



Revision	Date	Summary of changes
Draft A	16/02/2016	First draft for team review
Issue 1	23/02/2016	Updated sections 1, 5, 6 and 7. Sent for signatories review and sign-off
Issue 2	29/03/2016	Updated with Central and Bakerloo lines related material. For sign-off.

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1 Introduction

The NTfL programme involves the upgrade of the Piccadilly, Waterloo & City, Bakerloo and Central lines, all with new and increased fleets compared to pre-upgrade. The new trains will be delivered in the early stages of the upgrade of each line, with the exception of the Waterloo & City line where they will be delivered at the time of the upgrade, and will in turn require sufficient stabling space and up-to-date maintenance facilities.

The purpose of this document is to support the delivery of the Sponsor's Programme Requirements (Sponsor's Remit section 2.5., Ref 3) by providing information to the Programme on the stabling capacity requirements throughout the course of the upgrade. This is based on the Timetable Migration Plan, on estimated fleet sizes and depot throughput performance. The Sponsor's Requirements ensure the delivery of the NTfL business case benefits.

The provision of this information should enable the Programme to develop stabling solutions around the following key principles:

- Consider provision of stabling capacity to berth both minimum and maximum fleet sizes (Section 3).
- Provision of stabling capacity to accommodate the Timetable Migration Plan service changes (Section 5).
- Need to accommodate the coexistence of legacy and new fleet during new fleet introduction.
- Consider provision of spare and/or emergency stabling capacity at the same levels as of February 2016 to mitigate service disruption (e.g. line suspensions)
- Model and identify the optimum depot injection rates to ensure that the timetabled services can be launched in time and discuss them with the Sponsor and Operations.

The figures provided in this document are a best estimate derived from the Sponsor's analysis of service levels and train design options, which assumed a 'candidate train and associated system'. The information will be revised and refined once a final new train design and signalling system has been confirmed for delivery. Any operational and maintenance requirements are outlined in the NTfL Operations and Maintenance Concept (Ref 5). Engineering Vehicle requirements are captured in the Track Plant and Servicing Depots Portfolio Operational Concept for On Track Machines / Engineers' Vehicles (Ref 6). Stabling requirements for Engineering Vehicles or other track maintenance vehicles are additional to the requirements stated in this document. The following details are not covered in this document:

Not covered	Covered in:
Stabling of Engineer's Vehicles and/or other engineering machines	Ref 6
Disposal of legacy fleet	Ref 7
Arrangements or requirements for legacy fleet stabling during introduction of new trains	The Programme to consider stabling requirements for legacy trains during migration
Depot and Sidings Works / Maintenance facilities requirements	Ref 5

The Programme is required to maximise the customer benefit which can be achieved with the upgrade capability beyond the 33 peak trains per hour baseline level, as shown in Piccadilly Working Timetable (C) and Central Working Timetable (B). For information this document includes in Appendix A the indicative timetable design and minimum stabling requirements for service launch for future Piccadilly Working Timetable (D) and Central Working Timetable (C) service enhancements, beyond the baseline service frequency defined in the Sponsor's Requirements documentation suite (Ref 3). These are intended to illustrate the maximum service level which the Sponsor and Transport Planning expect to be deliverable given current forecasts and expectations.

2 Base Stabling Capacity (pre-Upgrade)

The base stabling capacity (February 2016) for NTfL lines can be seen in the following Table 1. It should be noted that the Piccadilly Line has approximately 10 spare stabling berths and the Waterloo & City has no spare berths, in relation to current fleet:

Piccadilly	Stabling	W&C	Stabling	Bakerloo	Stabling	Central	Stabling
Uxbridge platform	1	Waterloo depot	5	Stonebridge Park sidings	4	Ruislip depot	25
South Harrow sidings	6 (4 enabled)			Stonebridge Park depot	12	White City sidings	16
Northfields depot	38			Queens Park sidings/platforms	8	Loughton sidings	10
Arnos Grove sidings	7			London road sidings	11	Woodford sidings	6
Cockfosters depot	45			Elephant & Castle sidings	1	Hainault depot	35
Total	97 (95 enabled)	Total	5	Total	36	Total	92

Table 1 NTfL Base Stabling Capacity

3 Fleet Introduction

The current fleet sizes and the forecast NTfL Baseline Upgrade fleet sizes are as per Table 2. It should be noted that the Baseline Upgrade fleet sizes are based on a candidate system and are currently within a range, to be refined nearer to the point of contract sign-off for the new rolling stock.

