Regards

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100 Avenue Road Swiss Cottage - Infrastructure Protection Works

B112 Jubilee Line

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100 Avenue Road Project

Infrastructure Protection Works

Swiss Cottage to St. John's Wood

Northbound and Southbound Jubilee Lines

		Signature	Date
Prepared by	Anthony Vella Track Assessment Engineer		30-11-15
Checked by	Andrew Ho Track Assessment Engineer		10-06-16
Approved by	Andrew Brice Engineering Design Manager		10-06-16

Document History

Revision	Date	Summary of changes
01	10/06/2016	First draft issue

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1. Executive Summary

An assessment of the existing track geometry condition has been undertaken to assess the impact of any ground movements arising as a result of demolition for the proposed redevelopment at 100 Avenue Road, London, NW3.

100 Avenue Road is located in the vicinity of Swiss Cottage London Underground Train Station above the Northbound and Southbound Jubilee Line tunnels.

The track geometry condition on both the Northbound and Southbound roads has been found to be out of tolerance with a number of safety standard exceedances and maintenance limit exceedances when compared to a theoretical design alignment. There is little concern with regard to wheel unloading characteristic, with exception in the area of point numbers 105 & 106 on the Northbound, as shown by the twist assessment in the appendix. These areas marginally exceed the Maintenance Target (MT).

This assessment covers the effect of track movements and existing tunnel clearance only.

The trigger values are set conservatively. Some of the trigger values are not the absolute values specified in standards S1156 and S1159.

Track trigger values are detailed in Section 6 of this document.

Where possible, trigger values are aligned to actions prescribed in the Standard.

Where applicable, a "Change of ....." value relative to the survey baseline readings have been used.

Issues that require further action are highlighted in red

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2. Introduction

This report has been prepared by London Underground Track Engineering (LUTE) based upon survey information supplied by the London Underground Survey Team (LUST). The report relates to the existing track geometry and clearances for the Jubilee Line tracks between Swiss Cottage and St. John's Wood adjacent to the development at 100 Avenue Road.

This report gives an overview of existing track conditions showing track dimensions and tolerances relative to track standard:

Track – Dimensions and tolerances No S1159

Track – Gauging and Clearances No S1156

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3. Track Geometry Condition Assessment

Compliance to LUL category 1 standard S1159 is described in the following sections.

Notes

- *Data is based upon the static track position*
- *As design data is unavailable, the existing alignment has been 'design smoothed' to enable an allowance for levels, transitions, vertical curves and gradients. This information is not exact but it does give a good indication of the track geometry.*
- *Survey data at 2m and 5m intervals has been provided by LU Survey Team dated 2nd October 2014.*

3.1 Northbound

An assessment of the track geometry against the following clauses (where available) within S1159 has been undertaken. The table summarises areas where the standards have been exceeded and describes the worst case.

NB Jubilee	Maintenance Target	Maintenance Limit	Safety Standard
Deviation between consecutive levels (clause 2.1.1):	5	7	10
	5	7	15
Deviation between vertical position of running surfaces (2.1.6):	-14 / +5	-16 / +5	-18 / +5
	-14 & 5	-16 & 5	10
Deviation between lateral alignments (2.2.1):	8	10	15
	8	10	16
Deviation from lateral alignment (2.2.4):	-8 / +8	-10 / +10	-13 / +13
	-8 & 8	-10 & 10	16
Deviation from marked cant (2.3):	-10 / +8	-12 / +10	-15 / +10
	-6 & 4		
Deviation in gauge (3.1):	-5 / +11	-7 / +22	-10 / +27
	-5	-7	-8

Table 1 - Summary assessment of track geometry NB

Based upon static survey data for **10m twist (2.5.2)** it is noted that the results are within limiting values.

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3.2 Southbound

An assessment of the track geometry against the following clauses (where available) within S1159 has been undertaken. The table summarises areas where the standards have been exceeded and describes the worst case.

SB Jubilee	Maintenance Target	Maintenance Limit	Safety Standard
Deviation between consecutive levels (clause 2.1.1):	5	7	10
	5	7	14
Deviation between vertical position of running surfaces (2.1.6):	-14 / +5	-16 / +5	-18 / +5
	-14 & 5	9	9
Deviation between lateral alignments (2.2.1):	8	10	15
	8	12	
Deviation from lateral alignment (2.2.4):	-8 / +8	-10 / +10	-13 / +13
	-9 & 8	10	14
Deviation from marked cant (2.3):	-10 / +8	-12 / +10	-15 / +10
Deviation in gauge (3.1):	-5 / +11	-7 / +22	-10 / +27

Table 2 - Summary assessment of track geometry SB

Based upon static survey data for **10m twist (2.5.2)** it is noted that the results are within limiting values.

