London Junction to accommodate future double tracking - Update and circulate summary of turnback locations 	<p>Set up for 13/06</p> <p>Contact electrification Sponsor</p> <p>Circulate to all</p>	<p>■</p> <p>■</p> <p>■</p>	<p>Complete</p> <p>13/06</p> <p>09/06</p>

**OVERGROUND STATION AT OLD OAK COMMON
ASSESSMENT OF HYTHE ROAD STATION OPTIONS
DRAFT – MAY 2014**

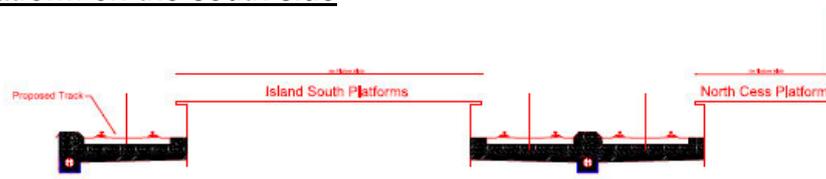
Purpose

This document sets out two options for a three platform station in order to facilitate the turning back of West London Line services towards Clapham Junction.

It identifies the key characteristics, benefits and drawbacks for both options and makes a recommendation for a working assumption for a preferred solution which shall be the basis for further scheme development.

Identified options

Option C – bay platform on the south side



Typical Cross Section



Option C bay platform on the north side



Typical Cross Section



Option comparison

Discipline	North option	South option	Preference
Transport Planning	<p>Drawback - passengers alighting in northbound direction and requiring next onward departure to Stratford will have to change platforms from Down platform to Up platform.</p> <p>Benefit - Passengers awaiting next departure to Clapham (biggest flow) will be able to access island platform for next departure, not having to chose at concourse level.</p>	<p>Benefit - Provides a cross platform interchange for passengers using a shuttle service and awaiting the next departure for Stratford, although could change at Shepherds Bush e.g. Jubilee line at North Greenwich.</p> <p>Drawback - Passengers awaiting next departure to Clapham (biggest flow) will have to make a decision in the concourse / ticket hall area which platform their trains departs from.</p>	North – island platform for all southbound departures a higher priority
Permanent Way		Benefit - Turnback facility on the Up direction preferred due to track geometry	South – to accommodate track geometry
Signalling	Proposition for signalling would be similar between two options – however need to consider signal spacing and overlap positions. For example, the overlap position could be such that it is not possible to arrive a train into the bay platform, and have a train arrive into the southbound through platform simultaneously		Unable to fully determine until signalling sketch has been developed
Railway Operations	n/a - Services arriving into bay platform will have to cross WLL Down but will be unconstrained on departure	n/a - Services arriving into bay platform will have unconstrained access but will have to cross WLL Up on departure	Unable to fully determine until timetable has been developed
Station Operations	Benefit - Wider, island platform will be located where passengers from WLL will be boarding , giving greater area for passengers to dwell.	Benefit - Wider, island platform will be located where passengers from WLL will be alighting , giving greater area at top of stairs for passenger circulation	North – large space for boarding passengers higher priority
Construction		Benefit - Property required to south for any Hythe Road station to construct a link to OOC so land take may not	South – access to Hythe Road and

		be substantially greater Benefit – Construction access to widen embankment may be easier to south with direct access from Hythe Road	synergies with providing link to OOC station
Maintenance	No identified preference between two options		n/a
Consents	Similar land take between two options – both options are likely to take buildings occupied by Car Giant		n/a
Regeneration	Benefit - Potentially provides better solution if a QPR proposal was taken forward, allowing match day access, although OAPF demand is not in base proposal.	Benefit - Potential to create a frontage towards Hythe Road with the widened embankment	North – to better manage stadium flows

Conclusion

On the basis of the information available, it is proposed that a turnback siding to the north of the station is assumed for the purposes of progressing the design of Option C and the Hythe Road station.

While there are potential benefits to progressing a turnback siding to the south of the station, particularly during construction, it was judged that the additional benefits that a platform to the north of the station would bring during operation outweigh these.

Further work will be required, particularly to assess if the train service can be timetabled with a bay platform to the north of the station (as opposed to a bay platform to the south or a bi-directional loop), before this solution can be accepted into the final design.

It is therefore proposed that a final decision on the preferred solution to provide three platforms is made following:

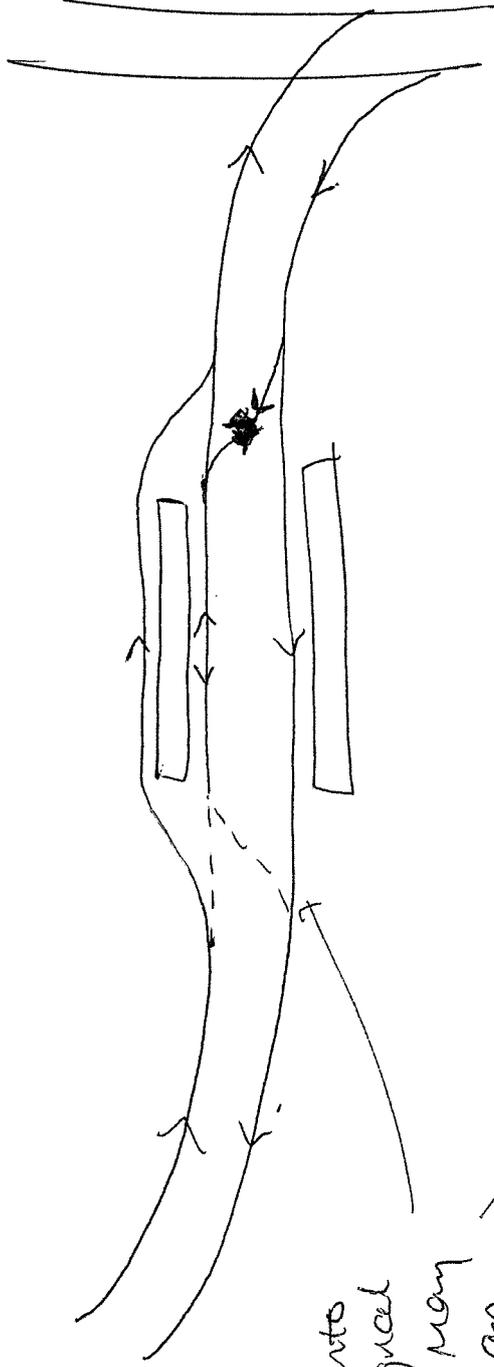
- Development of a Working Timetable for Option C
- Development of a signal sketch for Option C
- Assessment of constructability, land take requirements and engineering feasibility

West London Line track diagram

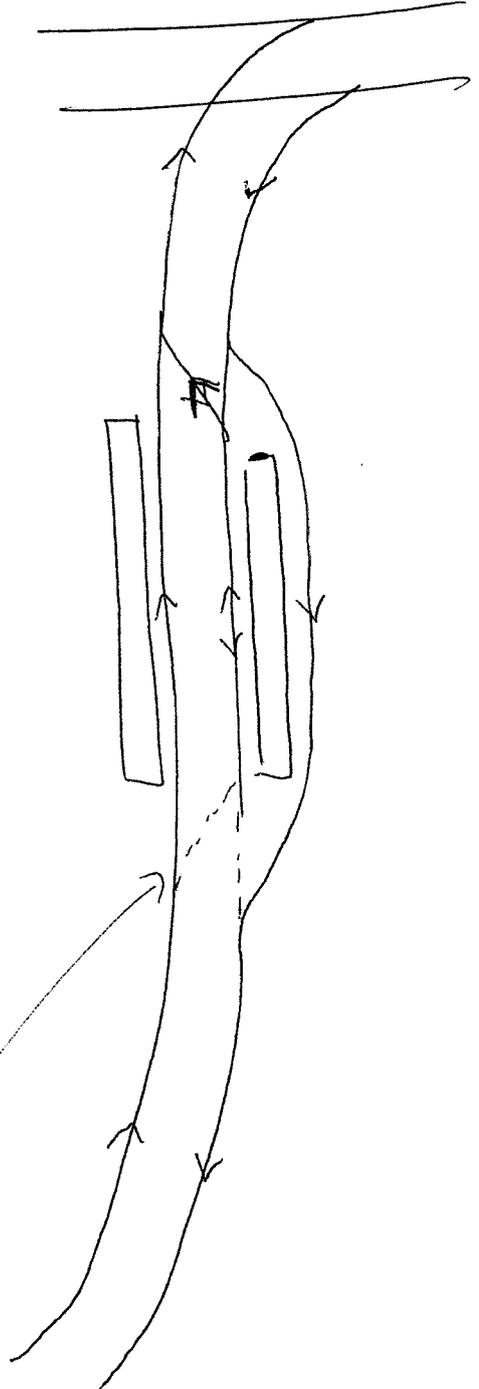
LOR	Seq	Line of Route Description	ELR	Route	Last Updated
MD160	001	Willesden High Level Jn. to Mitre Bridge Jn.	WMB	LNW South	02/02/2013
Location	Mileage M Ch	Running lines & speed restrictions	Signalling & Remarks		
Continued on Anglia Route Sectional Appendix.			TCB Wembley Mainlines SCC (W/M) AC:Rugby ECR		
Willesden High Level Jn	5 42 0 43	Continued on EA1310 seq 004			
OHNS	0 18	To Acton Wells Jn			
Route Boundary	0 09	ANGLIA ROUTE BOUNDARY			
Mitre Bridge Jn	0 00	To Wembley MD 165 seq 001			
Route Boundary	5 67 5 66	ROUTE BOUNDARY SOUTHERN			
Continued in Southern Sectional Appendix.		Continued on SC250 seq 007			

HYTHE ROAD

NORTH LOOP



SOUTH LOOP



If made into
loops signal
overlaps may
become an
issue.

Summary of findings from the Old Oak Common station operational assessment

Overview

The operational assessment of the Overground station at Old Oak Common was led by TfL, with support from Network Rail and WSP.

The purpose of the operational assessment was to ensure that the proposed station would be able to support an additional call on existing passenger services that operate on the North and West London lines (NLL and WLL). In addition, the assessment also took account of anticipated short and medium term growth on the railway, with a series of 'likely committed' schemes being included within the assessment that would occur irrespective of an Overground station at Old Oak Common being constructed. Impacts on freight operations were also considered as part of the assessment.

The service specification in table 1 was assumed as the Reference Case (2041) (future year without the Overground station in place) when assessing the operational viability of each option.

Service group	Train length	AM and PM peak frequency, trains per hour (tph)	Inter peak frequency, trains per hour (tph)
Richmond to Stratford	Up to 8-car, 5-car (from 2015)	4	4
Clapham Junction to Stratford	Up to 8-car, 5-car (from 2015)	6 (currently 4tph)	4 (currently 2tph, plus 2tph between Clapham Junction and Willesden Junction)
East/South Croydon to Watford Junction/Milton Keynes Central	Up to 8-car	2 (currently varies during peak periods)	1
Clapham Junction to Shepherds Bush	Up to 8-car	2 (currently varies during peak periods)	0
Nominal freight paths on the NLL and WLL	Up to 775m	2	4

Table 1: Summary of future train service proposition used to develop the timetable of a station at Old Oak Common

Unless otherwise stated, infrastructure on the NLL and WLL was assumed to be as existing and there were no anticipated enhancements outside those being proposed as part of the Old Oak Common station. It should be noted however that, as of 2014, the WLL is capable of accommodating 8-car passenger services, and as of 2015, the NLL will be capable of operating 5-car

passenger services. No enhancements to lengthen the fleet of 5-car London Overground Class 378s were proposed as part of this assessment, although 8-car trains on the NLL and WLL were assumed for the purposes of developing the business case. As Old Oak Common will need to be designed to accommodate the longest passenger service on the NLL and WLL, any new infrastructure proposed as part of this scheme is specified to accommodate 8-car trains of up to 170m length.

The assessment included within this report refers to operational viability during peak periods unless otherwise stated.

Please refer to the summarised operational assessments in each of the option chapters for an overview of the outputs. The key disciplines that were covered were;

Timetable Development

For each of the options a standard peak and off-peak timetable was developed for passenger and freight services on the NLL and WLL. This was to demonstrate that the inclusion of an additional call in the Old Oak Common area could be accommodated without adversely impacting the operation of services along the corridor.

Turnback Requirement

A key part of the proposition for the WLL and NLL to serve Old Oak Common is to extend the existing, peak only Clapham Junction to Shepherds Bush service to Old Oak Common. In extending this service, it would operate beyond the facility it currently reverses in on the North Pole Depot Reception line, and therefore a new facility in the Old Oak Common area needed to be identified.

A sifting exercise was undertaken to identify feasible alternatives. This was completed to assess the potential positive and adverse impacts on operations, engineering and stakeholder views and aspirations. The assessment was completed on a qualitative basis unless quantitative evidence was available to support an argument, such as capacity or distance of empty running.

An overview of the assessment is included under the 'turnback requirement' sub-chapter.

Rolling Stock Requirements

Through the development of a timetable for each of the options, the number of additional units required to operate each of the station locations was calculated.

Stabling Requirements

Additional stabling requirement brought about by the introduction of a new station at Old Oak Common was assessed to identify appropriate locations for units to be accommodated overnight.

Rolling Stock and Operating Costs

Operating costs have been calculated to take account of key industry and train operator costs. These costs are principally a factor of distance operated and have been factored on that basis. For ease of reporting, costs for each option are reported on an industry basis and include costs for services that operate on the NLL and WLL, including London Overground and Southern services.

For all operating cost calculations, it is assumed that passenger services on the NLL and WLL will operate on the basis of 8-car fixed formation, representing a 2041 scenario for the purposes of calculating the business case and reflects the assumptions used for the purposes of demand modelling¹.

Industry costs are calculated on the basis of Class 378 units operating on London Overground services and Class 377/7 units operating on services currently part of the Southern franchise. In reality, as it will be expensive and technically challenging to extend Class 378 units beyond 5-car length, these could feasibly be replaced prior to the opening of the Overground station with an equivalent unit.

While both Fixed and Variable Track Access Charges (FTAC) and (VTAC) only represent a minimal increase in charges to the train operator, it is the only charge included within the assessment that is variable by train length.

The number of additional drivers required is calculated on the basis of the number of additional units, with two drivers required for every additional unit.

Freight Impacts

As with passenger usage on the NLL and WLL, the freight market continues to grow and this is reflected by forecasts in the Freight Market Study as part of Network Rail's Long Term Planning Process (LTPP). While it is difficult to determine the usage of specific train paths at the date the Old Oak Common station is likely to open, an assessment of nominal freight paths was undertaken as part of the timetable development.

An overview of each of the options being considered was also presented to the relevant freight operators in order to seek their high level view on the level of acceptability of each of the options. Copies of the minutes from the meeting are available in document reference 'OOC FOC Consultation Meeting Notes'.

Railway Maintenance

The impacts on railway maintenance of each option were assessed at a high level to determine where infrastructure maintenance requirements may increase and therefore require changes to the possession regime. It is anticipated that this will be reviewed in greater detail in advance of gaining an Approval in Principle (AIP) from Network Rail upon the completion of the GRIP 3 development stage.

Option A

¹ It is assumed that the Overground station will open in 2026

Timetable development

The initial timetabling assessment of Option A demonstrated that the train service specification could be operated on a two platform layout at the Old Oak Common station.

The key characteristics of the service at Old Oak Common station are summarised in table 2 and figure 1.

Service	Peak frequency (trains per hour)	Old Oak Common platform	Direction of travel
Stratford to Richmond	4tph	Platform 1	Westbound
Richmond to Stratford	4tph	Platform 2	Eastbound
Stratford to Clapham Junction	6tph	Platform 1	Westbound
Clapham Junction to Stratford	6tph	Platform 2	Eastbound
Clapham Junction to Old Oak Common (and returning)	2tph	Platform 2	Looping via South West Sidings

Table 2: Service characteristics of Option A through Old Oak Common

Services included within the specification but not calling at Old Oak Common include:

- East Croydon to WCML via WLL (2tph)
- Nominal peak freight on all routes (2tph)

The proposed infrastructure at Old Oak Common is able to accommodate the proposed train services during peak and off-peak periods. The structure of the NLL and WLL service pattern is similar to today, with the location where passenger services interweave moving south from Willesden High Level to Acton Wells Junction.

Following a sift of turnback locations for the peak only Clapham Junction to Old Oak Common service, the timetable includes looping of this service via South West Sidings and West London Junction in a clockwise direction to make its return journey to Clapham Junction. This negates the need to provide a dedicated turnback facility within the platforms at Old Oak Common.

However, due to timetabling constraints, it is only possible to provide 1 minute layover time to make this move. Further work is required to understand if this time allowance is adequate as it may introduce additional performance risk and may not be technically achievable depending on driver arrangements for programming the onboard train computers for the return journey. The feasibility

of this should be investigated and reported as part of a completed GRIP 3 study in 2015.

Option A service pattern
NLL & WLL station at Old Oak Common Lane
 Service Specification for the AM high peak hour (08:00 – 09:00)



Service	Frequency (tph) – peak (off-peak)	Reversing, through or avoiding OOC
Richmond to Stratford	4 (4)	through
Clapham Junction to Stratford	6 (4)	through
Clapham Junction to Willesden Junction		
Watford Junction to Clapham Junction	1 (0)	avoid
Milton Keynes to South Croydon	1 (1)	avoid
Shepherds Bush to Clapham Junction		
OOC to Clapham Junction	2 (0)	via SWS
Total (serving OOC station)	12 (8)	

Figure 1: Service proposition for Option A

The feasibility of operating the Clapham Junction to Old Oak Common service during off peak periods was also assessed to identify if additional off peak capacity could be provided, however the interface with freight services limited

Green Jn) and 2 (existing Willesden turnback) were discounted due to operational constraints and the need to interweave with the small number of peak freight paths north of Willesden High Level Junction. In addition, it was determined that both locations would have required substantial investment to make them suitable to turnback 8-car trains. Location 3 (at the new NLL station) was also considered but discounted due to the need to build a three platform station at this location, making it more complex to construct and it being less desirable in terms of a passenger proposition.

Location 7 (looping via South West Sidings to Mitre Bridge Jn) was concluded as being more favourable than location 6 (turning back at South West Sidings) due to operational efficiency gained from operating a 'through' service which avoided excess dwell times while the driver changed ends. It was noted however, that while the initial timetable assessment demonstrated that the preferred option was feasible, it would be subject to further detailed assessment to understand if this could be accommodated in the short layover time and agreement from the train operator. In addition, this further assessment should take account of potential changes to the traction changeover proposition on the WLL which may speed up the changeover process and could allow for additional layover time to be included within the timetable. This would be completed as ahead of a completed GRIP 3 assessment in 2015.

Rolling stock requirements

In order to accommodate an Overground station adjacent to Old Oak Common Lane in Option A, the journey time of the Richmond to Stratford service will increase by approximately 2 minutes. In addition, the requirement to reroute the Clapham Junction to Stratford service via the new viaduct extends the journey time by approximately 4 to 5 minutes on this service compared to the existing end to end journey time.

On a round trip, depending on interoperation of the NLL and WLL services, this could extend the journey time by up to 10 minutes. It has been calculated from the timetable outputs that two additional units are required to support the service.

Analysis of the timetable outputs indicates that no additional units are required to operate the extension of the Clapham Junction to Shepherds Bush shuttle to Old Oak Common. This is principally because the service would have to operate as far as Mitre Bridge Junction without the Old Oak Common station in order to reverse in the North Pole Depot Reception line, which is 1.5 miles beyond Shepherds Bush.

Stabling requirements

The additional two units required to operate the revised train service are unlikely to impact the stabling strategy for the Overground network. In the medium term there are a series of likely committed schemes to enhance the Overground train service (such as increasing service frequency on the WLL and deploying electric multiple units (EMUs) on the Gospel Oak to Barking

service following electrification of the route) which are likely to require additional stabling capacity. These enhancements are being progressed as part of the LOTRAIN programme.

An appropriate solution to addressing any additional stabling required to support the station therefore may be to include a requirement for any extra capacity that is required as part the Old Oak Common station within the LOTRAIN programme. Opportunities to do this should be explored further.

Potential additional stabling capacity required to support train lengthening which may be progressed independently of this station proposal is not included within this assessment.

Rolling Stock and Operating Costs

Estimated rolling stock and operating costs are shown in table 3 below.

Cost element	Cost basis	£ p/a (unless otherwise stated)
Additional until miles operated		
Variable Track Access Charge (VTAC)	CP5 usage charges	
Capacity Charge	CP5 usage charges	
Fixed Track Access Charge (FTAC)	CP5 usage charges	
Electricity Charges for Traction (EC4T)	CP5 usage charges	
Train driver costs	Overground driver costs	
Total incremental operating costs		
Rolling stock costs		

Table 3: Operating costs for Option A

Please note that these costs currently exclude station operating costs.

As there is a negligible increase in the number of train miles operated per annum, there is only a marginal increase in the total operating costs. The number of unit miles increase by approximately 99,000 in Option A.

The principle driver for increase in operating costs is the requirement for two additional units to support the service. It should be noted however, that this treated as a one-off purchase cost, rather than an annual payment.

Freight Impacts

The introduction of additional infrastructure to separate out most passenger and freight flows through Acton Wells Junction is a key benefit of Option A. This would result in their being minimal interaction between the two services, with NLL freight flows being the only movement to directly conflict with passenger services at Old Oak Common Junction. This is demonstrated in figure 3 below. Routing peak only Clapham Junction to Old Oak Common services via South West Sidings and West London Junction may impact on the

small number of peak only freight paths from the WLL, however, it was not determined to be an insurmountable issue and could be managed with careful timetabling.