The figures presented here are the Sponsor’s estimate of fleet size based on analysis of service variables and train design options. All fleet size figures are exclusive of engineering trains.

Line	Current fleet size (legacy)	Baseline Upgrade Service fleet range (Business case forecast/max)	Start of fleet introduction	All Trains introduced
Piccadilly	86.5	98 / 112	11/10/2023	31/12/2025
Waterloo & City	5	6 / 7	18/03/2026	07/04/2026
Bakerloo	36	37 / 41	03/03/2026	19/01/2027
Central	87	95 / 104	16/07/2029	25/03/2032

Table 2 Fleet Introduction Sizes and Dates

The Programme is required to deliver stabling capacity sufficient to cover the Business Case forecast Baseline Upgrade fleet size as per Table 2. Plans for stabling the maximum Baseline Upgrade fleet size should also be developed and discussed with the Sponsor. The stabling requirements will be refined once the final train design and signalling system have been agreed.

4 Timetable Service Changes

According to the Timetable Migration Plan (Ref 4) there is a number of service changes planned at, or after, the delivery of GOA2 functionality (GOA4 for the Waterloo & City line). The following Tables list all the planned timetable changes for the NTfL lines. All figures show weekday service patterns. All service patterns are assumed to be the same in both directions, unless stated otherwise. Saturday and Sunday service patterns are assumed to be the same as weekday offpeak patterns, with the exception of Waterloo & City that does not operate on Sundays.

Moving forward from the baseline upgrade timetable, options will be explored to take advantage of the upgraded signalling and fleet size to find the peak service frequency -in excess of 33tph- at which benefits are maximised for the Piccadilly and Central lines. Offpeak, Saturdays and Sunday service levels are not currently envisaged to exceed 30tph. Indicative stabling requirements for trains in service for Piccadilly WTT(D) and Central (C) timetables are provided in Appendix A.

Those timetables do not constitute Sponsor requirements and are for illustrative purposes only.

The line migration plans are at different levels of maturity. This document will be updated as more information becomes available and once rolling stock and signalling products have been confirmed for delivery.

4.1 Piccadilly Line Timetable Migration Plan

The Piccadilly line Timetable Migration Plan is as follows:

Timetable	Implementation date	Headline frequencies and other comments
WTT(A)	May 2026	27 train peak cycle with 24tph offpeak, GOA2 enabled
WTT(B)	December 2026	30tph peak, 27tph offpeak, Ealing Broadway services, trains stop at Turnham Green all day
WTT(C)	December 2027	Baseline upgrade timetable: 33tph peak, 30tph offpeak

Table 3 Piccadilly Line Timetable Migration Plan

4.2 Waterloo & City Line Timetable Migration Plan

The Waterloo & City line Timetable Migration Plan is as follows (Waterloo & City line does not operate on Sundays):

Timetable	Implementation date	Headline frequencies and other comments
WTT(A)	October 2026	Baseline upgrade timetable: 27 train cycle peak with 21.8tph offpeak, GOA4 enabled

Table 4 Waterloo and City Line Timetable Migration Plan

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4.3 Bakerloo Line Timetable Migration Plan

The Bakerloo line Timetable Migration Plan is as follows:

Timetable	Implementation date	Headline frequencies and other comments
WTT(A)	May 2028	Baseline upgrade timetable: 27tph peak, 24tph offpeak, GOA2 enabled

Table 5 Bakerloo Line Timetable Migration Plan

4.4 Central Line Timetable Migration Plan

The Central line Timetable Migration Plan is as follows:

Timetable	Implementation date	Headline frequencies and other comments
WTT(A)	May 2032	No change in the peak but extended to termini at ends of the line via equal service pattern splits, offpeak at 27tph equally split to the end of the line termini. 4tph all day Hainault-Woodford via Grange Hill.
WTT(B)	May 2033	Baseline upgrade timetable: 33tph peak service equally split to end of line termini, 30tph offpeak equally split to end of line termini. 4tph all day Hainault-Woodford via Grange Hill.