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4. Infringements to Structure Profile Assessment – S1156

A clearance assessment by LUTE has been included in this report based upon survey data from September 2014.

4.1 Northbound Infringements

The worst case infringement is stated as -108mm using the "C4 Structure Profile Tunnel and Platform Offside". We believe this to be the correct profile as the infringement is under the platform nosing.

An inspection is recommended at this location to verify structure clearances.

4.2 Southbound Infringements

The worst case infringement is stated as -126mm using the "C4 Structure Profile Tunnel and Platform Offside". We believe this to be the correct profile as the infringement is under the platform nosing.

An inspection is recommended at this location to verify structure clearances.

5. Discussion / Summary

Based upon the TRV track survey for static 2m/10m/wheel unload, the track cant appears to be acceptable.

Other areas of the track geometry appear to be in a less favorable condition as noted in the tables above.

The report produced by URS Geotechnical Engineers on 100 Avenue Road, Swiss Cottage (Document No.47066169 Rev 2, dated July 2015) shows the following as expected ground movements:

- **During the Un-load Stage (i.e. demolition and excavation).** Maximum heave of 10mm in the zones with the largest load removal.

- **During the Re-Load Stage (i.e. construction phase).** Maximum net settlement on the southbound track is 5mm.

The structural integrity of the tunnel will be beyond the scope of this report; advice should be sought from the relevant LU Civil Engineer.

Based on these findings, advice must be sought from the LU Asset Performance Track Infrastructure Manager, Kyle Newman, to establish if there is a history of geometry non-compliance in this area. In addition, the clearance non-compliance needs to be checked to establish any risk.

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6. Survey Trigger Values

If Civils values are triggered, it is presumed this will initiate a further survey, to which the Track trigger values can be applied to for further assessment. It is requested that the Civils trigger values are supplied to LUTE so that the process and actions can be understood.

Based upon URS Geotechnical Engineer Calculations & Report, survey trigger values are detailed below. Any breach of the trigger values will necessitate the implementation of the specified actions. They are not all the absolute values in standards S1156/S1159, some are based upon any detected **change** from the OPs surveyed baseline set before works commence.

Table 3 – Summary of trigger values based on track assessment

Trigger	Clearance	2m Twist	10m Twist	Cant	Lateral Alignment	Vertical Profile
	S1156 (5.2.9)	*S1159 (2.4)*	*S1159 (2.5.1)*	*S1159 (2.3)*	*S1159 (2.2.1)*	*S1159 (2.1.1)*
GREEN	Change of clearance **≤ 3mm**	Absolute Value(s)* **< 20mm**	Absolute Value(s)* **< 37mm**	Change of cant **≤ 3mm**	Change of overlapping versines **≤ 3mm**	Change from baseline **≤ 3mm**
AMBER	Change of clearance **> 3mm ≤ 6mm**	Absolute Value(s)* **≥ 20mm < 25mm**	Absolute Value(s)* **≥ 37mm < 40mm**	Change of cant **> 3mm ≤ 6mm**	Change of overlapping versines **> 3mm ≤ 6mm**	Change from baseline **> 3mm ≤ 6mm**
RED	Change of clearance **> 6mm ≤ 12mm**	Absolute Value(s)* **≥ 25mm < 30mm**	Absolute Value(s)* **≥ 40mm < 50mm**	Change of cant **> 6mm ≤ 12mm**	Change of overlapping versines **> 6mm ≤ 12mm**	Change from baseline **> 6mm ≤ 12mm**
BLACK	Change of clearance **> 12mm**	Absolute Value(s)* **≥ 30mm**	Absolute Value(s)* **≥ 50mm**	Change of cant **> 12mm**	Change of overlapping versines **> 12mm**	Change from baseline **> 12mm**

* Absolute values are taken directly from Standard S1159.

- Where existing results are compliant, "Absolute" values are taken directly from the standard.
- Where existing values are non-compliant "Change of ..... " values have been supplied.
- Where ± values exist in the Standard, to avoid unnecessary complexity the trigger values have been supplied as "Change of....." Values due to the relatively small predicted movements.