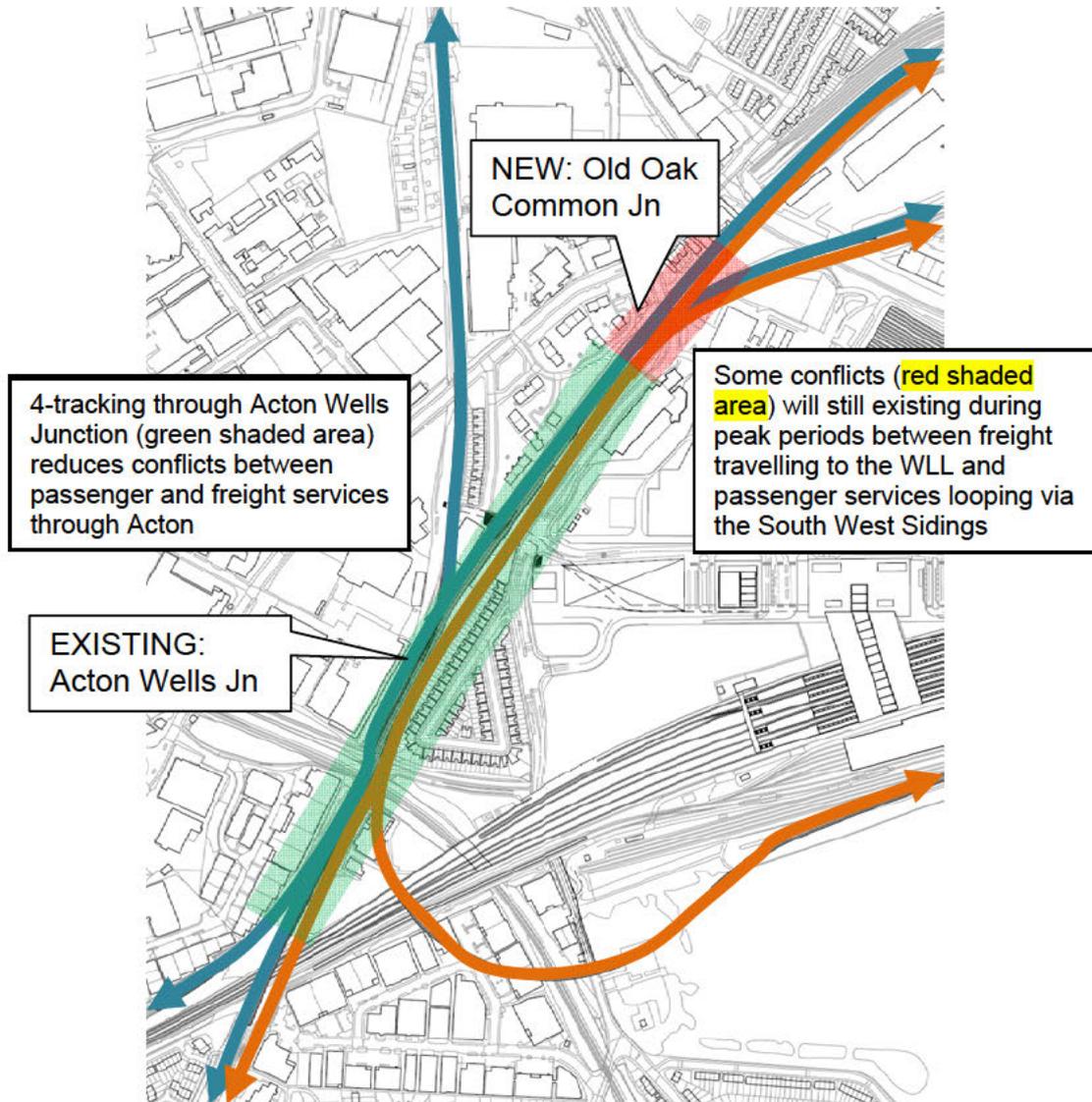


Figure 3: Proposed infrastructure for Option A reducing conflicts between freight and passenger services

Railway maintenance

A key component of delivering Option A is the provision of a new viaduct linking the WLL at Mitre Bridge Junction to the NLL at Acton Wells Junction. This is seen as beneficial for maintaining the railway as two routes would be available between the WLL and NLL during periods of planned and unplanned perturbation, and these can be used interchangeably by passenger services if one is unavailable due to maintenance requirements, for example. It should be noted however that the new route past the Intercity Express Programme (IEP) depot is unlikely to be permissible for freight services and therefore will be of limited or no benefit to this service group during perturbation.

Further ancillary benefits are that the new viaduct is likely to be constructed with slab track, reducing the frequency it would need to be maintained, and diversion of the WLL service away from Mitre Bridge Junction will reduce track wear through this location, and thus the frequency at which the track will need to be maintained.

While these benefits will assist in reducing maintenance requirements, it is likely that overall maintenance requirements for the railway in the Old Oak Common area will increase with Option A. The redesign of Acton Wells Junction with increased track work and this together with the specification to operate a higher frequency service through the junction will increase maintenance requirements. In addition, tight track curvature (190m radius at its tightest) along the western end of the new viaduct and changes in vertical track geometry (3.2% gradient) to the eastern end of the viaduct are both likely to increase maintenance requirements. Other issues were also identified with the location of switches and crossovers on bridge structures and the need to maintain track through the new station as further maintenance requirements.

Given the substantial increase in infrastructure within Option A, it is anticipated that the impact on railway maintenance would be most adverse if this option was progressed. This impact is heightened by the complexity of the infrastructure as well as tight track curvature and steep gradients.

Option B

Three options were assessed as part of the timetable development for Option B;

- Option Bi – Split WLL service with services operating Clapham Junction to Stratford and Clapham Junction to Old Oak Common
- Option Bii – A through WLL service from Clapham Junction to Stratford, reversing at Old Oak Common
- Option Biii - Split WLL service with services operating Clapham Junction to Stratford and Clapham Junction to Hounslow

Option Bi

Timetable development

The initial timetabling assessment of Option Bi (with a split West London Line (WLL) service) demonstrated that the train service specification could be operated on a three platform layout at the Old Oak Common station.

The key characteristics of the service at Old Oak Common station are summarised in table 4 and figure 4.

Service	Peak frequency (trains per hour)	Old Oak Common platform	Direction of travel
Stratford to Richmond	4tph	Platform 1	Westbound
Richmond to Stratford	4tph	Platform 2	Eastbound
Clapham Junction to Old Oak Common (and returning)	4tph	Platform 3	Terminating from a north direction

Table 4: Service characteristics of Option Bi through Old Oak Common

Services included within the specification but not calling at Old Oak Common include:

- Clapham Junction to Stratford (4tph)
- East Croydon to WCML via WLL (2tph)
- Nominal peak freight on all routes (2tph)

It is possible to achieve an approximate even headway on all services within the specification. However, as the route between Clapham Junction and Stratford is limited to accommodating approximately 12tph, it is necessary to reduce the service frequency of these services from 6tph to 4tph compared to the Reference Case (in table 1, Overview chapter) in order to accommodate 4tph operating from Clapham Junction to Old Oak Common as well as other passenger services to the WCML and nominal peak freight services. Retaining service frequencies between Clapham Junction and Stratford at 6tph (totalling 14tph) would exceed the capacity of the WLL. This is also shown in Table X below.

West London line service frequencies	Viable train service Peak frequency (trains per hour, in one direction)	Non-viable train service Peak frequency (trains per hour, in one direction)
Clapham Junction to Old Oak Common	4tph	4tph
Clapham Junction to Stratford	4tph	6tph
East/South Croydon to Milton Keynes Central/Watford Junction	2tph	2tph
Nominal peak freight paths	2tph	2tph
Total service frequency on the WLL	12tph	14tph

Table x: West London line service frequencies.

As a consequence, stations east of Willesden Junction would receive a net reduction in passenger train service from 10tph to 8tph. This is the main shortfall of this service specification and it would not be possible to address this unless the frequency of other passenger or freight service groups is reduced.

Option Bi service pattern
NLL & WLL station at Old Oak Common Lane
 – via the Acton Wells Loop with a split WLL service
 Service Specification for the AM high peak hour (08:00 – 09:00)



Service	Frequency (tph) – peak (off-peak)	Reversing, through or avoiding OOC
Richmond to Stratford	4 (4)	through
Clapham Junction to Stratford	4 (2)	avoid
Clapham Junction to Willesden Junction		
Watford Junction to Clapham Junction	1 (0)	avoid
Milton Keynes to South Croydon	1 (1)	avoid
Shepherds Bush to Clapham Junction		
OOC to Clapham Junction	4 (2)	reverse
Total (serving OOC station)	8 (6)	

Figure 4: Service proposition for Option Bi

The feasibility of mitigating this capacity gap was assessed at a high level by introducing a Willesden Junction to Stratford via Gospel Oak service. While no timetable was developed for this, it was found that introducing this service would only partly address this issue as the reduction in capacity between North London Line (from Willesden Junction east) and West London Line (from

Shepherds Bush south) stations would continue to exist, reducing the overall benefits of the scheme. In addition, it would be technically difficult to terminate Overground services at Willesden Junction without the provision of new infrastructure in the Willesden Junction area in order to turn back Overground services arriving from the east. This would increase costs, but has not been assessed as part of this study so the magnitude of expenditure is unknown.

During off-peak periods, the increase in the required number of freight paths places further constraints on the timetable. In order to retain a 4tph service from Clapham Junction to Stratford as well as the WLL to WCML passenger paths, it is only possible to deliver a train every 30 minutes between Clapham Junction and Old Oak Common. This is a lower service frequency than could be delivered in either Options A or C.

Due to the adverse impacts of this service proposition on reducing service frequency between Clapham Junction and Stratford, and the subsequent impacts on passengers' journeys, it was decided not to progress this option further.

Information on rolling stock, infrastructure and costs below is provided for completeness.

Turnback requirement

A key part of the proposition for the WLL and NLL to serve Old Oak Common is to extend the existing, peak only Clapham Junction to Shepherds Bush service to Old Oak Common. In extending this service, it would operate beyond the facility it currently reverses in on the North Pole Depot Reception line, and therefore a new facility in the Old Oak Common area needed to be identified.

A sifting exercise was undertaken to identify feasible alternatives. This was completed to assess the operational, engineering and wider stakeholder impacts.

A summary of the locations considered as part of Option B is provided in figure 5.

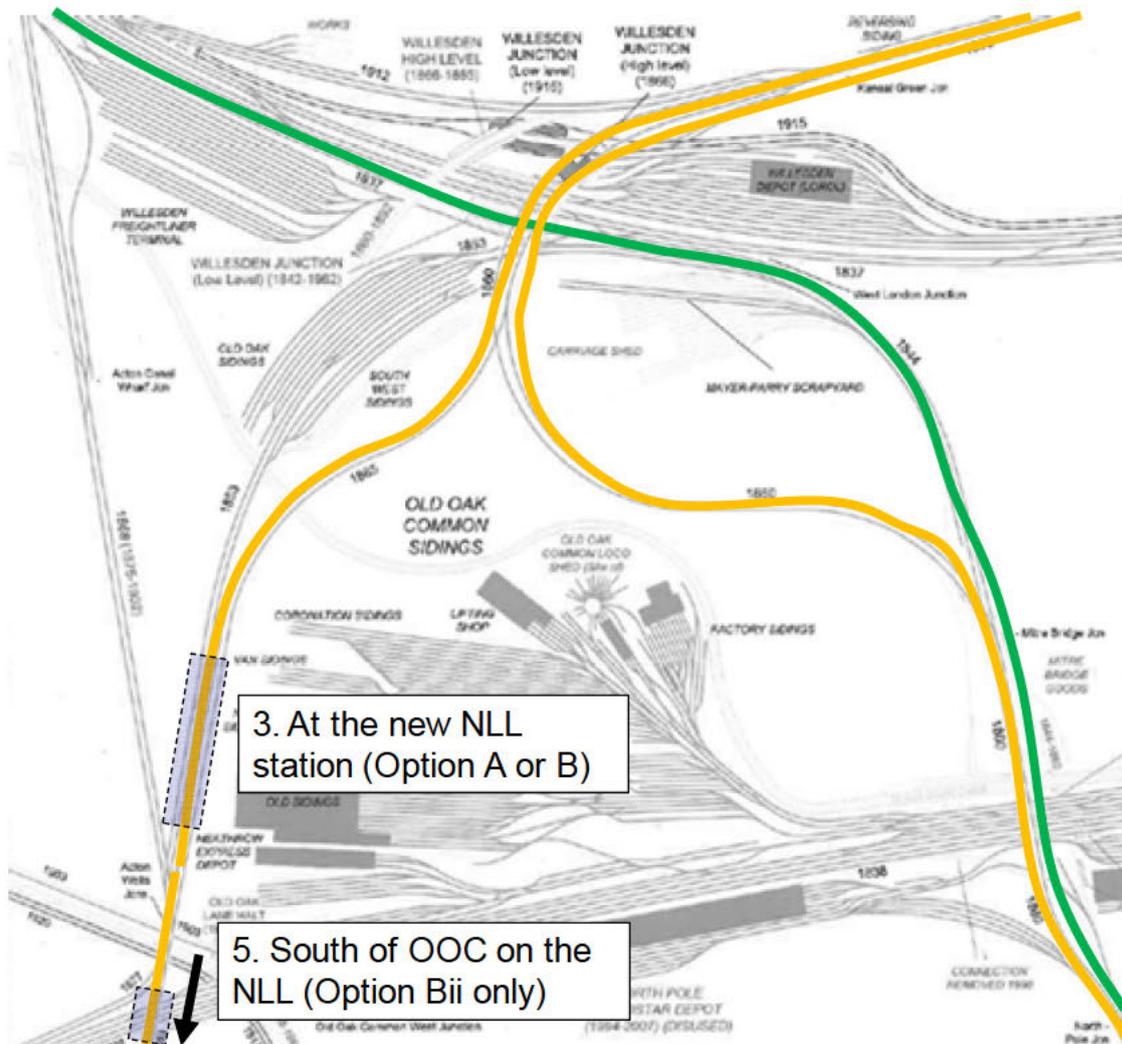


Figure 5: Turnback locations assessed as part of Option B

Due to the operating characteristics of Option B, there were limited options for locations to turnback the Clapham Junction to Old Oak Common service. To operate the shuttle service using location 5 (south of OOC), trains would have departed Old Oak Common out of passenger service to turnback at a location between Acton Wells Junction and Acton Central station. This would have required interweaving with freight through Acton Wells Junction as well as track work to accommodate a centre turnback, and was therefore discounted. Option 3 (at the new NLL station) was progressed as the preferred location to turnback the shuttle service. While this requires additional platform infrastructure in the Acton Wells Junction area, it provided an effective operational solution which allowed the Clapham Junction to Old Oak Common service to operate independently of the NLL passenger service and any freight services not operating via the South West Sidings.

Rolling Stock Requirements

Due to the reduction in frequency on the Clapham Junction to Stratford service it was calculated that no additional units were required to operate this option.

Although no formal assessment was undertaken, it was estimated that the trains that would have been removed from the Clapham Junction to Stratford service would have been required to support the extension of the Clapham Junction to Shepherds Bush service to Old Oak Common as well as increasing the service frequency from 2tph to 4tph.

Stabling Requirements

As it was identified that no additional rolling stock was required to operate this option, no additional stabling sites were required,

Rolling Stock and Operating Costs

Estimated rolling stock and operating costs are shown in table 6 below.

Cost element	Cost basis	£ p/a (unless otherwise stated)
Additional until miles operated		
Variable Track Access Charge (VTAC)	CP5 usage charges	
Capacity Charge	CP5 usage charges	
Fixed Track Access Charge (FTAC)	CP5 usage charges	
Electricity Charges for Traction (EC4T)	CP5 usage charges	
Train driver costs	Overground driver costs	
Total incremental operating costs		
Rolling stock costs		

Table 6: Operating costs for Option Bi

Please note that these costs currently exclude station operating costs.

As this option would have resulted in a reduction in the service frequency in the Clapham Junction to Stratford services from 6tph to 4tph, it was therefore calculated that there would be operating cost savings. The number of unit miles decrease by approximately 280,000 in Option Bi. This operating cost saving was reflected in the business case assessment, and while it may have made this option more affordable, there would also be a reduction in passenger benefits as a result of operating a less frequent service.

For the purposes of the assessment, it was assumed that units that would no longer be required due to the reduction in frequency on the Clapham Junction to Stratford service, would remain under TfL lease, and therefore, there would be no financial saving. In addition, while no formal assessment was undertaken, the likelihood would be that these units would be redeployed to support the enhanced Clapham Junction to Old Oak Common service which was specified to increase from 2tph to 4tph.

Freight Impacts

Option Bi was seen to introduce the greatest adverse impacts on freight services, due to the greater use of infrastructure by passenger services

through South West Sidings and West London Junction during peak and off-peak periods. Currently these routes are very lightly used and therefore serves as a regulating point to recess freight between different routes. This functionality would largely be lost by operating passenger services along this section of route and this potentially could have an adverse impact on both passenger and freight performance.

Railway Maintenance

The service proposition for Option Bi includes a reduction in the number of services operated along the NLL, potentially reducing maintenance requirements, but overall, the additional switches and crossovers to the south of the South West Sidings and diversion of passenger service along this section of alignment are likely to increase maintenance requirements in this area. As with all options, the introduction of a new station with trains braking and accelerating on approach and departure will increase maintenance and possession requirements.

While Option Bi does not deliver the same intensive use of key junctions such as Acton Wells as seen in Option A, it will substantially increase track and point usage through West London Junction and the South West Sidings, and was assessed accordingly.

Option Bii

Timetable development

The initial timetabling assessment of Option Bii (reversing WLL services at Old Oak Common) demonstrated that the train service specification could not be operated on the proposed infrastructure (four platform station) at Old Oak Common.

The key characteristics of the service at Old Oak Common station are summarised in table 7 and figure 6.

Service	Peak frequency (trains per hour)	Old Oak Common platform	Direction of travel
Stratford to Richmond	4tph	Platform 1	Westbound
Stratford to Clapham Junction	6tph	Platform 2	Reversing from a north direction
Clapham Junction to Stratford	6tph	Platform 3	Reversing from a north direction
Richmond to Stratford	4tph	Platform 4	Eastbound
Clapham Junction to Old Oak Common	2tph	Not feasible to path	Terminating from a north direction

Table x: Service characteristics of Option Bii through Old Oak Common

Services included within the specification but not calling at Old Oak Common include:

- East Croydon to WCML via WLL (2tph)
- Nominal peak freight on all routes (2tph)

Option Bii service pattern
NLL & WLL station at Old Oak Common Lane
 – via the West London Loop with a reversing WLL service
 Service Specification for the AM high peak hour (08:00 – 09:00)



Service	Frequency (tph) – peak (off-peak)	Reversing, through or avoiding OOC
Richmond to Stratford	4 (4)	through
Clapham Junction to Stratford	6 (4)	reverse
Clapham Junction to Willesden Junction		
Watford Junction to Clapham Junction	1 (0)	avoid
Milton Keynes to South Croydon	1 (1)	avoid
Shepherds Bush to Clapham Junction		
OOC to Clapham Junction	2 (0)	reverse
Total (serving OOC station)	12 (8)	

Figure 7: Service proposition for Option Bii



Figure 8: Pathing NLL services at Old Oak common in Option Bii

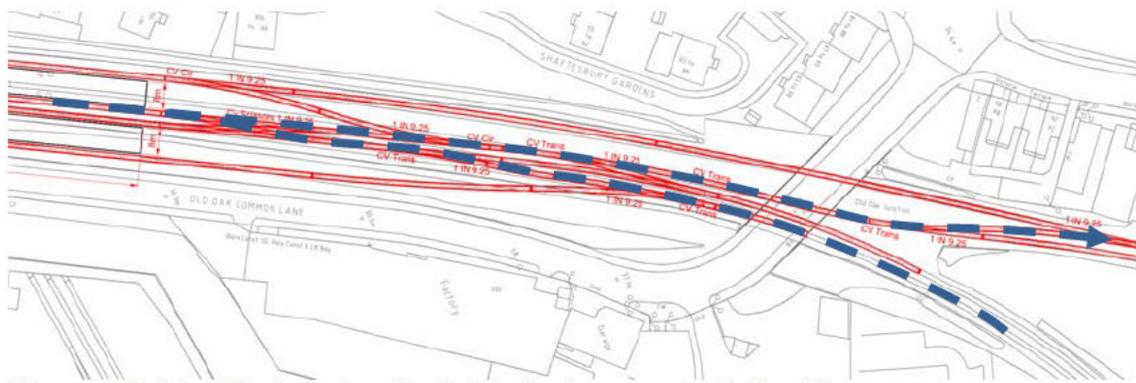


Figure 9: Pathing Clapham Junction to Stratford services in Option Bii

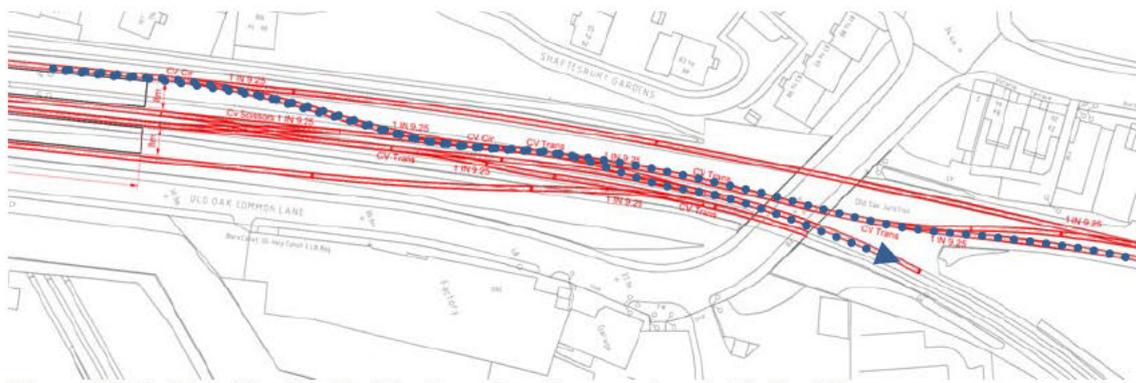


Figure 10: Pathing Stratford to Clapham Junction services in Option Bii

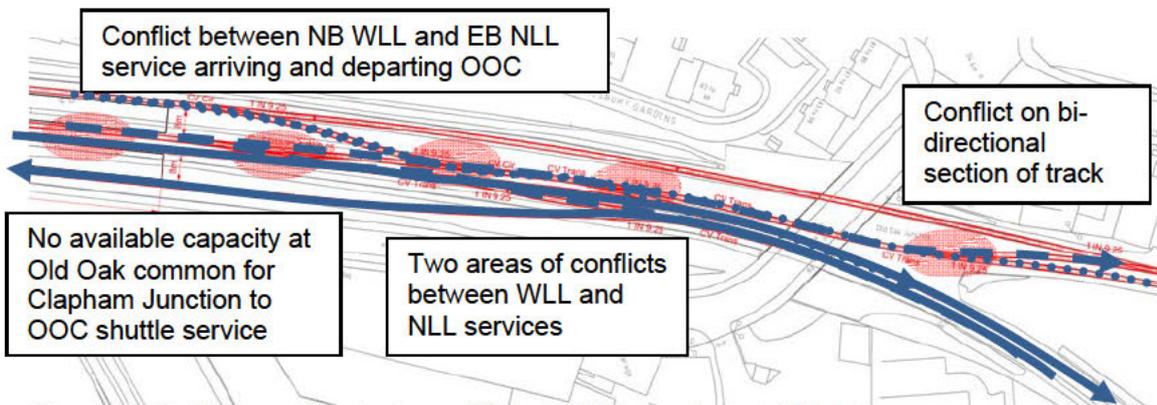


Figure 11: Pathing conflicts between WLL and NLL services at Old Oak common

The principal challenges with accommodating this train service specification were the extended platform occupation times of terminating or reversing trains within platforms 3 and 4 at the station and the high volume of conflicting moves to the north of the Old Oak Common station. This second challenge is demonstrated in figures 8 to 10 and overlaid together in figure 11.