Table 6 Central Line Timetable Migration Plan

5 Migration Stabling Requirements for Service Launch

During the timetable migration periods the operation of daily services needs to be safeguarded. This requires a certain number of total stabling berths as well as minimum stabling locations per depot/sidings location in order to allow the service ramp-up and ramp-down in an efficient and sustainable way. These minimum stabling requirements per timetable change are outlined in tables 7 to 10 below, by line, and refer only to the numbers of trains in service, not the total fleet size.

The purpose of the following tables is to assist the Programme identify what are the service launch requirements, and therefore provide the necessary stabling capacity to operate each timetable. The allocation of stabling berths for regular maintenance spares during each timetable migration step is left to the discretion of the Programme.

The Programme is still required to provide a total number of stabling berths sufficient to stable the fleet sizes as described in Section 3.

All stabling plans should ensure that they provide sufficient stabling capacity to accommodate spare legacy fleet during the introduction of the new trains and the configuration of depots throughout migration and to end state. It is the responsibility of the NTfL Project to develop comprehensive interim access plans covering all depots and stabling areas. The Piccadilly WTT(D) and Central WTT(C) timetable options in Appendix A are not currently planned but are indicative of future enhancements. For a better understanding of the service patterns refer to the NTfL Timetable Migration Plan (Ref 4).

5.1 Piccadilly Line Migration Minimum Stabling Requirements for Service Launch

Piccadilly line/stabling berths	Uxbridge platform	South Harrow sidings	Northfields depot	Arnos Grove sidings	Cockfosters depot
WTT(A)	1	6	32	7	31
WTT(B)	1	10	33	7	33
WTT(C)	1	12	34	7	35

Table 7 Piccadilly Line Migration Minimum Stabling Requirements for Service Launch

5.2 Waterloo & City Line Migration Minimum Stabling Requirements for Service Launch

Waterloo & City line/stabling berths	Waterloo depot
WTT(A)	6

Table 8 Waterloo & City Line Migration Minimum Stabling Requirements for Service Launch

5.3 Bakerloo Line Migration Minimum Stabling Requirements for Service Launch

Bakerloo line/stabling berths	Stonebridge Park sidings	Stonebridge Park depot	Queens Park sidings	London road sidings	Elephant & Castle sidings
WTT(A)	2	11	7	11	3

Table 9 Bakerloo Line Migration Minimum Stabling Requirements for Service Launch

5.4 Central Line Migration Minimum Stabling Requirements for Service Launch

Central line/stabling berths	Ruislip depot	White City sidings	Loughton sidings	Woodford sidings (inc. 1 platform)	Hainault depot
WTT(A)	23	12	10	6	38
WTT(B)	23	12	10	6	38

Table 10 Central Line Migration Minimum Stabling Requirements for Service Launch

6 Commercial Developments Interfacing with Stabling Locations

A number of commercial developments are being considered by TfL which may impact on the NTfL stabling capacity. These projects, as identified by Major Programme Sponsorship Sponsors and the Commercial Development team, are as follows:

Line	Location	Interface	Date/best estimate
Piccadilly	Cockfosters Depot	There is opportunity to develop the 'front site' at Cockfosters station, should the depot and sidings be redesigned as part of an upgrade scheme. Cockfosters is also a potential site for the service control centre.	No date – identified as an option
Waterloo & City	Waterloo	Network Rail are going to be implementing major changes to their station, including the lengthening of certain platforms and the integration of the currently disused Waterloo International Terminal facilities into the rest of the station for use by domestic services. The latter has implications for LU because of the creation of two additional links into the main LU ticket hall, but shouldn't have any impact on the Waterloo & City line areas. There's also talk of a longer term 'master plan' for the station but this is still years, if not decades, away.	Autumn 2017 Mid 2020s
Bakerloo	London Road	A housing development is being considered, with the proposed design reducing the 11 stabling roads to 9.	Design underway – dependencies with Bakerloo Line Extension
Bakerloo	Elephant & Castle	No commercial scheme but the station is being looked at by MPS in connection with both congestion relief proposals and the potential Bakerloo Line Extension into southeast London. Further impact will need to be assessed if the Bakerloo Line Extension goes ahead.	The Northern Line ticket hall expected to be delivered in 2021/22 if the programme proposed is fulfilled. The existing ticket hall is being considered within wider developments and work is being undertaken now to ascertain the best location for a new ticket hall.