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- The LU Standard minimum actions (detailed in S1156 & S1159) have been adjusted to 'trigger values' and relate to the worst case site situation, i.e. allowing for irregularities or non-compliance already within the track. A summary of the worst case situation is detailed within this document.
- Should a **red** or **black** trigger value be breached and actioned, i.e. a speed restriction imposed or trains stopped based upon the trigger values, then LU Engineering Standards (S1159 & S1156) minimum actions must be referenced by the on-site T002/3 to avoid unnecessary disruption of the passenger service as the movement causing the trigger to be breached may not have occurred at the worst case location.

Trigger	Actions
GREEN	No action required.
AMBER	Inform LUTE and Jubilee Line Track Manager ASAP with details of the recorded Track movement.
RED	a. Contact the Duty Operations Manager Engineering (DOME)/Duty Engineer/ Signals Operations Manager to alert them of movement and arrange for a 20mph speed restriction; b. Inform LUTE, Jubilee Line Track Manager and Infrastructure Protection ASAP with details of the recorded tunnel movement; c. Inform the Jubilee Line Track Manager and Duty Engineer to arrange for rectification works as necessary and to undertake an assessment (by a THP T002/3) on whether it is safe to continue to run trains at normal speed. d. The Site Contractor via LU Infrastructure Protection is to arrange and undertake a track survey to check the recorded movements against the baseline track survey data. New track survey is to be issued to LUTE within 48 hours of the survey having taken place.
BLACK	a. Contact the DOME/Duty Engineer and/or the Signals System Manager to arrange for the suspension of trains immediately; b. Inform LUTE, Jubilee Line Track Manager and Infrastructure Protection ASAP with details of the recorded tunnel movement; c. Inform the Jubilee Line Track Manager and Duty Engineer to arrange for rectification works as necessary and to undertake an assessment (by a THP T002/3) on whether it is safe to continue to run trains.

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7. General Recommendations / Actions

- To avoid the possibility of track maintenance work causing a breach of trigger values, close contact with the local track manager via the Outside Parties Engineer is recommended.
  LU Asset Performance –Jubilee Line – Kyle Newman
  LU Capital Programmes – Infrastructure Protection Engineer – Peter Brierley

- LUTE must be informed of any breach in the trigger values ASAP so that track assessments can take place to help alleviate the impact of that breach.

- The Emergency Preparedness Plan must include details on how a nominated Track Hand-Back Person (THP) T002/3 will be contacted should the relevant trigger value be breached.

  - The THP T002/3 must have the availability of a tunnel gauge, be competent with its use, and will need adequate help with its transportation to site.
    Note: This is a 3 person operation.

  - The THP T002/3 must also be competent to check:-
    - 10m Twist as described in LU Engineering Standards S1159, Clause 2.5.1.
    - 2m Twist as described in LU Engineering Standards S1159, Clause 2.4.
    - Change in Cross Level over 5 sleepers as described in LU Engineering Standards S1159, Clause 2.3.
    - Lateral Alignment deviation as described in LU Engineering Standards S1159, Clause 2.2.4.
    - Versine variation as described in LU Engineering Standards S1159, Clause 2.2.1. *Note: This is a 3 person operation.*
    - Vertical Profile as described in LU Engineering Standards S1159, Clause 2.1.1.
      Note: This is a 3 person operation.
    - A general inspection of track condition.

- Liaison to enable the THP T002/3 attendance can be made as follows:
- LU Asset Performance –Jubilee Line – Kyle Newman

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8. Appendices

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i. Northbound 5m Station Track Geometry Assessment