Assuming a four platform station at Old Oak Common, platforms 1 and 2 would be exclusively used by Richmond to Stratford services, while platforms 3 and 4 would be utilised by passenger services from Clapham Junction to Stratford as well as the Clapham Junction to Old Oak Common shuttles. This arrangement is proposed to make best use of available capacity. However, due to the requirement for all trains using platform 3 and 4 to make reversing or terminating moves, this extends platform occupation times. It is calculated that from the time a train enters the station to when it departs and the platform is available for the next train, would be a minimum of 10 minutes (note, this could be reduced by stepping back drivers, but is unlikely to provide substantial additional platform capacity to make this option any more viable).

Using this assumption, it would only be feasible to operate a 6tph service from Clapham Junction to Stratford via Old Oak Common if the timetable structure could be guaranteed with even headways and trains presented themselves on schedule. It would not be feasible to accommodate the Clapham Junction to Old Oak Common shuttles in addition to this as the platforms would already be occupied 100% of the time.

In addition to insufficient platform capacity, the high volume of crossing moves to the north of the station is also a key issue. In order to operate the service between Clapham Junction and Stratford via Old Oak Common, each train travelling in the eastbound direction would have to cross the corresponding services in the westbound direction, while the westbound service would additionally be required to cross the eastbound Richmond to Stratford service. This could create in excess of 18 conflicting moves per peak hour, excluding those with freight or the Clapham Junction to Old Oak Common shuttle service. This placed substantial constraints on the flexibility of the timetable and the ability to deliver a reliable train service would unlikely to be achievable.

As the proposed infrastructure would not be able to support the proposed train service specification and there would be substantial adverse impacts on service performance, the decision was made not to progress this option further,

Option Biii

Timetable development

The initial timetabling assessment of Option Biii (operating Overground services beyond Old Oak Common to southwest London) demonstrated that the train service specification could be operated on a two platform layout at the Old Oak Common station. It should be noted however that no formal timetable

assessment has been undertaken, and that this is based on the specification of Option Bi.

The key characteristics of the service at Old Oak Common station are summarised in table 8 and figure 12.

Service	Peak frequency (trains per hour)	Old Oak Common platform	Direction of travel
Stratford to Richmond	4tph	Platform 1	Westbound
Richmond to Stratford	4tph	Platform 2	Eastbound
Clapham Junction to southwest London	4tph	Platform 1	Westbound
Southwest London to Clapham Junction	4tph	Platform 2	Eastbound

Table 8: Service characteristics of Option Biii through Old Oak Common

Services included within the specification but not calling at Old Oak Common include:

- Clapham Junction to Stratford (4tph)
- East Croydon to WCML via WLL (2tph)
- Nominal peak freight on all routes (2tph)

The timetable for Option Bi includes the same level of train service operating to Old Oak Common station, albeit with only a two platform layout, and changes to the track work in the Acton Wells Junction area. Paths to extend the Clapham Junction to Old Oak Common beyond the station to other destinations in southwest London (feasibly Hounslow) were identified. No further work was undertaken to timetable these services west of Old Oak Common station.

It should be noted that while this option was demonstrated to be achievable in principle, the same constraints apply as identified in Option Bi and therefore this Option was not progressed further.

Option Biii service pattern NLL & WLL station at Old Oak Common Lane

– via the Acton Wells Loop with a split WLL service
Service Specification for the AM high peak hour (08:00 – 09:00)



Service	Frequency (tph) – peak (off-peak)	Reversing, through or avoiding OOC
Richmond to Stratford	4 (4)	through
Clapham Junction to Stratford	4 (2)	avoid
Clapham Junction to Willesden Junction		
Watford Junction to Clapham Junction	1 (0)	avoid
Milton Keynes to South Croydon	1 (1)	avoid
Shepherds Bush to Clapham Junction		
OOO to Clapham Junction		
Hounslow to Clapham Junction	4 (2)	through
Total (serving OOC station)	8 (6)	

Figure 12: Service proposition for Option Biii

Option C

Timetable development

The initial timetabling assessment of Option C demonstrated that the train service specification could be operated on a two platform layout at the Old Oak Common station and a three platforms layout at the Hythe Road station.

The key characteristics of the service at Old Oak Common station can be summarised in table 9 and figure 13:

Service	Peak frequency (trains per hour)	Old Oak Common platform	Direction of travel
Stratford to Richmond	4tph	Platform 1	Westbound
Richmond to Stratford	4tph	Platform 2	Eastbound
Stratford to Clapham Junction	6tph	Platform 1 (Hythe Road)	Westbound
Clapham Junction to Stratford	6tph	Platform 3 (Hythe Road)	Eastbound
Clapham Junction to Old Oak Common	2tph	Platform 2 (Hythe Road)	Eastbound

Table 9: Service characteristics of Option C through Old Oak Common

Services included within the specification but not calling at Old Oak Common include:

- East Croydon to WCML via WLL (2tph)
- Nominal peak freight on all routes (2tph)

The proposed infrastructure at Old Oak Common is able to accommodate the proposed train services during peak and off-peak periods.

The proposed infrastructure solution for Option C enables the current routing of NLL and WLL services to be retained, and can be considered the most straightforward of all the options to operate. A clear advantage of this option over others is the ability to operate the peak only Clapham Junction to Old Oak Common service independently of the NLL. This reduces the level of interweaving between these services and provides some additional operational flexibility, particularly during or immediately following perturbed scenarios. This flexibility is enhanced by having neutral sections between the NLL and WLL, allowing the service to operate independently during planned and unplanned perturbation.

Option C service pattern

NLL station at Old Oak Common Lane and WLL station at Hythe Road
Service Specification for the AM high peak hour (08:00 – 09:00)



Service	Frequency (tph) – peak (off-peak)	Reversing, through or avoiding OOC
Richmond to Stratford	4 (4)	through
Clapham Junction to Stratford	6 (4)	through
Clapham Junction to Willesden Junction		
Watford Junction to Clapham Junction	1 (0)	avoid
Milton Keynes to South Croydon	1 (1)	avoid
Shepherds Bush to Clapham Junction		
OOC to Clapham Junction	2 (0)	reverse
Total (serving OOC station)	12 (8)	

Figure 13: Service proposition for Option C

Turnback requirement

A key part of the proposition for the WLL and NLL to serve Old Oak Common is to extend the existing, peak only Clapham Junction to Shepherds Bush service to Old Oak Common. In extending this service, it would operate beyond the facility it currently reverses in on the North Pole Depot Reception line, and therefore a new facility in the Old Oak Common area needed to be identified.

A sifting exercise was undertaken to identify feasible alternatives. This was completed to assess the operational, engineering and wider stakeholder impacts.

A summary of the locations considered as part of Option C is provided in figure 14.

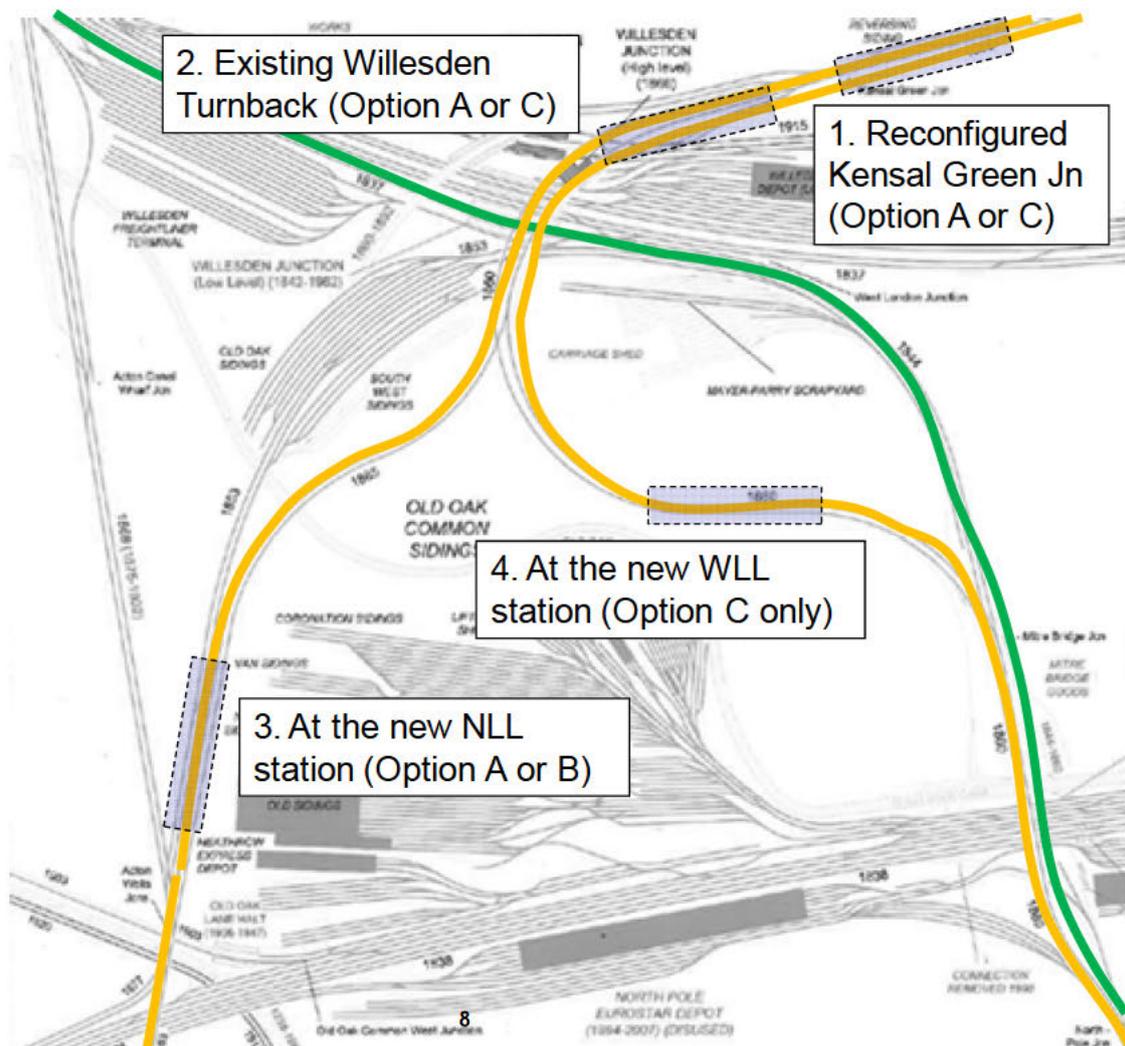


Figure 14: Turnback locations assessed as part of Option C

A number of the locations considered for Option C were common with Option A due to their similar operating characteristics. As with Option A, locations 1 (Kensal Green Jn) and 2 (existing Willesden turnback) were discounted due to operational and technical constraints. Location 3 (at the new NLL station) was also considered but discounted due to the need to build a three platform station at this location, making it more complex to construct and it being less desirable

in terms of a passenger proposition. Location 4 (at the new WLL station) was progressed. In order to deliver this solution, a third platform is required within the Hythe Road station, requiring additional land take and ground works, however it delivers a substantially more operationally robust solution. The three platform layout enables the shuttle service to operate independently of the NLL, reducing train conflicts and allows greater operational flexibility during periods of planned and unplanned perturbation. In addition, empty stock movements are also reduced.

Further work was also undertaken as part of the turnback sifting exercise for Option C to determine the platform layout of the station, with the platform layout in figure 15 identified as the preferred. This configuration requires widening of the railway alignment to the north in order to provide an island platform in the Up direction (towards Clapham Junction) so that passengers travelling towards stations on the WLL can board the first departing train. This platform layout allows for effective management of train and station operations by providing capacity to the largest flow of passengers. In addition, the layout with a centre turnback enhances the resilience of the train service by reducing conflicting moves. It was determined that these benefits outweighed the potential adverse impacts during construction of needing to widen the alignment at a location with poor road access.

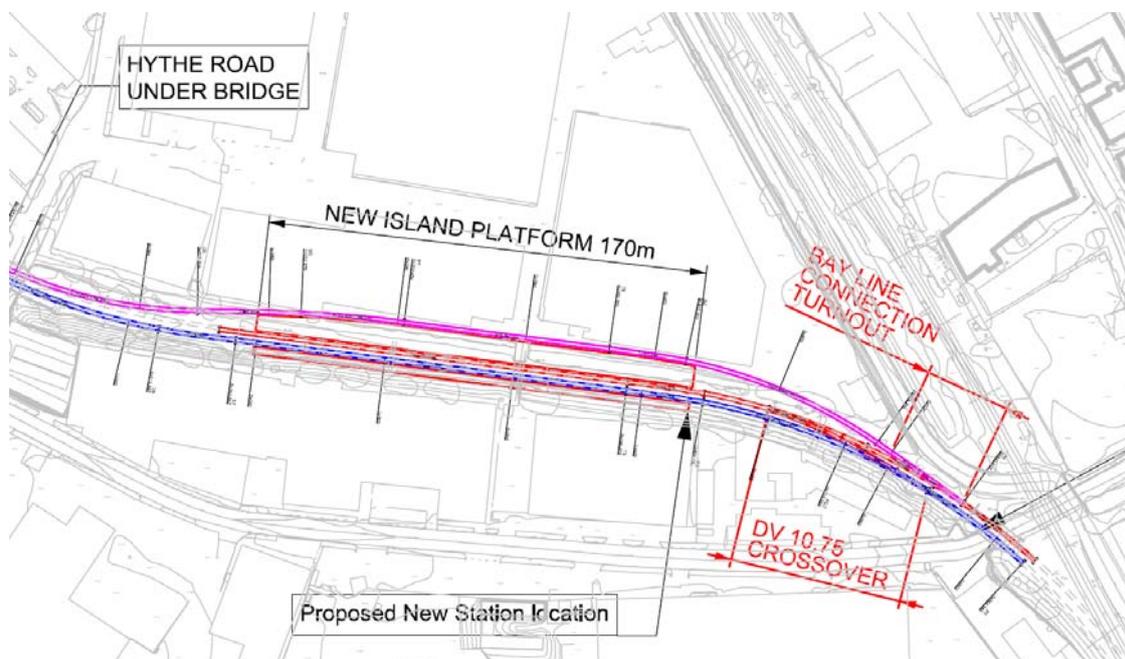


Figure 15: Option C, station layout at Hythe Road on the WLL. Doc ref: LOOC-ALLW-EPW-DGA-WSP-01221

Rolling stock requirements

With Option C the increase the journey time on both the Clapham Junction to Stratford and Richmond to Stratford service is calculated at approximately 2 minutes. This would lead to an extension of the round trip journey time by up to 4 minutes, requiring one additional unit to maintain the level of service.

Analysis of the timetable outputs indicates that no additional units are required to operate the extension of the Clapham Junction to Shepherds Bush shuttle to Old Oak Common. This is principally because the service would have to operate as far as Mitre Bridge Junction without the Old Oak Common station in order to reverse in the North Pole Depot Reception line, which is just short of the proposed station.

Stabling requirements

The additional unit required to operate the revised train service is unlikely to impact the stabling strategy for the Overground network. In the medium term there are a series of likely committed schemes to enhance the Overground train service (such as increasing service frequency on the WLL and deploying electric multiple units (EMUs) on the Gospel Oak to Barking route following electrification of the route) which are likely to require additional stabling capacity. These enhancements are being progressed as part of the LOTRAIN programme.

An appropriate solution to addressing any additional stabling required to support the station therefore may be to include a requirement for any extra capacity that is required as part the Old Oak Common station within the LOTRAIN programme. Opportunities to do this should be explored further.

In addition, isolated opportunities to provide extra stabling capacity may also exist with the infrastructure proposed as part of the Old Oak Common station. As part of Option C, a third platform would be provided at the Hythe Road station which could be utilised during off-peak periods or overnight when it is not required to support the train service. Further technical assessment of this proposal would be required to determine its feasibility.

Potential additional stabling capacity required to support train lengthening which may be progressed independently of this station proposal is not included within this assessment.

Rolling Stock and Operating Costs

Estimated rolling stock and operating costs are shown in table x10 below.

Cost element	Cost basis	£ p/a (unless otherwise stated)
Additional until miles operated		
Variable Track Access Charge (VTAC)	CP5 usage charges	
Capacity Charge	CP5 usage charges	
Fixed Track Access Charge (FTAC)	CP5 usage charges	
Electricity Charges for Traction (EC4T)	CP5 usage charges	
Train driver costs	Overground driver costs	
Total incremental operating costs		
Rolling stock costs		

Table 10: Operating costs for Option C

Please note that these costs currently exclude station operating costs.

As there is a negligible increase in the number of train miles operated per annum, there is only a marginal increase in the total operating costs. The number of unit miles increase by approximately 16,000 in Option C.

The principal driver for increase in operating costs is the requirement for one additional unit to support the additional station call on the NLL and WLL. It should be noted however, that this treated as a one-off purchase cost, rather than an annual payment.

Freight Impacts

The routing of passenger trains services with Option C do not change, and therefore the structure of the NLL and WLL timetables will largely remain as existing. For this reason, parallel moves which currently take place at Willesden High Level Junction (where NLL and WLL passenger service converge) can largely continue as is the current practice. This is therefore considered to be the most acceptable option to the freight industry.

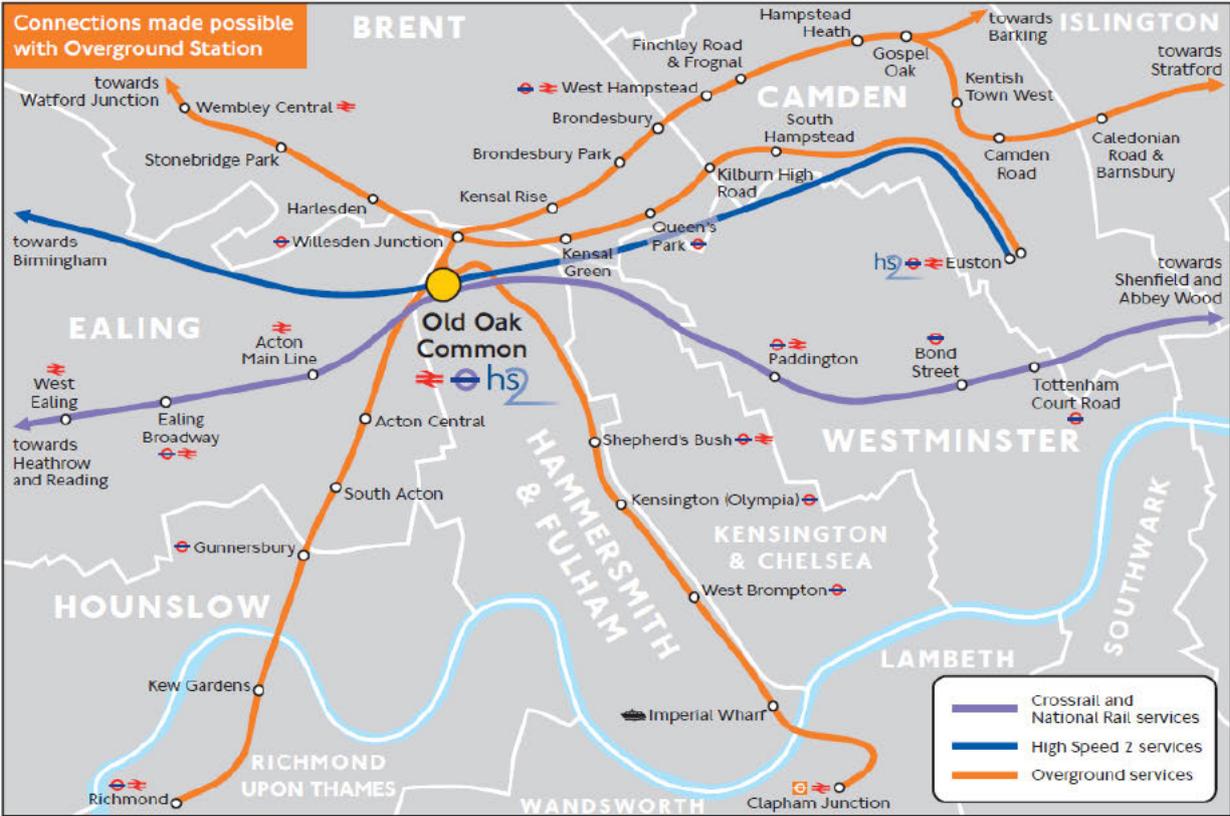
Railway Maintenance

As Option C would deliver very little change in infrastructure or infrastructure usage, particularly in comparison to other options, it was determined that there will be little or no material impact on maintenance or possession requirements. It is anticipated that additional maintenance to switches and crossovers within the Acton Wells and Mitre Bridge Junction areas as well as track wear through the two new stations could be managed within the existing possessions regime with a negligible impact on asset renewals. Renewing assets that are at less than half life remaining at the time of construction would assist with this.