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<p>Central</p>	<p>White City</p>	<p>Working with Commercial Development and Asset Development on northward expansion of Westfield London shopping centre over TfL land and with St. James re development of land north of Hammersmith & City line viaduct, which could include rafting over part of the Central line tracks just north of Wood Lane station.</p> <p>There is also a prospective development of the land to the north/east of White City station by Imperial College, which could be expanded to see improvements to (or possibly an over site development above) White City station.</p>	<p>To be completed by 2018</p> <p>Mid 2020s</p>
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Table 11 Commercial Developments Interfacing with Stabling Locations

Any loss of stabling capacity needs to be addressed by securing sufficient stabling in alternative suitable locations.

7 Abbreviations and Definitions

The following abbreviations are used in this document:

Abbreviations and Definitions	
Abbreviations	Definition
TPH	Trains per hour
GOA	Grade of automation
SPR	Sponsor's programme requirements
NTfL	New Tube for London

Table 12 Abbreviations and definitions

8 Document References

The following documents are referenced in this document:

References		
Ref.	Document ID	Title
New Tube for London Programme		
1.	NTfL-2344.1.1-LUL-RPT-00057	SPR Piccadilly
2.	NTfL-2344.1.1-LUL-RPT-00059	SPR Waterloo & City
3.	NTfL-2344.1.1-LUL-RPT-00056	Sponsor's Remit – accompanies SPR for individual lines
4.	NTfL-2344.1.1-LUL-PLN-00011	NTfL Timetable Migration Plan
5.	NTfL-2344.1.1-LUL-RPT-00066	NTfL Operations and Maintenance Concept
6.	PVEB3071.325670364	Track Plant and Servicing Depots Portfolio Operational Concept for On Track Machines / Engineers' Vehicles
7.	NTfL-2344.1.1-LUL-PLN-00013	Redundant Asset Strategy

Table 13 Document References

9 Consultation List

The NTfL Sponsor team and the following stakeholders have been consulted on this document:

Consultation list		
	Name	Title
1.	Tony Vigor	Schedules Manager Timetables
2.	Sarah Nuttall	Operational Development Manager Operations
3.	Simon Lawlor	Upgrades Delivery Manager Stations
4.	Alastair Baily	Upgrades Planning Manager
5.	Wendy Ransome	Transport Planning Principal Planner
6.	Gary Pulford	Senior Project Manager NTfL
7.	Blaise Westmaas	Programme Delivery Engineer NTfL

Table 14 Consultation List

10 Appendix A

10.1 Appendix A – Piccadilly Enhanced Timetable Service Changes

The indicative future enhanced timetable for Piccadilly is as follows:

Timetable	Implementation date	Headline frequencies and other comments
WTT(D) <i>(not a requirement)</i>	Future enhancement	36tph peak (indicative), 30tph offpeak

Table 15 Appendix A - Piccadilly Enhanced Timetable Service

The indicative migration stabling requirements are as follows:

Piccadilly line/stabling berths	Uxbridge platform	South Harrow sidings	Northfields depot	Arnos Grove sidings	Cockfosters depot
WTT(D) <i>(not a requirement)</i>	1	12	40	7	37

Table 16 Appendix A - Piccadilly Enhanced Timetable Minimum Stabling Requirements for Service Launch

10.2 Appendix A – Central Enhanced Timetable Service Changes

The indicative future enhanced timetable for Central is as follows:

Timetable	Implementation on date	Headline frequencies and other comments
WTT(C) <i>(not a requirement)</i>	Future enhancement	36tph peak (indicative) service equally split to end of line termini, 30tph offpeak equally split to end of line termini. 4tph all day Hainault-Woodford via Grange Hill.

Table 17 Appendix A - Central Enhanced Timetable Service

The indicative migration stabling requirements are as follows:

Central line/stabling berths	Ruislip depot	White City sidings	Loughton sidings	Woodford sidings (inc. 1 platform)	Hainault depot
WTT(C) <i>(not a requirement)</i>	30	12	10	6	38

Table 18 appendix A - Central Enhanced Timetable Minimum Stabling Requirements for Service Launch