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Northbound Jubilee Line

Standard	Survey Station (5m intervals)	Theoretical Rail Level (cm)	Surveyed Rail Level (cm)	Level Difference (mm)	Deviation Consecutive levels (mm)	Theoretical Cant (mm)	Surveyed Cant (mm)	Cant Difference (mm)	Deviation Cant (mm)	10m Twist (mm)	prop / exist versine diff (mm)	Lateral Deviation (mm)	Variation between surveyed overlapping versines (no allowance for transition) (mm)	2.2.1 with allowance for transition added (mm)	Design Gauge (mm)	Surveyed Gauge (mm)	Deviation in Gauge +/-(mm)
				Clause 2.1.6	Clause 2.1.1				Clause 2.3	Clause 2.5.2		Clause 2.2.4	Clause 2.2.1	Clause 2.2.1			Clause 3.1
S1159 Class I				-3 3	2				-3 3			-4 4	2	2			-3 3
S1159 MT				-14 5	5				-10 8	35		-8 8	8	8			-8 11
S1159 IML				-15 5	7				-12 10	37		-10 10	10	10			-10 11
S1159 SS	-			-13 5	10				-15 10	40		-13 13	15	15			-10 27
	1	141.939	141.939	0	0	-59	-59	0	0	0	1	0	0	1	1435	1436	3
	2	141.935	141.935	0	0	-56	-55	-1	-1	0	-0	0	0	0	1435	1435	0
	3	141.734	141.738	5	4	-55	-56	1	1	3	4	-5	10	9	1435	1434	-2
	4	141.834	141.842	8	4	-54	-54	0	0	5	-1	-9	3	1	1435	1436	1
	5	141.534	141.537	4	5	-54	-52	-2	-2	4	3	-4	3	3	1435	1432	-3
	6	141.435	141.442	8	4	-55	-57	2	2	3	-2	-8	7	5	1435	1434	-1
	11	141.339	141.344	5	3	-55	-56	1	1	4	1	-3	1	2	1435	1434	-1
	14	141.251	141.247	-4	9	-52	-51	-1	-1	6	-2	4	3	3	1435	1437	2
	17	141.174	141.156	-18	12	-46	-46	0	0	6	1	15	4	2	1435	1436	3
	20	141.110	141.095	-15	0	-43	-44	1	1	7	-1	18	2	2	1435	1435	0
	23	141.061	141.057	-4	11	-36	-36	0	0	12	-1	4	5	0	1435	1434	-1
	26	141.023	141.029	6	10	-29	-29	0	0	15	0	-6	9	1	1435	1435	0
	29	140.995	140.999	4	2	-20	-21	1	1	15	0	-4	9	0	1435	1434	-1
	32	140.972	140.971	0	5	-12	-11	-1	-1	18	3	0	9	2	1435	1435	0
	35	140.952	140.950	3	3	-4	-3	-1	-1	18	-3	-3	0	5	1435	1434	-1
	38	140.935	140.942	7	4	1	-2	3	3	9	1	-7	7	3	1435	1434	-1
	41	140.919	140.911	-8	15	3	9	-6	-6	12	2	8	3	1	1435	1435	0
	44	140.903	140.903	0	-7	-2	-1	3	3	1	-3	0	4	3	1435	1437	2