It was determined that Option C would have the least impact on railway maintenance and possession requirements compared to Options A and B, and is favoured on this assessment criteria because of this.

Overground station at Old Oak Common

Operational Assessment



Document control

Document Review

	Signature	Date
Prepared by [Redacted] Principal Planner
Reviewed by [Redacted] [Job title]
Reviewed by [Redacted] [Job title]
Reviewed by [Redacted] [Job title]
Approved by I confirm that this deliverable meets the requirements of Product Description and that all consultation comments have been addressed to the satisfaction of consultees. [Redacted] Sponsor

Document History

Revision	Date	Summary of changes
V0.1	14/05/14	First draft issued for comment
V0.2	17/03/15	Second draft

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Introduction

This report presents the operational assessment of options for connecting the London Overground network into the High Speed 2 (HS2) proposals at Old Oak Common. The assessment sets out the operational viability for each of the three options being considered, including timetable feasibility, impacts on existing operations and requirement for supporting assets, such as rolling stock and stabling facilities.

To demonstrate the viability of the scheme and support the case for investment, TfL commissioned WSP and Farrells to undertake a series of work packages to support a GRIP 3 equivalent study and identify a single preferred option. As well as assessing the viability, this document makes recommendations for a preferred option to support the selection of a single preferred option.

Background

The HS2 Ltd's proposals at Old Oak Common will see the construction of a new HS2, Crossrail and National Rail station. This will provide strong national and regional connections for rail passengers and local communities but fails to maximise the opportunities to connect in the new interchange at a local level.

Although the North and West London lines pass very close to Old Oak Common, there are no plans to link passenger services on these routes into the new interchange. The nearest station on the London Overground network would be Willesden Junction, some 1.5km away. In the absence of a London Overground station at Old Oak:

- Passengers from northwest, west and southeast London, and locations in the southeast, will have to travel into Euston to access HS2. This will add unnecessary time to journeys and increase crowding at both Euston and the wider London Underground network
- Regeneration of the Old Oak Opportunity Area will be constrained, reducing the number and range of jobs available to local people and the number of essential new homes
- West London will continue to be disadvantaged by a lack of interchanges, leading to unnecessary journeys to and from central London

TfL is making the case to connect in the Overground network, either as part of HS2 Ltd's plans or as a standalone proposal and this document provides evidence to support that proposal.

Scope of work

The railway operations work package can be split down to a number of activities, led by TfL with support from Network Rail and the consultants where necessary.

These activities can be summarised in the table below.

Item	Content
Stabling locations	Identify suitable stabling locations for additional rolling stock as identified in the relevant work package below.
Turnback facilities	Identify suitable locations for turning back rolling stock in the Willesden / Old Oak Common area for each option.
Railway maintenance	Working with NR and WSP identify impacts on maintenance activities and possessions requirements for the railway.
Timetable development	Calculate planning values and produce peak and off-peak standard hour timetables for North and West London lines. Work supported by methodology for determining new values as well as assumptions and risks.
Rolling stock requirements	Assessment of rolling stock requirements to support the additional call at Old Oak Common (assuming that likely committed schemes are delivered separately).
Freight impacts	Freight impacts to be assessed as part of timetable development and includes briefing to freight industry representatives to gain feedback.
Operating costs	Cost estimate to include key operating and industry costs, including rolling stock, driver and station costs.
Rolling stock costs	Rolling stock charges are based on the Shadow Bid for the procurement of London Overground rolling stock (Class 378) (2014).

Operational assessment

Overview

The operational assessment of the Overground station at Old Oak Common was led by TfL, with support from Network Rail and WSP.

The purpose of the operational assessment was to ensure that the proposed station would be able to support an additional call on existing passenger services that operate on the North and West London lines (NLL and WLL). In addition, the assessment also took account of anticipated short and medium term growth on the railway, with a series of 'likely committed' schemes being included within the assessment that would occur irrespective of an Overground station at Old Oak Common being constructed. Impacts on freight operations were also considered as part of the assessment.

The service specification in table 1 was assumed as the Reference Case (2041) (future year without the Overground station in place) when assessing the operational viability of each option.

Service group	Train length	AM and PM peak frequency, trains per hour (tph)	Off Inter peak frequency, trains per hour (tph)
Richmond to Stratford	Up to 8-car (5-car from 2015)	4	4
Clapham Junction to Stratford	Up to 8-car (5-car from 2015)	6 (currently 4tph)	4 (currently 2tph, plus 2tph between Clapham Junction and Willesden Junction)
East/South Croydon to Watford Junction/Milton Keynes Central	Up to 8-car	2 (currently varies during peak periods)	1
Clapham Junction to Shepherds Bush	Up to 8-car	2 (currently varies during peak periods)	0
Nominal freight paths on the NLL and WLL	Up to 775m	2	4

Table 1: Summary of future train service proposition used to develop the timetable of a station at Old Oak Common

Unless otherwise stated, infrastructure on the NLL and WLL was assumed to be as existing and there were no anticipated service enhancements outside those being proposed as part of the Old Oak Common station. It should be noted however that, as of 2014, the WLL is capable of accommodating 8-car passenger services, and as of 2015, the NLL will be capable of operating 5-car passenger services. No

enhancements to lengthen the fleet of 5-car London Overground Class 378s were proposed as part of this assessment, although 8-car trains on the NLL and WLL were assumed for the purposes of developing the business case. As Old Oak Common will need to be designed to accommodate the longest passenger service on the NLL and WLL, any new infrastructure proposed as part of this scheme is specified to accommodate 8-car trains of up to 170m length.

The assessment included within this report refers to operational viability during peak periods unless otherwise stated.

Please refer to the summarised operational assessments in each of the option chapters for an overview of the outputs. The key disciplines that were covered were;

Work packages

Timetable Development

For each of the options a standard peak and off-peak timetable was developed for passenger and freight services on the NLL and WLL. This was to demonstrate that the inclusion of an additional call in the Old Oak Common area could be accommodated without adversely impacting the operation of services along the corridor.

Turnback Requirement

A key part of the proposition for the WLL and NLL to serve Old Oak Common is to extend the existing, peak only Clapham Junction to Shepherds Bush service to Old Oak Common. In extending this service, it would operate beyond the facility it currently reverses in on the North Pole Depot Reception line, and therefore a new facility in the Old Oak Common area needed to be identified.

A sifting exercise was undertaken to identify feasible alternatives. This was completed to assess the potential positive and adverse impacts on operations, engineering and stakeholder views and aspirations. The assessment was completed on a qualitative basis unless quantitative evidence was available to support an argument, such as capacity or distance of empty running.

An overview of the assessment is included under the 'turnback requirement' sub-chapter.

Rolling Stock Requirements

Through the development of a timetable for each of the options, the number of additional units required to operate each of the station locations was calculated.

Stabling Requirements

Additional stabling requirement brought about by the introduction of a new station at Old Oak Common was assessed to identify appropriate locations for units to be accommodated overnight.

Rolling Stock and Operating Costs

Operating costs have been calculated to take account of key industry and train operator costs. These costs are principally a factor of distance operated and have been factored on that basis. For ease of reporting, costs for each option are presented on an industry basis and include costs for services that operate on the

NLL and WLL, including London Overground and Southern services. Costs are also calculated for station operations

Where appropriate, estimates are made using CP5 charges and train and station staff costs are estimated using current (2014) contract charges.

Rolling stock charges are based on the Shadow Bid for the procurement of London Overground rolling stock (Class 378) (2014). The costs are based on leasing of additional rolling stock and include a nominal charge for maintenance (on an annual basis).

Freight Impacts

As with passenger usage on the NLL and WLL, the freight market continues to grow and this is reflected by forecasts in the Freight Market Study as part of Network Rail's Long Term Planning Process (LTPP). While it is difficult to determine the usage of specific train paths at the date the Old Oak Common station is likely to open, an assessment of nominal freight paths was undertaken as part of the timetable development.

An overview of each of the options being considered was also presented to the relevant freight operators in order to seek their high level view on the level of acceptability of each of the options. Copies of the minutes from the meeting are available in document reference 'OOC FOC Consultation Meeting Notes'.

Railway Maintenance

The impacts on railway maintenance of each option were assessed at a high level to determine where infrastructure maintenance requirements may increase and therefore require changes to the possession regime. It is anticipated that this will be reviewed in greater detail in advance of gaining an Approval in Principle (AIP) from Network Rail upon the completion of the GRIP 3 development stage.

Option A

Overview

Option A proposes that a new station would be constructed on the NLL, just north of Acton Wells Junction. It would be served by both NLL and WLL services, the latter would operate through the station via a new viaduct which links the NLL near Acton Wells Junction to the WLL near North Pole Junction.

Please refer to Appendix C for a diagram of the proposal.

Timetable development

The initial timetabling assessment of Option A demonstrated that the train service specification could be operated on a two platform layout at the Old Oak Common station.

The key characteristics of the service at Old Oak Common station are summarised in table 2 and figure 1.

Service	Peak frequency (trains per hour)	Old Oak Common platform	Direction of travel
Stratford to Richmond	4tph	Platform 1	Westbound
Richmond to Stratford	4tph	Platform 2	Eastbound
Stratford to Clapham Junction	6tph	Platform 1	Westbound
Clapham Junction to Stratford	6tph	Platform 2	Eastbound
Clapham Junction to Old Oak Common (and returning)	2tph	Platform 2	Terminating Looping via South West Sidings

Table 2: Service characteristics of Option A through Old Oak Common

Services included within the specification but not calling at Old Oak Common include:

- East Croydon to WCML via WLL (2tph)
- Nominal peak freight on all routes (2tph)

The proposed infrastructure at Old Oak Common is able to accommodate the proposed train services during peak and off-peak periods. The structure of the NLL and WLL service pattern is similar to today, with the location where passenger services interweave moving south from Willesden High Level to Acton Wells Junction.

Following a sift of turnback locations for the peak only Clapham Junction to Old Oak Common service, the timetable includes looping of this service via South West

Sidings and West London Junction in a clockwise direction to make its return journey to Clapham Junction. This negates the need to provide a dedicated turnback facility within the platforms at Old Oak Common.

However, due to timetabling constraints, it is only possible to provide 1 minute layover time to make this move. Further work is require to understand if this time allowance is adequate as it may introduce additional performance risk and may not be technically achievable depending on driver arrangements for programming the onboard train computers for the return journey. The feasibility of this should be investigated and reported as part of a completed GRIP 3 study in 2015.

Option A service pattern
NLL & WLL station at Old Oak Common Lane
 Service Specification for the AM high peak hour (08:00 – 09:00)



Service	Frequency (tph) – peak (off-peak)	Reversing, through or avoiding OOC
Richmond to Stratford	4 (4)	through
Clapham Junction to Stratford	6 (4)	through
Clapham Junction to Willesden Junction		
Watford Junction to Clapham Junction	1 (0)	avoid
Milton Keynes to South Croydon	1 (1)	avoid
Shepherds Bush to Clapham Junction		
OOO to Clapham Junction	2 (0)	via SWS
Total (serving OOC station)	12 (8)	

Figure 1: Service proposition for Option A

The feasibility of operating the Clapham Junction to Old Oak Common service during off peak periods was also assessed to identify if additional off peak capacity could be provided, however the interface with freight services limited the feasibility of this. In order to achieve this, it is likely that the Timetable Planning Rules through Acton Wells Junction would have to be challenged, or potentially leading to a trade off between passenger and freight capacity.

Turnback requirement

A key part of the proposition for the WLL and NLL to serve Old Oak Common is to extend the existing, peak only Clapham Junction to Shepherds Bush service to Old Oak Common. In extending this service, it would operate beyond the facility it currently reverses at on the North Pole Depot Reception line, and therefore a new facility in the Old Oak Common area needed to be identified.

A sifting exercise was undertaken to identify feasible alternatives. This was completed to assess the operational, engineering and wider stakeholder impacts.

A summary of the locations considered as part of Option A is provided in figure 2.

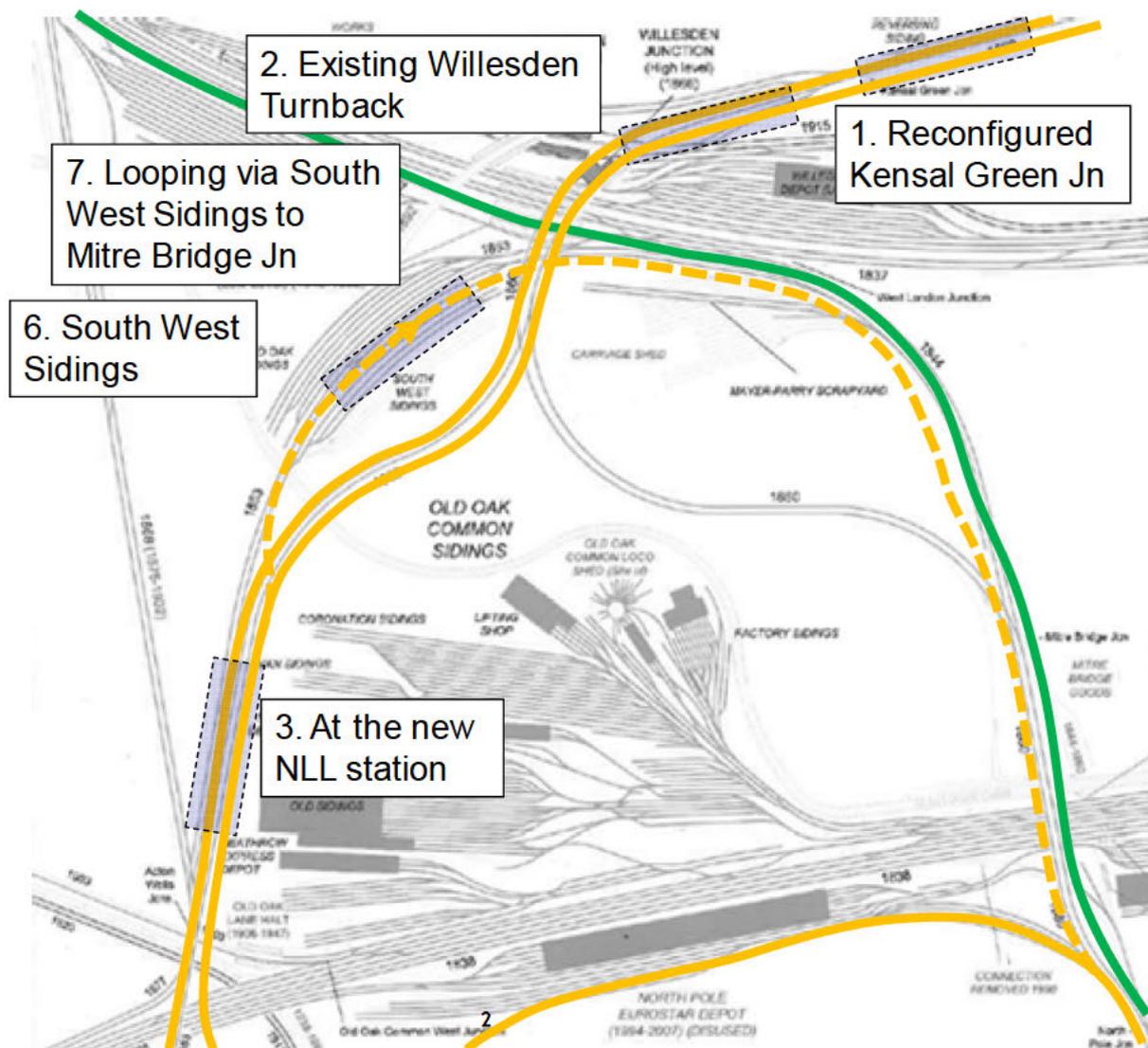


Figure 2: Turnback locations assessed as part of Option A

Five different locations were assessed for turning back the Clapham Junction to Old Oak Common service in Option A. Turning back at locations 1 (Kensal Green Jn) and 2 (existing Willesden turnback) were discounted due to operational constraints and the need to interweave with the small number of peak freight paths north of Willesden High Level Junction. In addition, it was determined that both locations would have required substantial investment to make them suitable to turnback 8-car trains.

Location 3 (at the new NLL station) was also considered but discounted due to the need to build a three platform station at this location, making it more complex to construct and it being less desirable in terms of a passenger proposition.

Location 7 (looping via South West Sidings to Mitre Bridge Jn) was concluded as being more favourable than location 6 (turning back at South West Sidings) due to operational efficiency gained from operating a 'through' service which avoided excess dwell times while the driver changed ends. It was noted however, that while the initial timetable assessment demonstrated that the preferred option was feasible, it would be subject to further detailed assessment to understand if this could be accommodated in the short layover time and agreement from the train operator. In addition, this further assessment should take account of potential changes to the traction changeover proposition on the WLL which may speed up the changeover process and could allow for additional layover time to be included within the timetable. This would be completed as ahead of a completed GRIP 3 assessment in 2015.

Rolling stock requirements

In order to accommodate an Overground station adjacent to Old Oak Common Lane in Option A, the journey time of the Richmond to Stratford service will increase by approximately 2 minutes. In addition, the requirement to reroute the Clapham Junction to Stratford service via the new viaduct extends the journey time by approximately 4 to 5 minutes on this service compared to the existing end to end journey time.

On a round trip, depending on interoperation of the NLL and WLL services, this could extend the journey time by up to 10 minutes. It has been calculated from the timetable outputs that two additional units are required to support the service.

Analysis of the timetable outputs indicates that no additional units are required to operate the extension of the Clapham Junction to Shepherds Bush shuttle to Old Oak Common. This is principally because the service would have to operate as far as Mitre Bridge Junction without the Old Oak Common station in order to reverse in the North Pole Depot Reception line, which is 1.5 miles beyond Shepherds Bush.

Stabling requirements

The additional two units required to operate the revised train service are unlikely to impact the stabling strategy for the Overground network. In the medium term there are a series of likely committed schemes to enhance the Overground train service (such as increasing service frequency on the WLL and deploying electric multiple units (EMUs) on the Gospel Oak to Barking service following electrification of the route) which are likely to require additional stabling capacity. These enhancements are being progressed as part of the LOTRAIN programme.

An appropriate solution to addressing any additional stabling required to support the station therefore may be to include a requirement for any extra capacity that is required as part the Old Oak Common station within the LOTRAIN programme. Opportunities to do this should be explored further.

Potential additional stabling capacity required to support train lengthening which may be progressed independently of this station proposal is not included within this assessment.

Rolling Stock and Operating Costs

Estimated rolling stock and operating costs are shown in table 3 below.

Cost element	Cost basis	£ p/a (unless otherwise stated)
Additional until miles operated		
Variable Track Access Charge (VTAC)	CP5 usage charges	
Capacity Charge	CP5 usage charges	
Fixed Track Access Charge (FTAC)	CP5 usage charges	
Electricity Charges for Traction (EC4T)	CP5 usage charges	
Train driver costs	Overground driver costs	
Total incremental operating costs		
Station operating costs	Overground Contract	
Incremental rolling stock costs	Overground Shadow Bid	
Total annual costs		

Table 3: Operating costs for Option A

As there is a negligible increase in the number of train miles operated per annum, there is only a marginal increase in the total operating costs. The number of unit miles increase by approximately 99,000 in Option A.

The principle driver for increase in operating costs is the requirement for two additional units to support the service.

Freight Impacts

The introduction of additional infrastructure to separate out most passenger and freight flows through Acton Wells Junction is a key benefit of Option A. This would result in their being minimal interaction between the two services, with NLL freight flows being the only movement to directly conflict with passenger services at Old Oak Common Junction. This is demonstrated in figure 3 below. Routing peak only Clapham Junction to Old Oak Common services via South West Sidings and West London Junction may impact on the small number of peak only freight paths from the WLL, however, it was not determined to be an insurmountable issue and could be managed with careful timetabling.