	47	140.888	140.891	3	3	0	0	0	0	9	4	-3	7	7	1435	1433	-2
	50	140.872	140.879	7	4	0	-1	1	1	0	-3	-7	9	8	1435	1433	-2
	53	140.855	140.855	0	-7	0	0	0	0	0	1	0	4	3	1435	1431	-4
	56	140.838	140.837	-1	1	1	2	-1	-1	3	-1	1	2	1	1435	1433	-2
	59	140.821	140.817	-4	3	1	1	0	0	3	-1	4	1	0	1435	1431	-4
	62	140.804	140.806	2	6	0	2	-2	-2	0	4	-2	5	5	1435	1433	-2
	65	140.786	140.789	-2	4	0	-3	3	3	4	-1	2	6	5	1435	1434	-1
	68	140.772	140.772	0	2	-1	0	-1	-1	2	-2	0	1	1	1435	1432	-3
	71	140.757	140.758	1	2	0	1	-1	-1	4	1	-1	4	4	1435	1429	-6
	74	140.741	140.739	-2	3	-1	-2	1	1	2	2	-2	1	1	1435	1427	-8
	77	140.725	140.727	2	4	-1	0	-1	-1	1	-0	-2	6	7	1435	1433	-2
	80	140.706	140.709	1	1	-1	-1	0	0	1	5	-1	10	10	1435	1429	-6
	83	140.691	140.694	3	2	-1	-3	2	2	3	-4	-3	10	9	1435	1432	-3
	86	140.675	140.673	-2	4	0	1	-1	-1	4	2	2	5	5	1435	1430	-5
	89	140.656	140.651	-7	6	1	3	-2	-2	6	-2	7	4	4	1435	1431	-4
	92	140.642	140.642	0	7	-1	-2	1	1	3	2	0	5	4	1435	1429	-6
	95	140.626	140.632	6	6	-2	-3	1	1	6	-2	-6	4	3	1435	1432	-3
	98	140.609	140.614	5	1	-2	-3	-1	-1	1	1	-5	3	3	1435	1426	-7
	101	140.592	140.591	-1	6	0	-2	2	2	3	0	1	1	1	1435	1431	-4
	104	140.576	140.569	-7	6	1	4	-3	-3	5	-3	7	3	3	1435	1435	0
	107	140.560	140.556	-4	3	1	0	1	1	2	2	4	5	5	1435	1432	-3
	110	140.545	140.549	5	9	1	-3	4	4	7	-1	-5	3	2	1435	1430	-5
	113	140.529	140.533	4	1	1	3	-2	-2	3	1	-4	2	2	1435	1431	-4
	116	140.513	140.517	4	0	0	1	-1	-1	2	1	-4	2	0	1435	1434	-1
	119	140.496	140.497	1	3	-5	-4	-1	-1	2	0	-1	3	1	1435	1436	1
	122	140.479	140.481	2	0	-16	-13	-3	-3	14	3	-2	2	3	1435	1436	1
	125	140.463	140.473	10	8	-29	-31	2	2	27	-6	-10	15	10	1435	1442	7
	128	140.451	140.452	1	9	-43	-44	1	1	31	7	-1	8	3	1435	1439	0
	131	140.446	140.453	8	7	-53	-54	1	1	23	-4	-8	19	11	1435	1435	0
	132	140.452	140.456	4	4	-58	-60	2	2	16	1	-4	2	2	1435	1436	1
	133	140.475	140.473	-2	6	-60	-59	-1	-1	5	-1	2	3	2	1435	1437	2
	134	140.520	140.520	0	2	-62	-61	-1	-1	1	1	0	3	3	1435	1436	1
	135	140.600	140.600	0	0	0	-63	63	0	4	-29	0	0	0	1435	1435	0

Note(1) means value not calculated as there is no survey for the preceding station

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ii. Southbound 5m Station Track Geometry Assessment

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Southbound Jubilee Line

Standard	Survey Station (5m intervals)	Theoretical Rail Level (m)	Surveyed Rail Level (m)	Level Difference (mm)	Deviation Consecutive levels (mm)	Theoretical Cant (mm)	Surveyed Cant (mm)	Cant Difference (mm)	Deviation Cant (mm)	10m Twist (mm)	prop / exist versine diff (mm)	Lateral Deviation (mm)	Variation between surveyed overlapping versines (no allowance for transition) (mm)	2.2.1 with allowance for transition added (mm)	Design Gauge (mm)	Surveyed Gauge (mm)	Deviation in Gauge +/-(mm)
				Clause 2.1.6	Clause 2.1.1				Clause 2.3	Clause 2.5.2		Clause 2.2.4	Clause 2.2.1	Clause 2.2.1			Clause 3.1
S1159 Class I				-3 3	2				-3 3			-4 4	2	2			-3 3
S1159 MT				-14 5	5				-10 8	35		-8 8	8	8			-5 11
S1159 ML				-15 5	7				-12 10	37		-10 10	10	10			-7 20
S1159 SS				-16 5	10				-15 10	40		-13 13	15	15			-10 27
	201	140.400	140.400	0	0	41	41	0	0	0	0	0	0	1	1435	1432	-3
	202	140.400	140.395	-5	5	42	42	0	0	0	-2	-2	0	2	1435	1440	5
	203	140.405	140.395	-8	7	42	43	-1	-1	2	2	8	5	4	1435	1440	5
	204	140.410	140.400	-10	2	42	40	2	2	2	-1	10	3	2	1435	1442	7
	205	140.420	140.425	4	14	45	46	-3	-3	3	-2	-4	1	0	1435	1433	-2
	206	140.434	140.437	2	2	43	41	2	2	1	4	-2	8	7	1435	1440	5
	211	140.451	140.445	-2	5	42	43	-1	-1	3	-3	2	8	8	1435	1441	6
	214	140.463	140.471	1	4	42	41	1	1	0	6	-1	11	11	1435	1436	1
	217	140.485	140.488	-1	2	42	43	-1	-1	0	-5	1	12	11	1435	1441	6
	220	140.506	140.509	0	1	42	41	1	1	0	1	0	6	6	1435	1438	3
	223	140.528	140.530	2	2	43	45	-2	-2	2	2	-2	2	2	1435	1442	7
	226	140.547	140.551	4	2	43	41	2	2	0	-1	-4	4	3	1435	1438	3
	229	140.565	140.563	-2	6	45	45	0	0	0	-1	2	1	0	1435	1440	5
	232	140.583	140.580	-3	1	45	46	-1	-1	5	0	3	1	1	1435	1437	2
	235	140.601	140.599	-2	1	44	46	-2	-2	1	1	2	0	0	1435	1437	2
	238	140.618	140.624	6	8	42	41	1	1	5	1	-6	2	0	1435	1438	3
	241	140.634	140.637	3	3	38	37	1	1	5	-2	-3	6	3	1435	1438	3
	244	140.650	140.646	-4	7	35	38	-3	-3	3	2	4	2	0	1435	1436	1
	247	140.665	140.663	-2	2	31	29	2	2	8	-3	2	5	5	1435	1439	4
	250	140.680	140.683	2	5	30	28	2	2	10	3	-2	7	6	1435	1438	3
	253	140.696	140.695	-1	4	31	33	-2	-2	4	-1	1	3	3	1435	1440	5
	256	140.712	140.712	0	1	31	31	0	0	3	1	0	1	1	1435	1438	3
	259	140.727	140.729	2	1	31	30	1	1	3	-3	-2	4	4	1435	1445	10
	262	140.743	140.742	-1	3	32	33	-1	-1	2	2	1	6	5	1435	1437	2
	265	140.755	140.755	0	1	32	33	-1	-1	3	1	0	1	1	1435	1434	-1
	268	140.775	140.773	-2	2	32	30	2	2	3	-1	2	2	2	1435	1437	2
	271	140.751	140.754	2	5	33	33	0	0	0	0	-2	0	0	1435	1439	4
	274	140.807	140.805	-3	5	33	35	-2	-2	5	-2	3	1	1	1435	1441	6
	277	140.825	140.824	1	3	33	31	2	2	2	4	-1	6	5	1435	1436	1
	280	140.838	140.839	1	0	31	34	-3	-3	1	-4	-1	8	8	1435	1435	4
	283	140.851	140.855	4	3	28	27	1	1	4	5	-4	5	6	1435	1439	4
	286	140.863	140.866	3	1	27	24	3	3	10	-2	-3	7	6	1435	1441	6
	289	140.873	140.873	-1	4	27	28	-1	-1	1	-3	1	2	1	1435	1439	4
	292	140.884	140.883	-2	1	28	25	-1	-1	5	4	2	10	5	1435	1440	5
	295	140.896	140.896	0	1	28	30	-2	-2	2	-5	0	11	11	1435	1438	3
	298	140.909	140.914	5	5	27	27	0	0	2	1	-5	7	6	1435	1439	4
	301	140.925	140.932	7	2	24	24	2	2	6	1	-7	1	0	1435	1436	1
	304	140.946	140.950	4	3	27	28	-1	-1	3	-1	-4	3	2	1435	1439	4
	307	140.975	140.971	-4	8	28	28	0	0	4	1	4	1	1	1435	1436	1
	310	141.016	141.002	-14	10	25	31	-2	-2	3	-2	14	3	3	1435	1441	6
	313	141.071	141.062	-9	5	25	28	1	1	0	1	-3	3	3	1435	1435	0
	316	141.140	141.130	-10	1	25	27	2	2	4	1	-10	0	0	1435	1435	0
	319	141.222	141.221	-1	9	30	33	-3	-3	5	-1	1	2	2	1435	1437	2
	322	141.314	141.323	9	10	30	29	1	1	2	1	-9	2	2	1435	1438	3
	325	141.412	141.415	2	5	29	30	-1	-1	3	-2	-2	2	1	1435	1438	3
	328	141.514	141.516	2	1	23	27	2	2	2	4	-2	6	6	1435	1437	2
	331	141.617	141.616	-1	3	25	30	-1	-1	0	-2	1	7	6	1435	1437	2
	332	141.720	141.720	0	1	30	25	1	1	2	-1	0	0	0	1435	1440	5
	333	141.822	141.822	0	0	30	31	-1	-1	1	0	0	2	1	1435	1437	2
	334	141.922	141.922	0	0	30	29	1	1	0	1	0	5	1	1435	1433	-2
	335	142.016	142.016	0	0	0	29	-29	U	2	23	0	0	U	1435	1438	3

Note: U means value not calculated as there is no survey for the preceding station