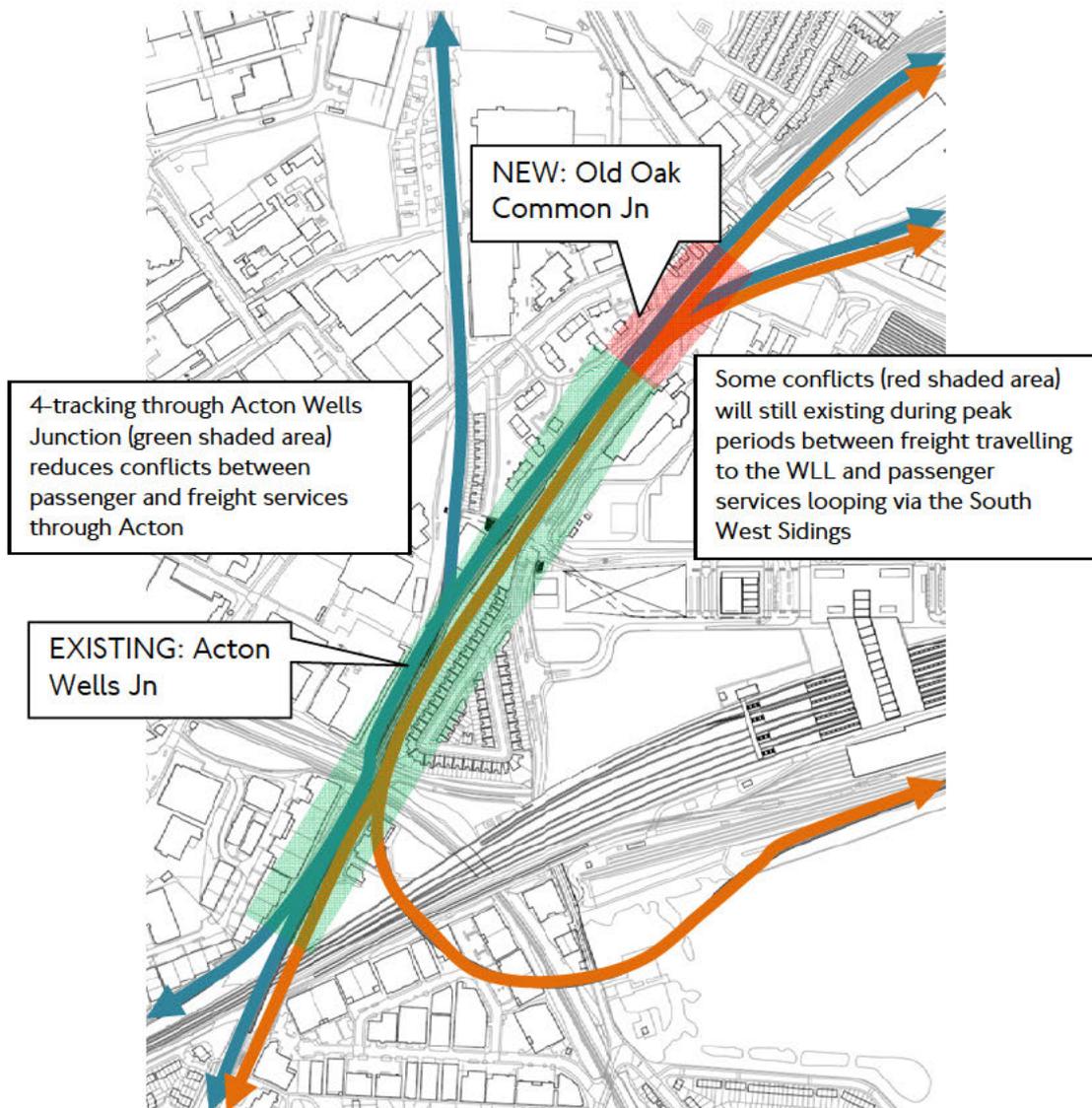


Figure 3: Proposed infrastructure for Option A reducing conflicts between freight and passenger services

Railway maintenance

A key component of delivering Option A is the provision of a new viaduct linking the WLL at Mitre Bridge Junction to the NLL at Acton Wells Junction. This is seen as beneficial for maintaining the railway as two routes would be available between the WLL and NLL during periods of planned and unplanned perturbation, and these can be used interchangeably by passenger services if one is unavailable due to maintenance requirements, for example. It should be noted however that the new route past the Intercity Express Programme (IEP) depot is unlikely to be permissible for freight services and therefore will be of limited or no benefit to this service group during perturbation.

Further ancillary benefits are that the new viaduct is likely to be constructed with slab track, reducing the frequency it would need to be maintained, and diversion of the WLL service away from Mitre Bridge Junction will reduce track wear through this location, and thus the frequency at which the track will need to be maintained.

While these benefits will assist in reducing maintenance requirements, it is likely that overall maintenance requirements for the railway in the Old Oak Common area will increase with Option A. The redesign of Acton Wells Junction with increased track work and this together with the specification to operate a higher frequency service through the junction will increase maintenance requirements. In addition, tight track curvature (190m radius at its tightest) along the western end of the new viaduct and changes in vertical track geometry (3.2% gradient) to the eastern end of the viaduct are both likely to increase maintenance requirements. Other issues were also identified with the location of switches and crossovers on bridge structures and the need to maintain track through the new station as further maintenance requirements.

Given the substantial increase in infrastructure within Option A, it is anticipated that the impact on railway maintenance would be most adverse if this option was progressed. This impact is heightened by the complexity of the infrastructure as well as tight track curvature and steep gradients.

Option B

Overview

Similar to Option A, Option B proposes a new station on the NLL, just north of Acton Wells Junction which would be served by both NLL and WLL services. However, unlike Option A, WLL services are proposed to connect to the station largely using existing rail infrastructure via West London Junction and the South West Sidings.

Three options were assessed as part of the timetable development for Option B;

- Option Bi – Split WLL service with services operating Clapham Junction to Stratford and Clapham Junction to Old Oak Common
- Option Bii – A through WLL service from Clapham Junction to Stratford, reversing at Old Oak Common
- Option Biii - Split WLL service with services operating Clapham Junction to Stratford and Clapham Junction to Hounslow

Please refer to Appendix C for a diagram of the proposal.

Option Bi

Timetable development

The initial timetabling assessment of Option Bi (with a split West London Line (WLL) service) demonstrated that the train service specification could be operated on a three platform layout at the Old Oak Common station.

The key characteristics of the service at Old Oak Common station are summarised in table 4 and figure 4.

Service	Peak frequency (trains per hour)	Old Oak Common platform	Direction of travel
Stratford to Richmond	4tph	Platform 1	Westbound
Richmond to Stratford	4tph	Platform 2	Eastbound
Clapham Junction to Old Oak Common (and returning)	4tph	Platform 3	Terminating from a north direction

Table 4: Service characteristics of Option Bi through Old Oak Common

Services included within the specification but not calling at Old Oak Common include:

- Clapham Junction to Stratford (4tph)
- East Croydon to WCML via WLL (2tph)
- Nominal peak freight on all routes (2tph)

It is possible to achieve an approximate even headway on all services within the specification. However, as the route between Clapham Junction and Stratford is limited to accommodating approximately 12tph, it is necessary to reduce the service frequency of these services from 6tph to 4tph compared to the Reference Case (in table 1, Overview chapter) in order to accommodate 4tph operating from Clapham Junction to Old Oak Common as well as other passenger services to the WCML and nominal peak freight services. Retaining service frequencies between Clapham Junction and Stratford at 6tph (totalling 14tph) would exceed the capacity of the WLL. This is also shown in Table X below.

West London line service frequencies	Viable train service Peak frequency (trains per hour, in one direction)	Non-viable train service Peak frequency (trains per hour, in one direction)
Clapham Junction to Old Oak Common	4tph	4tph
Clapham Junction to Stratford	4tph	6tph
East/South Croydon to Milton Keynes Central/Watford Junction	2tph	2tph
Nominal peak freight paths	2tph	2tph
Total service frequency on the WLL	12tph	14tph

Table x: West London line service frequencies.

In order to retain current connectivity between WLL and NLL stations as well as providing a 4tph service from the WLL to Old Oak Common, this would drive an excess of paths on the WLL. As a consequence, stations east of Willesden Junction would receive a net reduction in passenger train service from 10tph to 8tph. This is the main shortfall of this service specification and it would not be possible to address this unless the frequency of other passenger or freight service groups is reduced.

Option Bi service pattern
NLL & WLL station at Old Oak Common Lane
 – via the Acton Wells Loop with a split WLL service
 Service Specification for the AM high peak hour (08:00 – 09:00)



Service	Frequency (tph) – peak (off-peak)	Reversing, through or avoiding OOC
Richmond to Stratford	4 (4)	through
Clapham Junction to Stratford	4 (2)	avoid
Clapham Junction to Willesden Junction		
Watford Junction to Clapham Junction	1 (0)	avoid
Milton Keynes to South Croydon	1 (1)	avoid
Shepherd's Bush to Clapham Junction		
OOC to Clapham Junction	4 (2)	reverse
Total (serving OOC station)	8 (6)	

Figure 4: Service proposition for Option Bi

The feasibility of mitigating this capacity gap was assessed at a high level by introducing a Willesden Junction to Stratford via Gospel Oak service. While no timetable was developed for this, it was found that introducing this service would only partly address this issue as the reduction in capacity between North London Line (from Willesden Junction east) and West London Line (from

Shepherds Bush south) stations would continue to exist, reducing the overall benefits of the scheme. In addition, it would be technically difficult to terminate Overground services at Willesden Junction without the provision of new infrastructure in the Willesden Junction area in order to turn back Overground services arriving from the east. This would increase costs, but has not been assessed as part of this study so the magnitude of expenditure is unknown.

During off-peak periods, the increase in the required number of freight paths places further constraints on the timetable. In order to retain a 4tph service from Clapham Junction to Stratford as well as the WLL to WCML passenger paths, it is only possible to deliver a train every 30 minutes between Clapham Junction and Old Oak Common. This is a lower service frequency than could be delivered in either Options A or C.

Due to the adverse impacts of this service proposition on reducing service frequency between Clapham Junction and Stratford, and the subsequent impacts on passengers' journeys, it was decided not to progress this option further.

Information on rolling stock, infrastructure and costs below is provided for completeness.

Turnback requirement

A key part of the proposition for the WLL and NLL to serve Old Oak Common is to extend the existing, peak only Clapham Junction to Shepherds Bush service to Old Oak Common. In extending this service, it would operate beyond the facility it currently reverses in on the North Pole Depot Reception line, and therefore a new facility in the Old Oak Common area needed to be identified.

A sifting exercise was undertaken to identify feasible alternatives. This was completed to assess the operational, engineering and wider stakeholder impacts.

A summary of the locations considered as part of Option B is provided in figure 5.

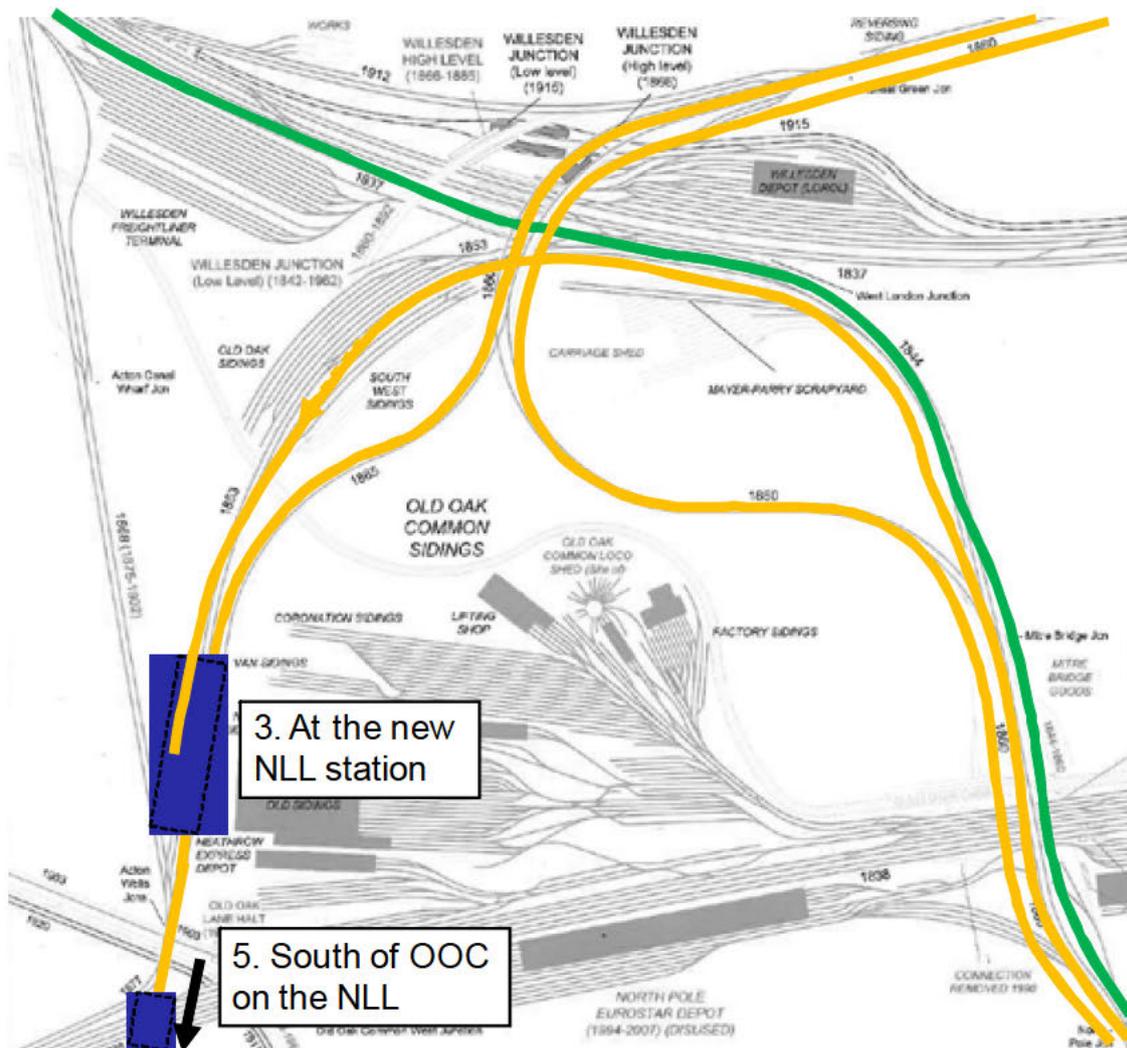


Figure 5: Turnback locations assessed as part of Option B

Due to the operating characteristics of Option B, there were limited options for locations to turnback the Clapham Junction to Old Oak Common service. To operate the shuttle service using location 5 (south of OOC), trains would have to depart Old Oak Common out of passenger service to turnback at a location between Acton Wells Junction and Acton Central station. This would have required interweaving with freight through Acton Wells Junction as well as track work to accommodate a centre turnback, and was therefore discounted.

Option 3 (at the new NLL station) was progressed as the preferred location to turnback the shuttle service. While this requires additional platform infrastructure in the Acton Wells Junction area, it provided an effective operational solution which allowed the Clapham Junction to Old Oak Common service to operate independently of the NLL passenger service and any freight services not operating via the South West Sidings.

Rolling Stock Requirements

Due to the reduction in frequency on the Clapham Junction to Stratford service it was calculated that no additional units were required to operate this option.

Although no formal assessment was undertaken, it was estimated that the trains that would have been removed from the Clapham Junction to Stratford service would have been required to support the extension of the Clapham Junction to Shepherds Bush service to Old Oak Common as well as increasing the service frequency from 2tph to 4tph.

Stabling Requirements

As it was identified that no additional rolling stock was required to operate this option, no additional stabling sites were required,

Rolling Stock and Operating Costs

Estimated rolling stock and operating costs are shown in table 6 below.

Cost element	Cost basis	£ p/a (unless otherwise stated)
Additional unit miles operated		
Variable Track Access Charge (VTAC)	CP5 usage charges	
Capacity Charge	CP5 usage charges	
Fixed Track Access Charge (FTAC)	CP5 usage charges	
Electricity Charges for Traction (EC4T)	CP5 usage charges	
Train driver costs	Overground driver costs	
Total incremental operating costs		
Station operating costs	Overground Contract	
Incremental rolling stock costs	Overground Shadow Bid	
Total annual costs		

Table 6: Operating costs for Option Bi

Please note that these costs currently exclude station operating costs.

As this option would have resulted in a reduction in the service frequency in the Clapham Junction to Stratford services from 6tph to 4tph, it was therefore calculated that there would be operating cost savings. The number of unit miles decrease by approximately 280,000 in Option Bi. This operating cost saving was reflected in the business case assessment, and while it may have made this option more affordable, there would also be a reduction in passenger benefits as a result of operating a less frequent service.

For the purposes of the assessment, it was assumed that units that would no longer be required due to the reduction in frequency on the Clapham Junction

to Stratford service, would remain under TfL lease, and therefore, there would be no financial saving. In addition, while no formal assessment was undertaken, the likelihood would be that these units would be redeployed to support the enhanced Clapham Junction to Old Oak Common service which was specified to increase from 2tph to 4tph.

Freight Impacts

Option Bi was seen to introduce the greatest adverse impacts on freight services (compared to Options A and C), due to the greater use of infrastructure by passenger services through South West Sidings and West London Junction during peak and off-peak periods. Currently these routes are very lightly used and therefore serve as a regulating point to recess freight between different routes. This functionality would largely be lost by operating passenger services along this section of route and this potentially could have an adverse impact on both passenger and freight performance.

Railway Maintenance

The service proposition for Option Bi includes a reduction in the number of services operated along the NLL, potentially reducing maintenance requirements, but overall, the additional switches and crossovers to the south of the South West Sidings and diversion of passenger service along this section of alignment are likely to increase maintenance requirements in this area. As with all options, the introduction of a new station with trains braking and accelerating on approach and departure will increase maintenance and possession requirements.

While Option Bi does not deliver the same intensive use of key junctions such as Acton Wells as seen in Option A, it will substantially increase track and point usage through West London Junction and the South West Sidings, and was assessed accordingly.

Conclusion

The operational assessment of this option has demonstrated that it is feasible to operate this service in principle; however, there would be a resulting reduction in frequency between WLL and NLL stations which is not likely to be acceptable. The potential impacts on freight operations through West London Junction and South West Sidings is also considered a high risk and is therefore not recommended to be progressed further.

Option Bii

Timetable development

The initial timetabling assessment of Option Bii (reversing WLL services at Old Oak Common) demonstrated that the train service specification could not be operated on the proposed infrastructure (four platform station) at Old Oak Common.

The key characteristics of the service at Old Oak Common station are summarised in table 7 and figure 6.

Service	Peak frequency (trains per hour)	Old Oak Common platform	Direction of travel
Stratford to Richmond	4tph	Platform 1	Westbound
Stratford to Clapham Junction	6tph	Platform 2	Reversing from a north direction
Clapham Junction to Stratford	6tph	Platform 3	Reversing from a north direction
Richmond to Stratford	4tph	Platform 4	Eastbound
Clapham Junction to Old Oak Common	2tph	Not feasible to path	Terminating from a north direction

Table x: Service characteristics of Option Bii through Old Oak Common

Services included within the specification but not calling at Old Oak Common include:

- East Croydon to WCML via WLL (2tph)
- Nominal peak freight on all routes (2tph)

Option Bii service pattern
NLL & WLL station at Old Oak Common Lane
 – via the West London Loop with a reversing WLL service
 Service Specification for the AM high peak hour (08:00 – 09:00)



Service	Frequency (tph) – peak (off-peak)	Reversing, through or avoiding OOC
Richmond to Stratford	4 (4)	through
Clapham Junction to Stratford	6 (4)	reverse
Clapham Junction to Willesden Junction		
Watford Junction to Clapham Junction	1 (0)	avoid
Milton Keynes to South Croydon	1 (1)	avoid
Shepherds Bush to Clapham Junction		
OOC to Clapham Junction	2 (0)	reverse
Total (serving OOC station)	12 (8)	

Figure 7: Service proposition for Option Bii

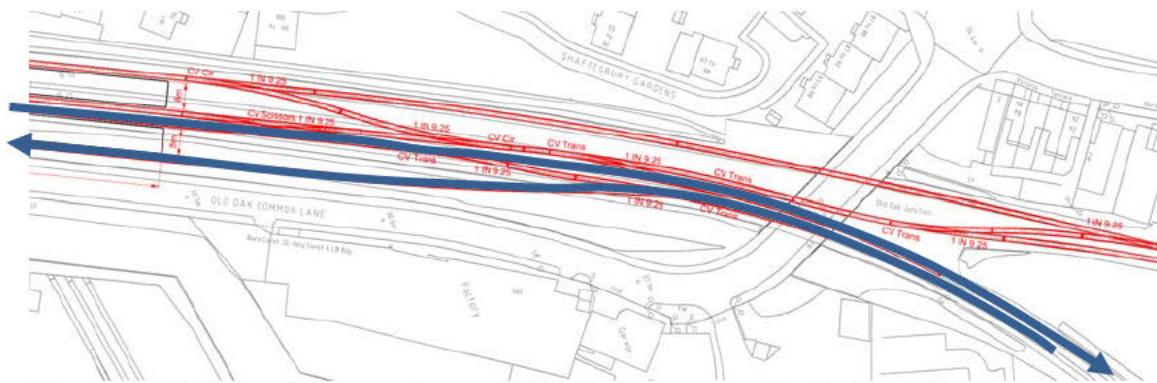


Figure 8: Pathing NLL services at Old Oak common in Option Bii

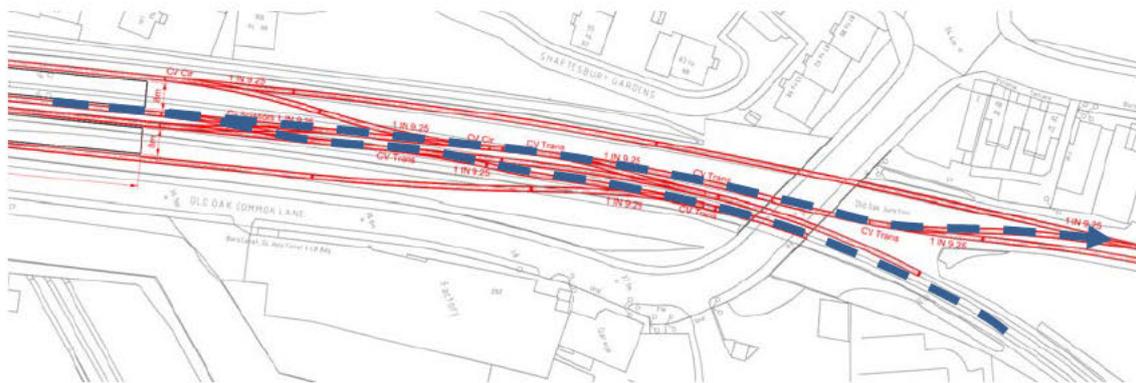


Figure 9: Pathing Clapham Junction to Stratford services in Option Bii



Figure 10: Pathing Stratford to Clapham Junction services in Option Bii

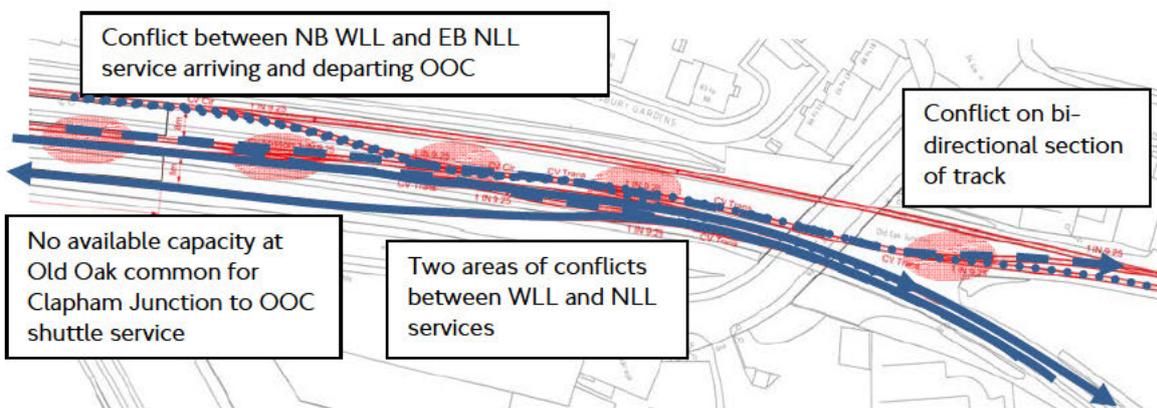


Figure 11: Pathing conflicts between WLL and NLL services at Old Oak common

The principal challenges with accommodating this train service specification were the extended platform occupation times of terminating or reversing trains within platforms 3 and 4 at the station and the high volume of conflicting moves to the north of the Old Oak Common station. This second challenge is demonstrated in figures 8 to 10 and overlaid together in figure 11.