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iii. Northbound Clearance Assessment

Clearance Log Track 1	**Local Database**																	
Job Number	**Description B111 NB**																	
Machine																		
User LU Track Engineering																		
Software Build Code 7.7.26																		
Run Date 05/11/2015																		
Normal Speed Clearance Profile	24 C1 Structures																	
Heights mm ARL	>2250	2250 -1000	1000 -700	700 -500	<500	>2250	2250 -1000	1000 -700	700 -500	<500								
Normal Clearances mm	0	0	0	0	0	0	0	0	0	0								
Failed Clearances mm	0	0	0	0	0	0	0	0	0	0								
High Speed Clearance Profile	24 C1 Structures																	
Heights mm ARL	>2250	2250 -1000	1000 -700	700 -500	<500	>2250	2250 -1000	1000 -700	700 -500	<500								
Normal Clearances mm	0	0	0	0	0	0	0	0	0	0								
Failed Clearances mm	0	0	0	0	0	0	0	0	0	0								
Run Start Time 14:06:14																		
Run Finish Date/Time 05/Nov/2015 14:08:50																		
Side	**LH Side**					**RH Side**												
Height	**>2250**	**2250 -10(**	**1000 -70(**	**700 -500**	**<500**	**>2250**	**2250 -10(**	**1000 -70(**	**700 -500**	**<500**	**Val**	**Check**	**Cl Pro**	**Accurac**	**Lat Tols**	**Ageing**	**Seq**	**kph**
Segment	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**								
Filename																		
c:\ELRDB\B111N\000000GK.sc0	-20	-30	0	-20	35	110	68	282	-46	-73	?	INFRINGEMEN	24	5	25		1	40
c:\ELRDB\B111N\000005GK.sc0	-16	-36	-33	-16	31		19	35	-54	-98	?	INFRINGEMEN	24	5	25		2	40
c:\ELRDB\B111N\000010GK.sc0	10	6	16	14	37				-58	-80	?	INFRINGEMEN	24	5	25		3	40
c:\ELRDB\B111N\000015GK.sc0	36	29	37	31	54				-59	-75	?	INFRINGEMEN	24	5	25		4	40
c:\ELRDB\B111N\000020GK.sc0	31	21	26	22	46				-57	-105	?	INFRINGEMEN	24	5	25		5	40
c:\ELRDB\B111N\000025GK.sc0	11	4	1	-3	33				-60	-76	?	INFRINGEMEN	24	5	25		6	40
c:\ELRDB\B111N\000030GK.sc0	29	10	12	5	30				-57	-76	?	INFRINGEMEN	24	5	25		7	40
c:\ELRDB\B111N\000035GK.sc0	28	17	20	17	45				-63	-72	?	INFRINGEMEN	24	5	25		8	40
c:\ELRDB\B111N\000040GK.sc0	31	17	20	17	41				-60	-84	?	INFRINGEMEN	24	5	25		9	40
c:\ELRDB\B111N\000045GK.sc0	39	22	23	17	40				-53	-75	?	INFRINGEMEN	24	5	25		10	40
c:\ELRDB\B111N\000050GK.sc0	9	5	4	0	28				-55	-99	?	INFRINGEMEN	24	5	25		11	40
c:\ELRDB\B111N\000055GK.sc0	-8	-14	-18	-24	14				-51	-79	?	INFRINGEMEN	24	5	25		12	40
c:\ELRDB\B111N\000060GK.sc0	-9	-15	-13	-17	21				-53	-108	?	INFRINGEMEN	24	5	25		13	40
c:\ELRDB\B111N\000065GK.sc0	20	2	9	6	37				-53	-94	?	INFRINGEMEN	24	5	25		14	40
c:\ELRDB\B111N\000070GK.sc0	9	2	5	2	33	526			-56	-86	?	INFRINGEMEN	24	5	25		15	40
c:\ELRDB\B111N\000075GK.sc0	13	-3	3	-4	32				-51	-85	?	INFRINGEMEN	24	5	25		16	40
c:\ELRDB\B111N\000080GK.sc0	9	-6	-3	-7	33				-49	-69	?	INFRINGEMEN	24	5	25		17	40
c:\ELRDB\B111N\000085GK.sc0	4	-2	-17	-20	19				-46	-103	?	INFRINGEMEN	24	5	25		18	40
c:\ELRDB\B111N\000090GK.sc0	-3	-6	-15	-21	-16				-51	-101	?	INFRINGEMEN	24	5	25		19	40
c:\ELRDB\B111N\000095GK.sc0	6	-5	-16	-21	5	863			-52	-66	?	INFRINGEMEN	24	5	25		20	40
c:\ELRDB\B111N\000100GK.sc0	18	3	5	-3	32				-53	-78	?	INFRINGEMEN	24	5	25		21	40
c:\ELRDB\B111N\000105GK.sc0	23	1	0	-5	34				-55	-78	?	INFRINGEMEN	24	5	25		22	40
c:\ELRDB\B111N\000110GK.sc0	36	25	11	7	34				-58	-85	?	INFRINGEMEN	24	5	25		23	40
c:\ELRDB\B111N\000115GK.sc0	17	12	4	-5	14				-56	-81	?	INFRINGEMEN	24	5	25		24	40
c:\ELRDB\B111N\000120GK.sc0	16	3	4	-2	31				-53	-102	?	INFRINGEMEN	24	5	25		25	40
c:\ELRDB\B111N\000125GK.sc0	2	-38	-10	-12	20	820	8	12	-60	-105	?	INFRINGEMEN	24	5	25		26	40
c:\ELRDB\B111N\000130GK.sc0	-9	-15	-5	-11	20	52	247	320	302	-94	?	INFRINGEMEN	24	5	25		27	40
Vehicle List Track 1																		
c:\Vehicles Feb 15\Tube Static - C4 SPmin Tunnel and Platform Offside																		
Maximum vehicle speed is: Not Known																		
	C4 SP (Below 171mm)																	
	C4 SP Tunnel and Platfrom Offside (Above 171mm) END																	
	C4 SP Tunnel & Platform Offside (Above 171mm) CENTRE																	