Assuming a four platform station at Old Oak Common, platforms 1 and 2 would be exclusively used by Richmond to Stratford services, while platforms 3 and 4 would be utilised by passenger services from Clapham Junction to Stratford as well as the Clapham Junction to Old Oak Common shuttles. This arrangement is proposed to make best use of available capacity. However, due to the requirement for all trains using platform 3 and 4 to make reversing or terminating moves, this extends platform occupation times. It is calculated that from the time a train enters the station to when it departs and the platform is available for the next train, would be a minimum of 10 minutes (note, this could be reduced by stepping back drivers, but is unlikely to provide substantial additional platform capacity to make this option any more viable).

Using this assumption, it would only be feasible to operate a 6tph service from Clapham Junction to Stratford via Old Oak Common if the timetable structure could be guaranteed with even headways and trains presented themselves on schedule. It would not be feasible to accommodate the Clapham Junction to Old Oak Common shuttles in addition to this as the platforms would already be occupied 100% of the time.

In addition to insufficient platform capacity, the high volume of crossing moves to the north of the station is also a key issue. In order to operate the service between Clapham Junction and Stratford via Old Oak Common, each train travelling in the eastbound direction would have to cross the corresponding services in the westbound direction, while the westbound service would additionally be required to cross the eastbound Richmond to Stratford service. This could create in excess of 18 conflicting moves per peak hour, excluding those with freight or the Clapham Junction to Old Oak Common shuttle service. This placed substantial constraints on the flexibility of the timetable and the ability to deliver a reliable train service would unlikely to be achievable.

Conclusion

As the proposed infrastructure would not be able to support the proposed train service specification and there would be substantial adverse impacts on service performance, the decision was made not to progress this option further,

Option Biii

Timetable development

The initial timetabling assessment of Option Biii (operating Overground services beyond Old Oak Common to southwest London) demonstrated that the train service specification could be operated on a two platform layout at the Old Oak Common station. It should be noted however that no formal timetable

assessment has been undertaken, and that this is based on the specification of Option Bi.

The key characteristics of the service at Old Oak Common station are summarised in table 8 and figure 12.

Service	Peak frequency (trains per hour)	Old Oak Common platform	Direction of travel
Stratford to Richmond	4tph	Platform 1	Westbound
Richmond to Stratford	4tph	Platform 2	Eastbound
Clapham Junction to southwest London	4tph	Platform 1	Westbound
Southwest London to Clapham Junction	4tph	Platform 2	Eastbound

Table 8: Service characteristics of Option Biii through Old Oak Common

Services included within the specification but not calling at Old Oak Common include:

- Clapham Junction to Stratford (4tph)
- East Croydon to WCML via WLL (2tph)
- Nominal peak freight on all routes (2tph)

The timetable for Option Bi includes the same level of train service operating to Old Oak Common station, albeit with only a two platform layout, and changes to the track work in the Acton Wells Junction area. Paths to extend the Clapham Junction to Old Oak Common beyond the station to other destinations in southwest London (feasibly Hounslow) were identified. No further work was undertaken to timetable these services west of Old Oak Common station.

Conclusion

It should be noted that while this option was demonstrated to be achievable in principle, the same constraints apply as identified in Option Bi and therefore this Option was not progressed further.

**Option Biii service pattern
NLL & WLL station at Old Oak Common Lane**

– via the Acton Wells Loop with a split WLL service
Service Specification for the AM high peak hour (08:00 – 09:00)



Service	Frequency (tph) – peak (off-peak)	Reversing, through or avoiding OOC
Richmond to Stratford	4 (4)	through
Clapham Junction to Stratford	4 (2)	avoid
Clapham Junction to Willesden Junction		
Watford Junction to Clapham Junction	1 (0)	avoid
Milton Keynes to South Croydon	1 (1)	avoid
Shepherds Bush to Clapham Junction		
OOO to Clapham Junction		
Hounslow to Clapham Junction	4 (2)	through
Total (serving OOC station)	8 (6)	

Figure 12: Service proposition for Option Biii

Option C

Overview

Option C proposes two new stations;

- A station on the NLL, just north of Acton Wells Junction; and,
- A station on the WLL between Mitre Bridge and Willesden High Level Junction.

Please refer to Appendix C for a diagram of the proposal.

Timetable development

The initial timetabling assessment of Option C demonstrated that the train service specification could be operated on a two platform layout at the Old Oak Common station and a three platforms layout at the Hythe Road station.

The key characteristics of the service at Old Oak Common station can be summarised in table 9 and figure 13:

Service	Peak frequency (trains per hour)	Old Oak Common platform	Direction of travel
Stratford to Richmond	4tph	Platform 1	Westbound
Richmond to Stratford	4tph	Platform 2	Eastbound
Stratford to Clapham Junction	6tph	Platform 1 (Hythe Road)	Westbound
Clapham Junction to Stratford	6tph	Platform 3 (Hythe Road)	Eastbound
Clapham Junction to Old Oak Common	2tph	Platform 2 (Hythe Road)	Eastbound

Table 9: Service characteristics of Option C through Old Oak Common

Services included within the specification but not calling at Old Oak Common include:

- East Croydon to WCML via WLL (2tph)
- Nominal peak freight on all routes (2tph)

The proposed infrastructure at Old Oak Common is able to accommodate the proposed train services during peak and off-peak periods.

The proposed infrastructure solution for Option C enables the current routing of NLL and WLL services to be retained, and can be considered the most straightforward of all the options to operate. A clear advantage of this option over others is the ability to operate the peak only Clapham Junction to Old Oak Common service independently

of the NLL. This reduces the level of interweaving between these services and provides some additional operational flexibility, particularly during or immediately following perturbed scenarios. This flexibility is enhanced by having neutral sections between the NLL and WLL, allowing the service to operate independently during planned and unplanned perturbation.

Option C service pattern

NLL station at Old Oak Common Lane and WLL station at Hythe Road
Service Specification for the AM high peak hour (08:00 – 09:00)



Service	Frequency (tph) – peak (off-peak)	Reversing, through or avoiding OOC
Richmond to Stratford	4 (4)	through
Clapham Junction to Stratford	6 (4)	through
Clapham Junction to Willesden Junction		
Watford Junction to Clapham Junction	1 (0)	avoid
Milton Keynes to South Croydon	1 (1)	avoid
Shepherd's Bush to Clapham Junction		
OOC to Clapham Junction	2 (0)	reverse
Total (serving OOC station)	12 (8)	

Figure 13: Service proposition for Option C

Turnback requirement

A key part of the proposition for the WLL and NLL to serve Old Oak Common is to extend the existing, peak only Clapham Junction to Shepherds Bush service to Old Oak Common. In extending this service, it would operate beyond the facility it currently reverses in on the North Pole Depot Reception line, and therefore a new facility in the Old Oak Common area needed to be identified.

A sifting exercise was undertaken to identify feasible alternatives. This was completed to assess the operational, engineering and wider stakeholder impacts.

A summary of the locations considered as part of Option C is provided in figure 14.

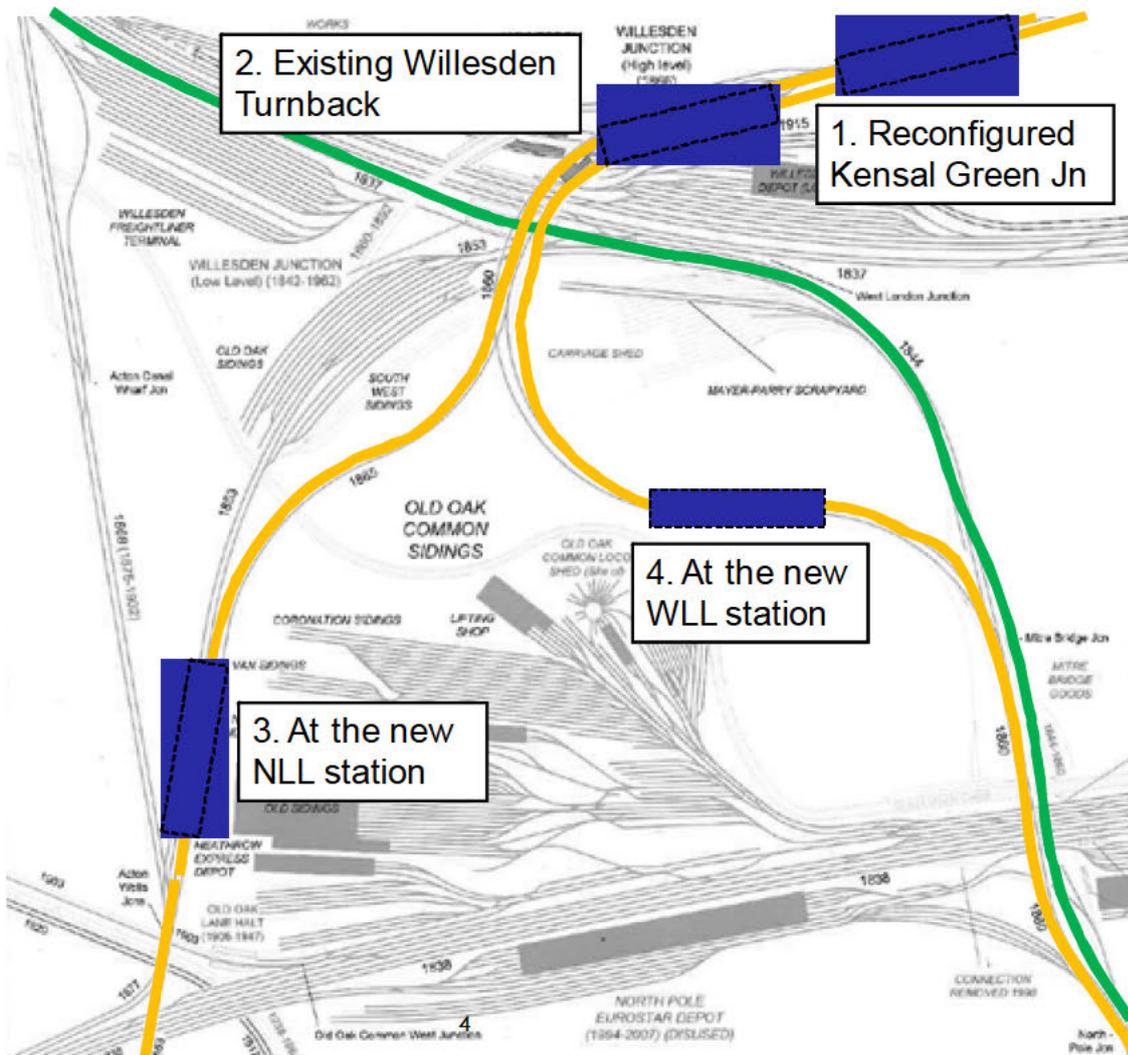


Figure 14: Turnback locations assessed as part of Option C

A number of the locations considered for Option C were common with Option A due to their similar operating characteristics. As with Option A, locations 1 (Kensal Green Jn) and 2 (existing Willesden turnback) were discounted due to operational and technical constraints. Location 3 (at the new NLL station) was also considered but discounted due to the need to build a three platform station at this location, making it more complex to construct and it being less desirable in terms of a passenger proposition. Location 4 (at the new WLL station) was progressed. In order to deliver this solution, a third platform is required within the Hythe Road station, requiring additional land take and ground works, however it delivers a substantially more

operationally robust solution. The three platform layout enables the shuttle service to operate independently of the NLL, reducing train conflicts and allows greater operational flexibility during periods of planned and unplanned perturbation. In addition, empty stock movements are also reduced.

Further work was also undertaken as part of the turnback sifting exercise for Option C to determine the platform layout of the station, with the platform layout in figure 15 identified as the preferred. This configuration requires widening of the railway alignment to the north in order to provide an island platform in the Up direction (towards Clapham Junction) so that passengers travelling towards stations on the WLL can board the first departing train. This platform layout allows for effective management of train and station operations by providing capacity to the largest flow of passengers. In addition, the layout with a centre turnback enhances the resilience of the train service by reducing conflicting moves. It was determined that these benefits outweighed the potential adverse impacts during construction of needing to widen the alignment at a location with poor road access.

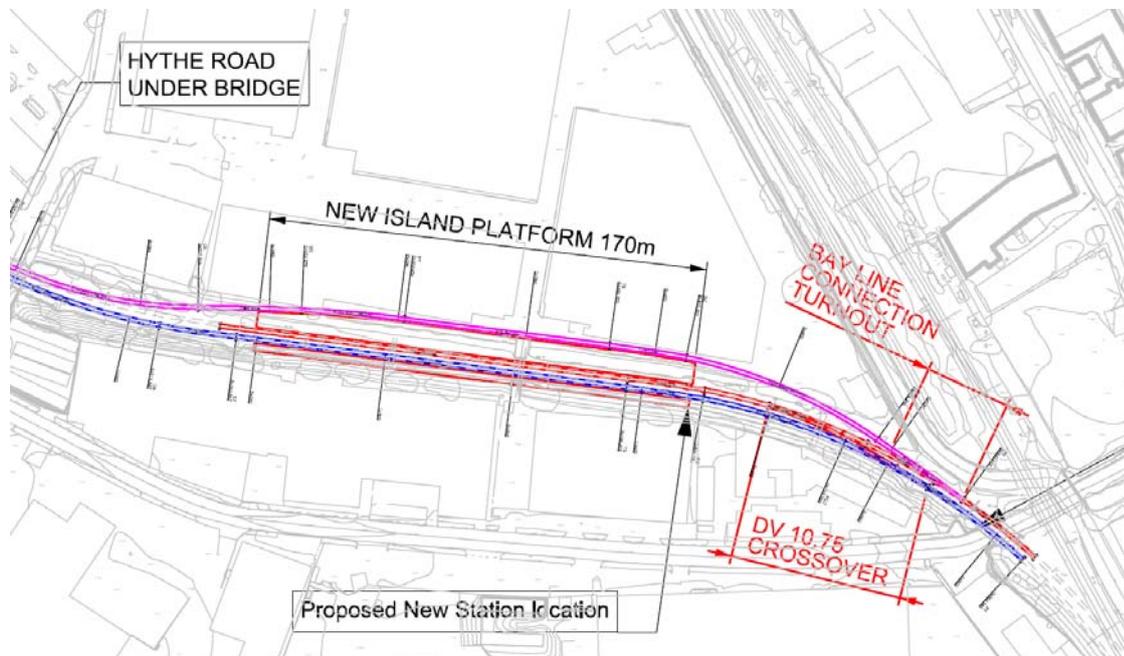


Figure 15: Option C, station layout at Hythe Road on the WLL. Doc ref: LOOC-ALLW-EPW-DGA-WSP-01221

Rolling stock requirements

With Option C the increase the journey time on both the Clapham Junction to Stratford and Richmond to Stratford service is calculated at approximately 2 minutes. This would lead to an extension of the round trip journey time by up to 4 minutes, requiring one additional unit to maintain the level of service.

Analysis of the timetable outputs indicates that no additional units are required to operate the extension of the Clapham Junction to Shepherds Bush shuttle to Old Oak Common. This is principally because the service would have to operate as far as Mitre Bridge Junction without the Old Oak Common station in order to reverse in the North Pole Depot Reception line, which is just short of the proposed station.

Stabling requirements

The additional unit required to operate the revised train service is unlikely to impact the stabling strategy for the Overground network. In the medium term there are a series of likely committed schemes to enhance the Overground train service (such as increasing service frequency on the WLL and deploying electric multiple units (EMUs) on the Gospel Oak to Barking route following electrification of the route) which are likely to require additional stabling capacity. These enhancements are being progressed as part of the LOTRAIN programme.

An appropriate solution to addressing any additional stabling required to support the station therefore may be to include a requirement for any extra capacity that is required as part the Old Oak Common station within the LOTRAIN programme. Opportunities to do this should be explored further.

In addition, isolated opportunities to provide extra stabling capacity may also exist with the infrastructure proposed as part of the Old Oak Common station. As part of Option C, a third platform would be provided at the Hythe Road station which could be utilised during off-peak periods or overnight when it is not required to support the train service. Further technical assessment of this proposal would be required to determine its feasibility.

Potential additional stabling capacity required to support train lengthening which may be progressed independently of this station proposal is not included within this assessment.

Rolling Stock and Operating Costs

Estimated rolling stock and operating costs are shown in table x10 below.

Cost element	Cost basis	£ p/a (unless otherwise stated)
Additional until miles operated		
Variable Track Access Charge (VTAC)	CP5 usage charges	
Capacity Charge	CP5 usage charges	
Fixed Track Access Charge (FTAC)	CP5 usage charges	
Electricity Charges for Traction (EC4T)	CP5 usage charges	
Train driver costs	Overground driver costs	
Total incremental operating costs		
Station operating costs	Overground Contract	
Incremental rolling stock costs	Overground Shadow Bid	
Total annual costs		

Table 10: Operating costs for Option C

Please note that these costs currently exclude station operating costs.

As there is a negligible increase in the number of train miles operated per annum, there is only a marginal increase in the total operating costs. The number of unit miles increase by approximately 16,000 in Option C.

The principal driver for increase in operating costs is the requirement for one additional unit to support the additional station call on the NLL and WLL.

Freight Impacts

The routing of passenger trains services with Option C do not change, and therefore the structure of the NLL and WLL timetables will largely remain as existing. For this reason, parallel moves which currently take place at Willesden High Level Junction (where NLL and WLL passenger service converge) can largely continue as is the current practice. This is therefore considered to be the most acceptable option to the freight industry.

Railway Maintenance

As Option C would deliver very little change in infrastructure or infrastructure usage, particularly in comparison to other options, it was determined that there will be little or no material impact on maintenance or possession requirements. It is anticipated that additional maintenance to switches and crossovers within the Acton Wells and Mitre Bridge Junction areas as well as track wear through the two new stations could be managed within the existing possessions regime with a negligible impact on asset renewals. Renewing assets that are at less than half life remaining at the time of construction would assist with this.

It was determined that Option C would have the least impact on railway maintenance and possession requirements compared to Options A and B, and is favoured on this assessment criteria because of this.

Conclusions and recommendations

Conclusion

The operational assessment has demonstrated that all three of Options A, B and C are operationally viable at this stage of assessment and are able to accommodate the specified level of service.

The key points of each option are summarised below.

Option A

- Able to support the specified train service
- Grade-separation of North Pole Junction required to avoid conflicts between WLL Overground services and residual freight services as well as passenger services to the WCML
- Additional track through Acton Wells Junction help reduce conflicts between freight and passenger services which was seen as a major benefit of this option
- Clapham Junction services looped via South West Sidings to increase efficiency and reduce infrastructure requirements
- Interaction with small number of peak freight paths via South West Sidings to be managed through effective timetabling

Option B

- Able to support the specified train service in Option Bi (operating 4tph from Clapham Junction to Stratford and 4tph from Clapham Junction to Old Oak Common)
- Insufficient capacity to operate all West London line services via Old Oak Common Lane station as shown in Option Bii. For this reason, this option is to be discounted.
- Trade off from operating to Old Oak Common in Option Bi is a reduction in Clapham Junction to Stratford service frequency from 6tph to 4tph – reducing capacity and connectivity.
- Train service frequency on the West London line would reduce further during off-peak periods (to accommodate freight)
- Interaction with all day freight via South West Sidings identified as a key issue
- Additional platform at OOC Lane required which is likely to present a more complex passenger proposition

Option C

- Able to support the specified train service
- Trains utilise existing routing in the Old Oak Common area, making more straightforward to timetable, particularly at junctions such as Willesden Junction High level
- Third platform at Hythe Road allows West London to operate 'self-contained' if required.
- Keeping current routing of Overground services is unlikely to substantially increase interaction with freight services
- Passenger proposition of operating two stations from Old Oak Common requires further consideration to ensure that the solution is navigable and straightforward to understand.

Recommendations

On the basis of the initial findings reported in this study it is recommended that Options A and C are progressed and considered further.

The interaction with freight and existing passenger services in the West London Junction area (South West Sidings) in Option B is likely to be difficult to manage, particularly during off-peak periods. This coupled with the reduction in passenger capacity between WLL and NLL stations is unlikely to be acceptable, and it is therefore recommended that this option is not progressed any further.

Next steps

This assessment has identified a number of areas which required further consideration and it is recommended that these are reviewed ahead of completing a full GRIP 3 study.

- Assess the impacts of any potential changes to the traction changeover proposition on the WLL on the timetable proposal for the Old Oak Common station
- Can stabling requirements be accommodated at existing sites.
- Assess the Impacts of introducing a new station at Old Oak Common on the interface with operating 6tph out of a single platform at Clapham Junction (already assumed to be in place).
- Interface and engagement with the rail industry, particularly freight operators.
- Impacts on maintenance of new and existing infrastructure
- Understanding of the interface with related projects, such as LOTRAIN and train lengthening of Overground units beyond the committed 5-car (LOCIP) programme.
- Station proposition for the concession operator and station functionality.

- Progress and completion of a Network Rail requirements documentation and TfL Operational Concept report

Additional detailed areas (which also relate to areas outside of the operational assessment) include:

- Undertake dynamic pedestrian modeling for Option C (both stations) to inform sizing requirements. Currently dynamic modeling has only been undertaken for the 'worst case', Option A. However, no dynamic modeling has been undertaken for the Hythe Road station.
- Gain a better understanding of the implications of a two stage opening of the Overground station (2020 and 2026) on operational viability (two minute journey time extension on the WLL but not the NLL as part of first phase), station staff requirements, rolling stock requirements etc.
- Consider how units transfer from their stabling location to be brought into service during perturbed scenarios – this may simply be a review of what happens today.
- Review whether the proposal requires a 'build' of an 8-car platform at the Old Oak Common Lane station given that it is unlikely that the NLL will be an 8-car railway by 2026. A more realistic approach would be to deliver platforms the length of the longest passenger train with provision to accommodate 160m trains (i.e. signaling and track layout in the appropriate location to make space provision.
- Given that TfL are currently in the process of gating a number of additional stations on the London Overground network, it would be beneficial to review whether the Old Oak Common station should be gated or alternative revenue protection measure should be put in place.
- Consider in greater detail how the phased development of Old Oak will impact on demand growth at the two stations, and how this may impact operational requirements up to 2026 before the HS2/GWML station opens.

Appendix A: Supporting information

Overview

An overview of the proposition for each option is summarised in the table below

Option	Description
Reference case	As current
Option A (previous Option 8.2)	New viaduct over the IEP depot sidings and a new station at Old Oak Common Lane
Option Bi (previous Option X)	Operation via South West Sidings and a new station at Old Oak Common Lane – service pattern in Bi with trains <u>terminating</u> at Old Oak Common
Option Bii	Operation via South West Sidings and a new station at Old Oak Common Lane – service pattern Bii with trains <u>reversing</u> at Old Oak Common on to Stratford
Option C (new option)	Operation along existing North and West London Lines with two separate stations at Old Oak Common Lane and Hythe Road
Option Biii (sensitivity)	Operation via South West Sidings and a new station at Old Oak Common Lane – Option Biii service specification (station adjacent to OOC Lane) – variation on Option Bii

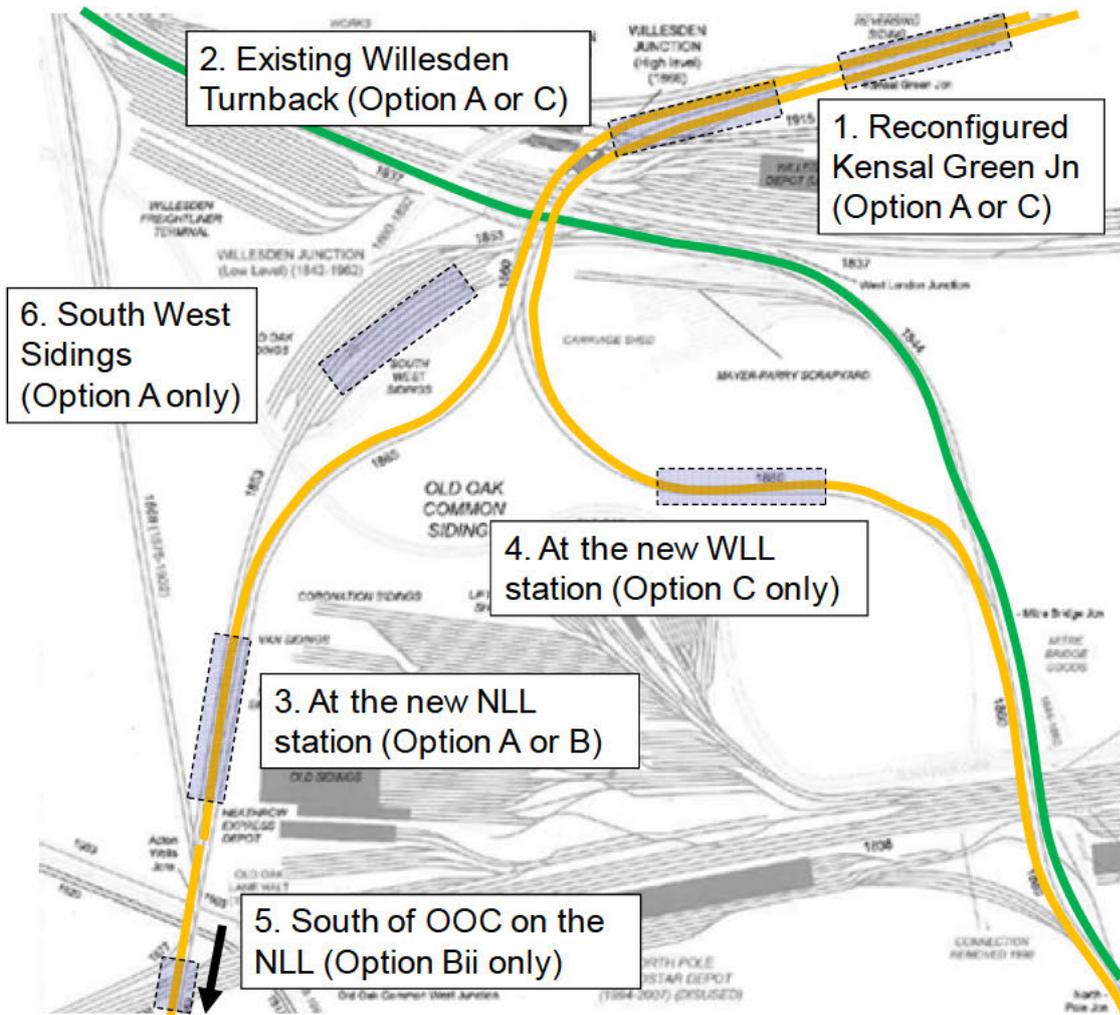
Turnback facilities

A summary of the options for providing turnback facilities is shown in the diagram below.

A workshop was held on 14/05/14 to discuss the options to provide turnback facilities and conclude a preferred solution for each of the three options being considered. The workshop was attended by TfL and Network Rail representatives.

A full summary, including commentary on the benefits and drawbacks of each of the turnback options, is provided in ‘140519 Turnback options assessment’ which is available on request.

A fully summary of the track layout for the layout of the Overground station at Hythe Road to provide a turnback siding, , including commentary on the benefits and drawbacks of each of the turnback options, is provided in ‘140611 Option C turnback comparison’ which is available on request.



Summary of turnback locations

	Location 1: Kensal Green Jn	Location 2: Willesden HL turnback	Location 3: Within the Old Oak Common station	Location 4: Within the Hythe Road station	Location 5: South of Old Oak Common station	Location 6: South West Sidings	Location 7: Loop via South West Sidings
Option A: Old Oak Common viaduct solution	Fallback – high cost and potential capacity issues	Fallback option – too short and potential capacity issues	Fallback – support TSS, although ops and eng issues exist	n/a – Hythe Road station would not be open in Option A	n/a – not operationally feasible	Fallback – support TSS and require only two OOC platforms	Taken forward – support TSS and require only two OOC platforms
Option Bi – Old Oak Common station with <u>terminating</u> services	n/a – not operationally feasible to serve OOC station	n/a – not operationally feasible to serve OOC station	Taken forward – could be a low cost, low risk solution	n/a – Hythe Road station would not be open in Option B	Discounted – operationally conflicts	n/a – services arriving from the wrong direction	n/a – viaduct would not be constructed to loop round
Option Bii – Old Oak Common station with <u>reversing</u> services	n/a – not operationally feasible to serve OOC station	n/a – not operationally feasible to serve OOC station	Discounted – not operationally feasible to accommodate all services	n/a – Hythe Road station would not be open in Option B	n/a – not operationally feasible – would split WLL services	n/a – services arriving from the wrong direction	n/a – viaduct would not be constructed to loop round
Option C: Two stations at Old Oak Common and Hythe Road	Fallback – high cost and potential capacity issues	Fallback option – too short and potential capacity issues	n/a – not operationally feasible	Taken forward – reduce train conflicts but needs engineering study	Discounted – not considered operationally feasible	n/a – WLL services would be operating through Hythe Road station	n/a – viaduct would not be constructed to loop round
Option Biii – Extending WLL services to Hounslow	n/a – not operationally feasible	n/a – not operationally feasible	n/a – not operationally feasible	n/a – Hythe Road station would not be open in Option B	Taken forward – extending to Hounslow	n/a – services arriving from the wrong direction	n/a – viaduct would not be constructed to loop round
Summary	Fallback option	Fallback option	Taken forward	Taken forward	Taken forward	Fallback option	Taken forward

Timetable development

This section of the supporting technical information includes assessment of Sectional Running Times (SRTs), junction margins, headways and platform occupation times for each option.

The timetable assessment for the proposed Overground station was completed to determine the viability of incorporating the proposed new infrastructure and its ability to support the Train Service Specification (TSS). The developed timetable was tested in RailSys 8.9.95 to establish any non-compliance with Train Planning Rules (TPRs) as well as pathing conflicts.

The RailSys model includes the existing London Overground network, however as proposed changes to the infrastructure and services were on the NLL and WLL, only these two routes were the focus of the assessment. No detailed analysis was undertaken on neighbouring routes

An iterative process was used to develop the proposed timetable for each infrastructure option. This allowed the proposal to incorporate changes to the timetable structure to resolve operational issues and reflect the emerging infrastructure design, such as track and platform layout.

In going through this process it was possible to develop an optimised solution to meet the identified requirements and TSS as well as identify, which, if any, options should be discounted due to their lack of operational feasibility.

Sectional Running Times (SRTs)

The technical minimum running times (MRTech) have been calculated in RailSys incorporating into the train stopping patterns and the reference train characteristics. It should be noted that the MRTech were based on 95% of train performance for traction and braking, the proposed speeds as shown in the scheme plans for the affected area, and the existing linespeeds on the remainder of the network. These values were then rounded up to the nearest half minute to represent the estimated planning values (SRTs), which have been adopted in the timetable development.

The rounding up methodology adopted in this report considers the followings:

- the impact of defensive driving techniques on train speeds when driver seeing potential restrictive signal aspects due to short distance between stations on train speeds;
- the speed restrictions and small curves proposed in the affected area.
- If it is less than 10 seconds to the nearest half minute, the next half minute will be adopted.

It should be noted that as part of the timetable development process, engineering allowance, path allowance, performance allowance and adjustment allowance will be given on certain route sections. However, these allowances have not been specified in the proposed timetables at this stage of work. For simplicity, in the proposed timetables the journey times on certain route sections might be longer than the estimated Sectional Running Times (SRTs) in order to address timing allowances required.

Option A (Down NLL and Up WLL)

From	To	Train Activities	MRTech (s)	Sectional Running Times (SRTs)
Willesden Jn HL	Old Oak Common Lane	Start-Stop	139	150
Old Oak Common Lane	Acton Wells Jn	Start-Pass	18	30
Acton Wells Jn	Acton Central	Pass-Stop	136	150
Acton Wells Jn	North Pole Jn	Pass-Pass	149	180
North Pole Jn	Shepherds Bush	Pass-Stop	110	150

Option A (Up NLL and Down WLL)

From	To	Train Activities	MRTech (s)	Sectional Running Times (SRTs)
Shepherds Bush	North Pole Signal VC813	Start-Pass	104	120
North Pole Signal VC813	North Pole Jn	Pass-Pass	10	30
North Pole Jn	Acton Wells Jn	Pass-Pass	169	180
Acton Wells Jn	Old Oak Common Lane	Pass-Stop	40	60
Old Oak Common Lane	Willesden Jn HL	Start-Stop	109	120
Acton Central	Acton Wells Jn	Start-Pass	125	150

Option Bi (Down NLL and Up WLL)

From	To	Train Activities	MRTech (s)	Sectional Running Times (SRTs)
Willesden Jn HL	Old Oak Common Lane	Start-Stop	139	150
Old Oak Common Lane	Willesden West London Jn	Start-Pass	128	150
Willesden West London Jn	Mitre Bridge Jn	Pass-Pass	92	120
Mitre Bridge Jn	North Pole Signal VC818	Pass-Pass	45	60
North Pole Signal VC818	North Pole Jn	Pass-Pass	14	30
North Pole Jn	Shepherds Bush	Pass-Stop	136	150

Option Bi (Up NLL and Down WLL)

From	To	Train Activities	MRTech (s)	Sectional Running Times (SRTs)
Shepherds Bush	North Pole Signal VC813	Start-Pass	104	120
North Pole Signal VC813	North Pole Jn	Pass-Pass	10	30
North Pole Jn	Mitre Bridge Jn	Pass-Pass	67	90
Mitre Bridge Jn	Willesden West London Jn	Pass-Pass	100	120
Willesden West London Jn	Old Oak Common Lane	Pass-Stop	146	150
Old Oak Common Lane	Willesden Jn HL	Start-Stop	109	120

Option Bi (Down NLL and Up WLL)

From	To	Train Activities	MRTech (s)	Sectional Running Times (SRTs)
Willesden Jn High Level	OOO WLL	Start-Stop	110	120
OOO WLL	North Pole Jn	Start-Pass	80	90
North Pole Jn	Shepherds Bush	Pass-Stop	130	180

Option Bi (Up NLL and Down WLL)

From	To	Train Activities	MRTech (s)	Sectional Running Times (SRTs)
Shepherds Bush	North Pole Signal VC813	Start-Pass	104	120
North Pole Signal VC813	North Pole Jn	Pass-Pass	10	30
North Pole Jn	Mitre Bridge Jn	Pass-Pass	67	90
Mitre Bridge Jn	OOO WLL	Pass-Stop	61	90
OOO WLL	Willesden Jn HL	Start-Stop	90	120

It should be noted that unless otherwise stated, the planning values for the NLL are the same in Option B and C.

It has been assumed that dwell time at Old Oak Common would be 60 seconds for West London and North London Line trains. In addition, dwell time at Willesden Junction High Level would be reduced from 120 seconds to 60 seconds.

This 60 second dwell time value also applies to the NLL in Options B and C as well as the WLL station in Option C

The use of 60 seconds dwell time rather than the alternative 90 seconds may be considered given the potential demand at these two stations, but it will allow the platforms to be cleared quicker and reduce the operation risks, such as the impact on capacity through the stations.

It should be noted however that for the purposes of pedestrian modelling a 60 second dwell time was assumed. The assessment concluded that the station could accommodate future demand (2041) within specified crowded guidelines (isolated instances of Fruin level C) assuming Option A demand (assumed to be the worst case). A sensitivity was also undertaken to assess if the station could accommodate demand that could result from nearby development potential which found that the station could function with isolated levels of crowding at Fruin level D.

In Options B and C, where WLL trains reverse or terminate within the Old Oak Common area a minimum turnaround time of 300 seconds for 4, 5 and 6-car units and 360 seconds for 8-car units applies. In both options it is assumed that the trains would reverse or terminate in the platform.

Junction margins

The technical junction margins for the fouling moves have been calculated based on the proposed signalling arrangements and trains operating on green signals. The current junction margin of 2.5 minutes for passenger trains at Acton Wells Junction could remain. However, it should be noted that junction margin for passenger trains at Acton Wells Junction was not used. This is because train parallel moves at this junction have been adopted in the proposed timetable so as to maximise the junction capacity.

Fouling move	Technical junction margins (s)		Planning value (s) at station
	Timed at the new station	Timed at Acton Well Jn	
Westbound Richmond departure before Eastbound arrival from Clapham Jn	139	81	150
Eastbound Clapham Jn train crossing the junction before Westbound Richmond train departing	Eastbound Clapham Jn arriving 18s after Westbound Richmond train departing at OOCL	40	30

The methodology of calculating junction margins applies the same in all options.

Headways

The technical headways between Acton Central and Willesden Junction High Level have been calculated incorporating the passenger train stopping pattern and dwell time at Old Oak Common Lane station but without giving any timing allowances in this section. These values were then round up to the nearest half minutes as the estimated planning headways.

Acton Central to Willesden Jn HL	Westbound (s)		Eastbound (s)	
	Technical	Planning value	Technical	Planning value
	221	240	272	300

Compared to the current planning values of 3 (westbound) and 4 (eastbound) minutes for the passenger trains between Willesden Jn HL and Acton Wells Jn, the additional stop at Old Oak Common Lane would lead to a longer planning headway by one minute. However, given the service level required (10tph) and timetable structure developed (5 minutes passenger train interval), the proposed signalling will not have adverse impact on the proposed operations.

The methodology of calculating headways applies the same in all options.

Platform reoccupation time

Train movement sequence	Westbound (s)		Eastbound (s)	
	Technical value	Planning value	Technical value	Planning value
Richmond trains following Clapham trains	161	180	212	240

The minimum platform reoccupation times at the proposed new station have also been calculated based on the Richmond trains following the Clapham Jn trains. They were then round up to the nearest half minutes as the estimated planning headways. It is clear the platform reoccupation time for eastbound passenger trains at Old Oak Common Lane station will exceed the 3 minutes currently adopted at Willesden Junction High Level.

The methodology of calculating platform occupation times applies the same in all options.

Rolling stock requirements

Rolling stock requirements were determined through the timetable development process. It was assumed that interworking between NLL and WLL Overground services would continue at Stratford, and therefore, it was not possible to attribute any additional rolling stock requirements to a specific route.

Freight impacts

The timetable development process was the principle approach to assessing the impacts on freight services.

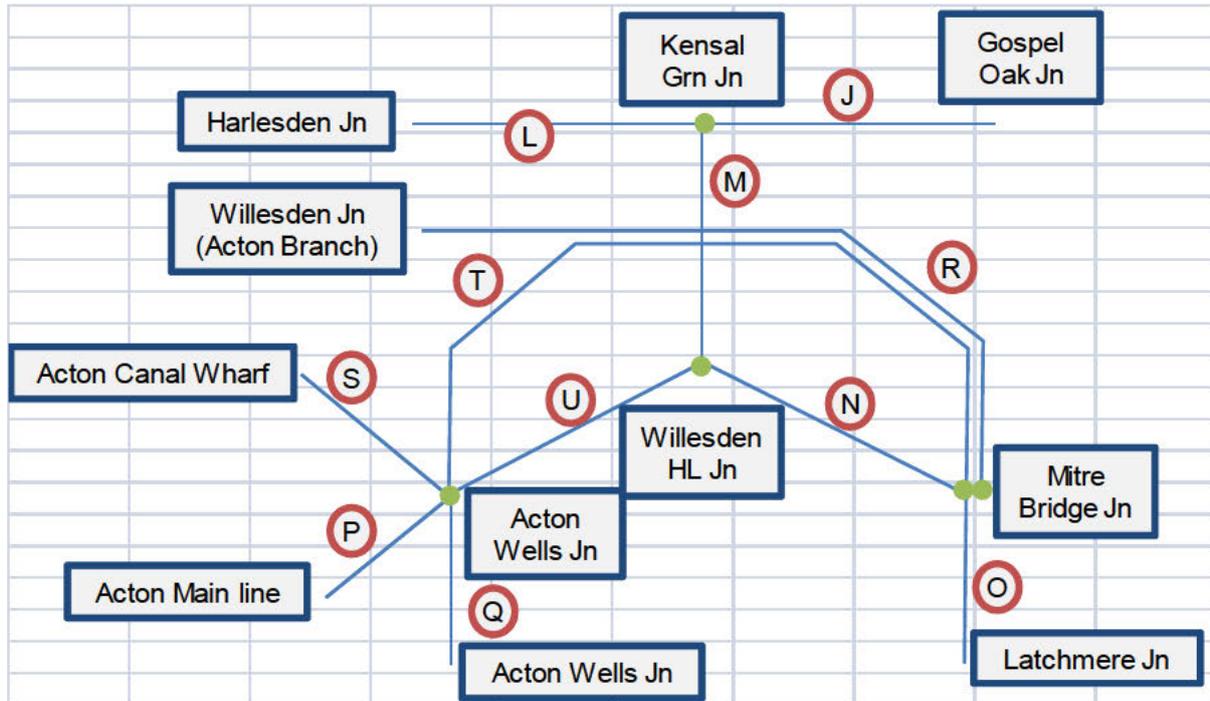
It was assumed that freight market growth would be consistent with the Network Rail Freight Market Study. The table and figure below show the freight figures used within the Freight Market Study by section of route.

The timetable development considered the possible freight paths on the NLL and WLL between the following locations within the current Overground Network

- Latchmere Jn
- Mitre Bridge Jn (to/from WCML)
- South Acton
- Acton Wells Jn
- Kensal Green Jn
- Gospel Oak
- Camden Road Jn

- Camden Road East Jn
- Canonbury West Jn
- Navarino Road Jn
- Lea Jn
- Channelsae Jn

In the model, the freight paths were planned around passenger services. The feasibility whether they could operate at above locations was then examined.



Growth in freight flows (average number of paths per weekday hour)

Link name	2011-12	2023	2033	2043
	Total	Total	Total	Total
J Kensal Green Jn - Gospel Oak	1.4	2.8	4.3	5.9
L Kensal Green Jn - Willesden Jn / Harlesden Jn	0.2	0.9	1.8	2.6
M Willesden High Level Jn - Kensal Green Jn	1.3	1.8	2.4	3.2
N Willesden High Level Jn - Mitre Bridge Jn	0.4	0.5	0.6	0.8
O Latchmere Jn - Mitre Bridge Jn	1.4	1.9	2.3	3.0
P Acton Wells Jn - Acton Main Line	1.9	2.3	2.8	3.6
Q South Acton Jn - Acton Wells Jn	0.3	0.4	0.6	0.8
R Mitre Bridge Jn - Willesden Jn (Acton Branch)	0.5	0.8	0.9	1.3
S Acton Wells Jn - Acton Canal Wharf	0.8	0.8	0.9	1.3
T Acton Wells Jn - Mitre Bridge Jn	0.6	0.7	0.8	0.9
U Acton Wells Jn - Willesden High Level Jn	0.9	1.3	1.8	2.4

In addition, a briefing was also held by TfL and Network Rail to provide an overview of the Overground station options. Representatives from the key freight operators on the NLL and WLL were invited, with attendance only available from Freightliner.

The discussion highlight that there were no 'show-stoppers' to any of the options that were being developed, however, a number of isolated concerns were raised. These can be summarised as:

- Use of the new viaduct in Option A would not be possible due to the tight vertical and horizontal geometry of the alignment. Similar queries have been raised by other stakeholders with regards to using the alignment as an alternative diversionary route.
- High capacity utilisation between Acton Wells Junction and Willesden Junction High Level as well as South West Sidings (SWS). Currently some freight services recess in the SWS area and this level of standage would need to be retained.
- Option B was not considered viable due to the high utilisation of SWS by Overground services in both Options Bi and Bii
- It was queried why Willesden High Level could not be used in Option C as a turnback location for WLL services. Refer to supporting information above on reasons for discounting this option.
- Light engines reverse at Acton Wells which is not always easy to see in the Working Timetable. These units run around from Acton Canal Wharf to support a MML to Neasden daily aggregates service. It was highlighted that there will need to be capacity and capability for such moves to continue.
- Industry advice is for TfL not to base planning on freight contractual rights but base them on the timetable. Worth noting contractual rights are over three years out of date.

Summary notes from the meeting were prepared by WSP but not shared with the freight operators. These are provided in 'OOC FOC Consultation Meeting Notes' and are available on request.

Operating costs

For all operating cost calculations, it is assumed that passenger services on the NLL and WLL will operate on the basis of 8-car fixed formation, representing a 2041 scenario for the purposes of calculating the business case and reflects the assumptions used for the purposes of demand modelling¹.

Industry costs are calculated on the basis of Class 378 units operating on London Overground services and Class 377/7 units operating on services currently part of the Southern franchise. In reality, as it will be expensive and technically challenging to extend Class 378 units beyond 5-car length, these could feasibly be replaced prior to the opening of the Overground station with an equivalent unit.

While both Fixed and Variable Track Access Charges (FTAC) and (VTAC) only represent a minimal increase in charges to the train operator, it is the only charge included within the assessment that is variable by train length.

The number of additional drivers required to operate the extra units (which is a function of the extended journey times in the Old Oak Common area) is calculated on the basis of the number of additional units, with two drivers required for every additional unit.

¹ It is assumed that the Overground station will open in 2026

Staff and rolling stock costs were based on either existing contracts (in the case of staff and cleaners) or Shadow Bids (in the case of rolling stock). This information was provided by the Overground Contract Management team.

As a full station design had yet to be completed, the number of staff was indicative and based on existing staffing levels and East London line (ELL) Phase 2 stations. The number of staff took account of management and supervisor roles as well as staff to perform standard duties as part of the day to day operation of the station. A view was taken that with Option C, which would provide two stations, station and cleaning staff would be shared between the two sets of platforms. For this reason, the station staff costs were approximately 1.5 times the number for Option C as they were for Option A, rather than being double.

Please refer to document reference '140714 OOC Overground operating costs v0.4' for calculations of operating costs referred to in this document.

Appendix B: Risks and assumptions

Assumptions

Assumptions are noted in the register below

Subject	Comments								
Signalling scheme plan	<p>For Option A, track alignment and signalling arrangements are modelled as the “Option A1A Signalling Alterations”, drawing no. 70002685-SIG-A1A, Version D.</p> <p>For Option C, track alignment and signalling arrangements are modelled as the “Option C2A Signalling Alterations”, drawing no. 70002685-SIG-C2A-C, Version C.</p>								
Linespeeds	<p>For the affected area, the linespeeds were assumed as the scheme plans proposed. On the remainder of the network, the linespeeds were assumed current (2014).</p>								
Operational Rules	<p>The sectional running times (SRTs), junction margins and headways have been calculated in RailSys based on train running on green signals.</p>								
Sectional Running Times (SRTs)	<p>In agreement with the Planning Manager, London Overground Operations, the calculated minimum running times for the proposed new infrastructure have then been rounded up to the nearest half minute as the planning values to be adopted in timetabling.</p>								
Train and platform lengths	<p>The 8 car Class 378 were used for the purposes of this assessment. While the train length is shorter than anticipated future requirements, it is not believed that this will have a material impact on the findings of this assessment and is likely to represent a worst case in terms of train planning.</p> <p>Platform lengths on the NLL (between Richmond and Stratford, excluding the proposed Old Oak Common Lane station) will be able to accommodate 6-car trains from the mid-2020’s. The introduction of 8-car (which is assumed for business case purposes for 2041) operation on the NLL would require resignalling and platform lengthening of the route and is considered consistent with the introduction of ERTMS within the same decade.</p> <table border="1" data-bbox="427 1644 1406 2011"> <thead> <tr> <th data-bbox="427 1644 1193 1682">Planning assumption</th> <th data-bbox="1193 1644 1406 1682">Year</th> </tr> </thead> <tbody> <tr> <td data-bbox="427 1682 1193 1720">Business Case assumption – 8-car railway</td> <td data-bbox="1193 1682 1406 1720">2041</td> </tr> <tr> <td data-bbox="427 1720 1193 1794">Infrastructure planning assumption – 6-car station at OOC with provision for 8-cars (170m)</td> <td data-bbox="1193 1720 1406 1794">2026</td> </tr> <tr> <td data-bbox="427 1794 1193 2011">Long term planning assumption – Introduction of 6-cars in mid-2020’s, consistent with existing lease expiring on Class 378’s and purchase / lease of new rolling stock. NLL to be resignalled to introduce ERTMS by 2046 (Control Period 11) which could allow the introduction of longer trains,</td> <td data-bbox="1193 1794 1406 2011">2026 to 2041</td> </tr> </tbody> </table>	Planning assumption	Year	Business Case assumption – 8-car railway	2041	Infrastructure planning assumption – 6-car station at OOC with provision for 8-cars (170m)	2026	Long term planning assumption – Introduction of 6-cars in mid-2020’s, consistent with existing lease expiring on Class 378’s and purchase / lease of new rolling stock. NLL to be resignalled to introduce ERTMS by 2046 (Control Period 11) which could allow the introduction of longer trains,	2026 to 2041
Planning assumption	Year								
Business Case assumption – 8-car railway	2041								
Infrastructure planning assumption – 6-car station at OOC with provision for 8-cars (170m)	2026								
Long term planning assumption – Introduction of 6-cars in mid-2020’s, consistent with existing lease expiring on Class 378’s and purchase / lease of new rolling stock. NLL to be resignalled to introduce ERTMS by 2046 (Control Period 11) which could allow the introduction of longer trains,	2026 to 2041								

	operating at closer headways. Information on ERTMS provided by Kenneth Gray at Network Rail, email from David Buttigieg of 14 th June 2013.	
Freight Planning	Use existing freight paths as the basis for timetable development and refine based on identified constraints and using information from Network Rail on freight rights.	
Traction changeover location	<p>Assumed to be at current location (between Shepherds Bush and North Pole Junction). Noted that a scheme has been identified to extend the AC power supply to Shepherds Bush but that this is currently unfunded and uncommitted.</p> <p>Different approaches to traction changeover between operator and stock type are noted; LOROL and freight undertake this on the move, while Southern currently complete this in a stationary position.</p> <p>Traction changeover on the move for Southern could reduce SRTs by up to one minute. Traction changeover at Shepherds Bush station could reduce this by a further half a minute for both passenger operators.</p>	

Risks

Risks are noted in the register below

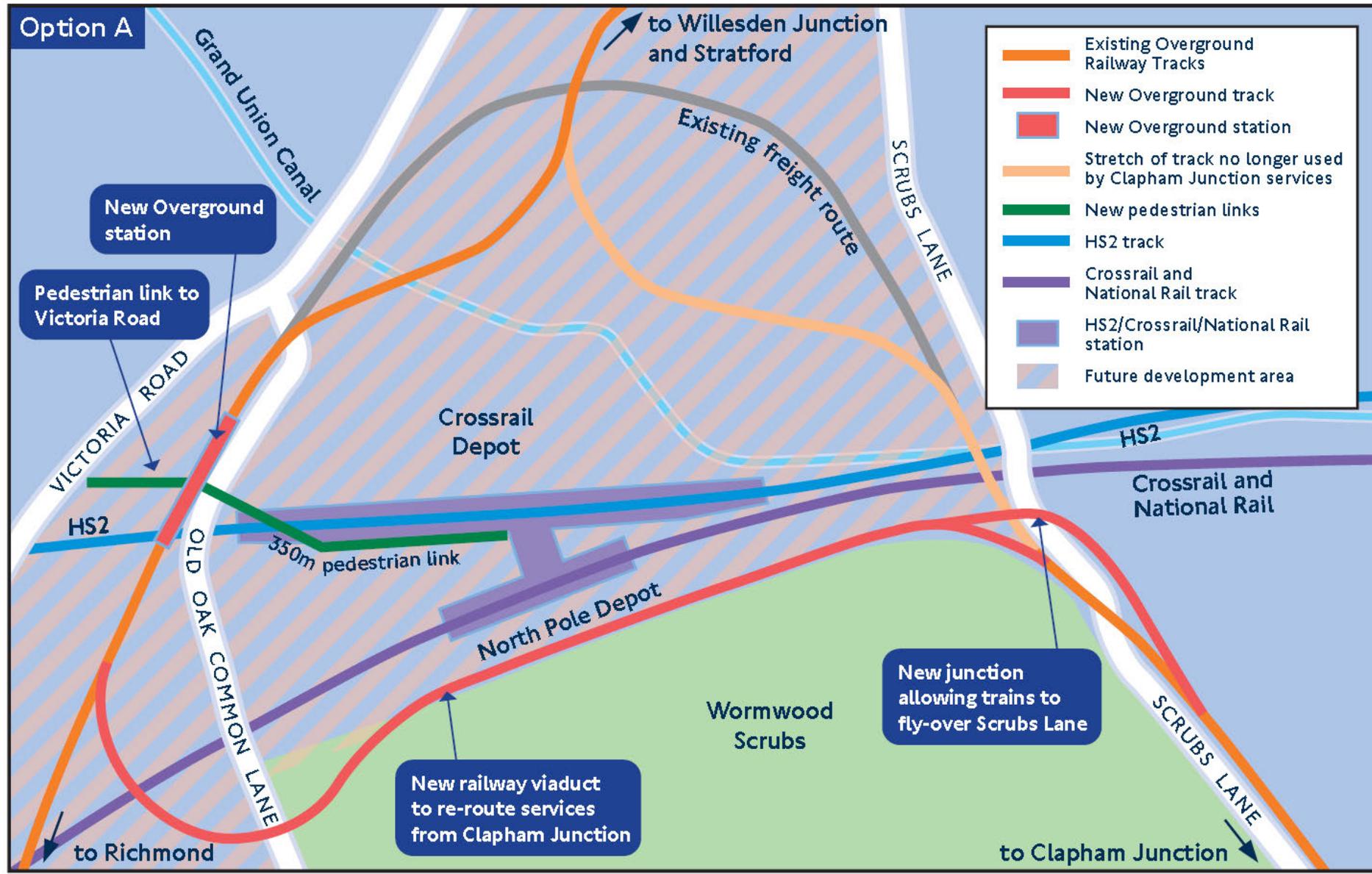
Subject	Comments	RAG
Design change	The scheme plan is updated which invalidates the findings of the timetable assessment undertaken as part of this Single Option Selection assessment. Any changes to the scheme plan may impact the signalling layout, headways and junction margins.	
Planning Values	LOROL are seeking an introduction of a 6 minute (360 second) minimum turnaround time for the introduction of 5-car units as part of the LOCIP programme, but it is not believed that the introduction of 8-car units should increase this substantially further. It is anticipated that keeping the planning values to those stated above represents a best case scenario.	
Planning Values 2	There is potential that assumptions used for the purposes of developing the operational assessment may change. For example, dwell time has been assumed at 60 seconds at the Old Oak Common station, and this could increase. Similarly, the assumption of using the existing signalling layout may be considered pessimistic as changes to the signalling layout could reduce headways.	

Unfunded schemes	The assessment includes a number of 'likely committed' schemes. These include schemes which are currently being developed as part of future Control Period and TfL Business Plan investment. This includes the introduction of more frequent services on the WLL (increasing by 2tph all day) and the introduction of 8-car trains (which has been determined necessary by 2041 to relieve crowding that may result from background demand growth). While these are unlikely to have a substantial impact on operational viability (they are more likely to impact the business case), whether these schemes have been implemented may impact service reliability and performance.	
Freight growth	The timetable development includes assumptions regarding volume of growth in freight traffic in line with Network Rail's Freight Market study. This was based on advice given by Network Rail. There is a risk however, that volumes of freight traffic operating across the network may not reflect the forecasts and this may impact operational viability.	
Traction changeover location	Transferring the traction changeover on the WLL to a solution where all passenger and freight service complete the procedure on the move could reduced SRTs and give back some additional pathing time if WLL services were to loop via West London Junction (Option A), increasing on the 1 minute that is currently assumed.	
Timetable structure	Clapham Junction: Was used as the starting point for developing the timetables to optimise turnaround times. If it is found that constraints needs to be addressed elsewhere and the timetable is based around a different location (e.g. Willesden Junction), then turnaround times may extend at Clapham Junction, requiring more than one platform. There may need to be an infrastructure solution therefore that considers providing 2 WLL 8-car platforms at Clapham Junction (extending into Kensington Sidings).	
Dwell times	<p>Dwell times currently assumed as 60 seconds at Old Oak Common which may be considered too low for the station given the potential demand (Willesden Junction is assumed to reduce from 120 to 60 seconds).</p> <p>There is a risk that if this is increased, this could impact the capacity of the rail infrastructure through the station as there is only one signalling section between the OOC and Willesden High Level stations. Therefore, a train cannot approach OOC until the preceding one has left. If this is considered a risk that cannot be accepted later in the project development, then it may not be possible to operate the 2tph Clapham Junction to OOC shuttles. ETCS may help, but not in the lifetime of this project and would need to be Level 3 (moving block).</p>	

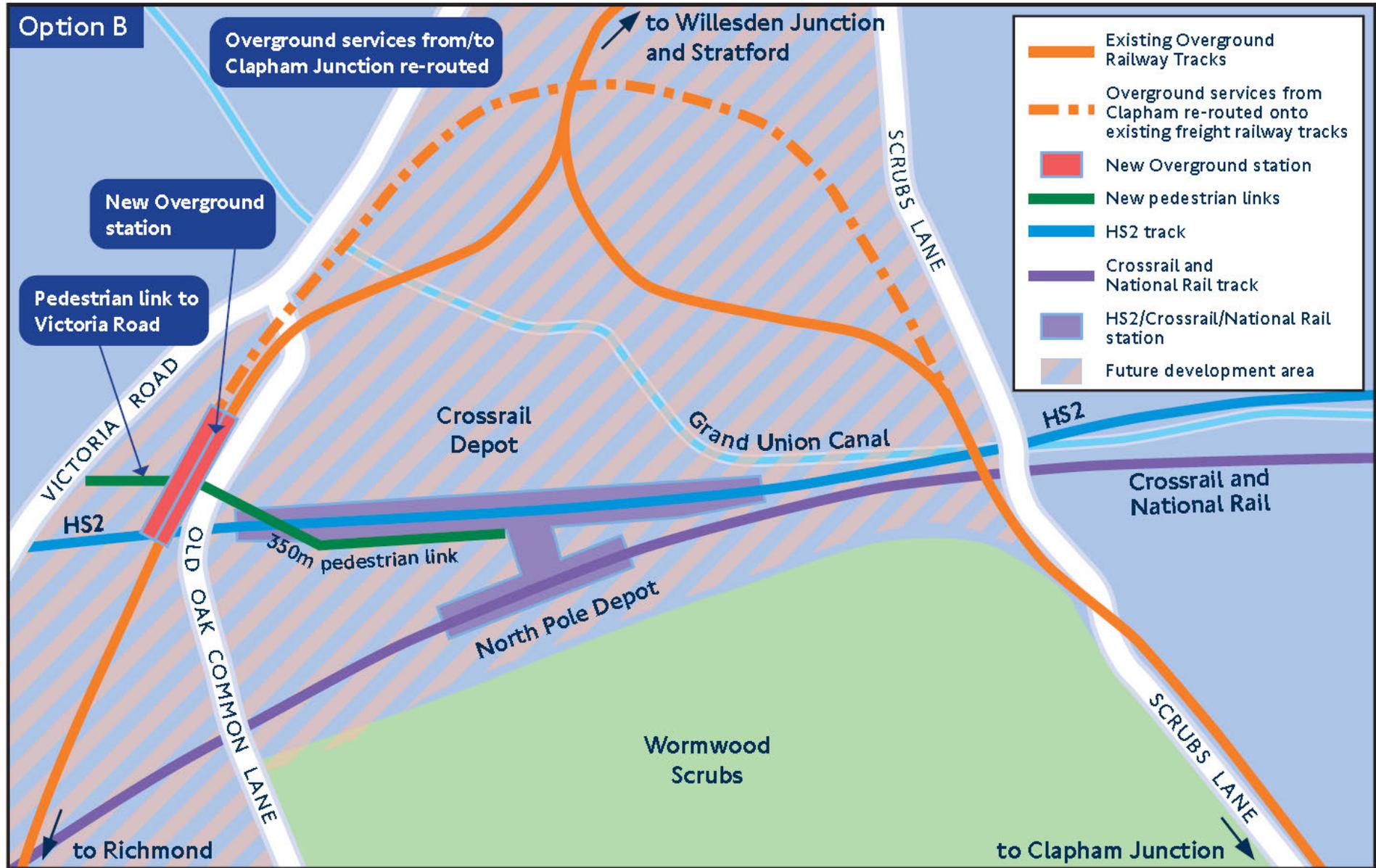
Industry acceptability	While TfL have worked collaboratively with Network Rail in developing the Overground station scheme and sought initial views from freight operators on the proposals for a new Overground station, further operational analysis will be required to progress the scheme. This is likely to be an iterative process as the engineering solution develops, but may impact on industry acceptability of the scheme. Continued engagement with Network Rail and operators is therefore recommended.	
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Appendix C: Option diagrams

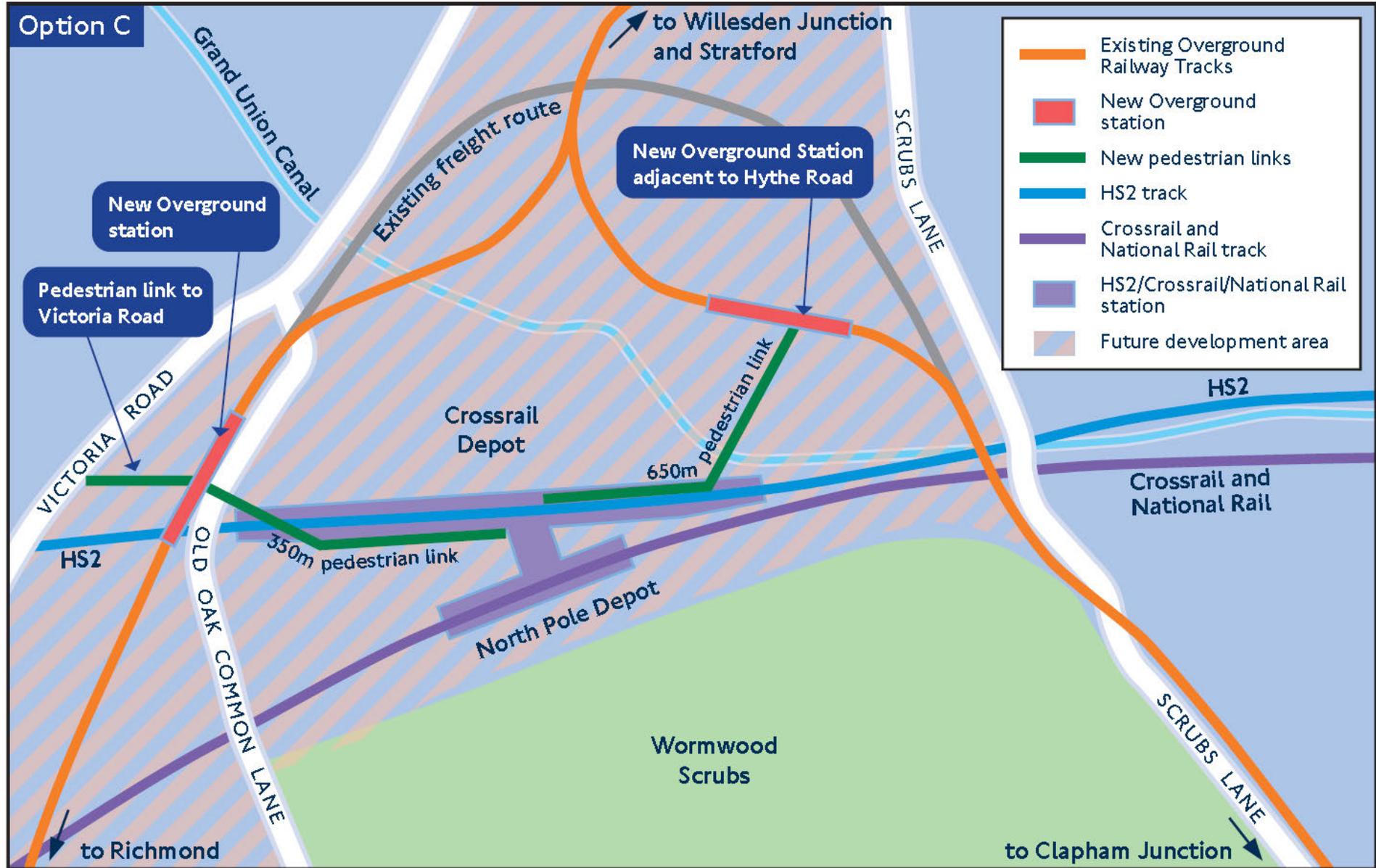
Overground station Option A



Overground station Option B



Overground station Option C



HYTHE ROAD TURNBACK OPTIONS – CIVIL & STRUCTURAL – NORTH SIDING/LOOP



PRIVATE ROAD AREA IN THE HEART OF CAR GIANT

ADDITIONAL TURNBACK LOOP/SIDING ON NORTH SIDE WITH WIDER EMBANKMENT

CONSTRUCTION ACCESS LAND REQUIREMENT FOR NORTH SIDE IN THE HEART OF CAR GIANT OPERATION
FURTHER LAND WILL BE REQUIRED FOR LINK ON SOUTH SIDE TO HS2