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Clearance Log Track 1	**Local Database**																		
Job Number	**Description B112 NB**																		
Machine																			
User LU Track Engineering																			
Software Build Code 7.7.26																			
Run Date 05/11/2015																			
Normal Speed Clearance Profile	24	C1 Structures																	
Heights mm ARL	>2250	2250 -1000	1000 -700	700 -500	<500	>2250	2250 -1000	1000 -700	700 -500	<500									
Normal Clearances mm	0	0	0	0	0	0	0	0	0	0									
Failed Clearances mm	0	0	0	0	0	0	0	0	0	0									
High Speed Clearance Profile	24	C1 Structures																	
Heights mm ARL	>2250	2250 -1000	1000 -700	700 -500	<500	>2250	2250 -1000	1000 -700	700 -500	<500									
Normal Clearances mm	0	0	0	0	0	0	0	0	0	0									
Failed Clearances mm	0	0	0	0	0	0	0	0	0	0									
Run Start Time 13:47:48																			
Run Finish Date/Time 05/Nov/2015 13:49:10																			
Side	**LH Side**					**RH Side**													
Height	**>2250**	**2250 -10(**	**1000 -70(**	**700 -500**	**<500**	**>2250**	**2250 -10(**	**1000 -70(**	**700 -500**	**<500**	**Val**	**Check**	**Cl Pro**	**Accurac**	**Lat Tols**	**Ageing**	**Seq**	**kph**	
Segment	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**									
Filename																			
c:\ELRDB\B112N\000726GK.sc0	115	127	270	200	79	62	94	232	186	39	?	CLEAR	24	5	25		1	40	
c:\ELRDB\B112N\000731GK.sc0	118	112	269	219	69	107	116	256	207	47	?	CLEAR	24	5	25		2	40	
c:\ELRDB\B112N\000736GK.sc0	111	133	271	202	52	98	102	246	201	63	?	CLEAR	24	5	25		3	40	
c:\ELRDB\B112N\000741GK.sc0	124	135	267	214	54	96	95	243	196	60	?	CLEAR	24	5	25		4	40	
c:\ELRDB\B112N\000746GK.sc0	123	110	265	208	60	86	81	65	190	57	?	CLEAR	24	5	25		5	40	
c:\ELRDB\B112N\000751GK.sc0	133	176	288	236	61	71	48	63	24	-35	?	INFRINGEMEN	24	5	25		6	40	
c:\ELRDB\B112N\000756GK.sc0	114	148	278	243	88	69	55	56	18	-40	?	INFRINGEMEN	24	5	25		7	40	
c:\ELRDB\B112N\000761GK.sc0	86	135	258	243	64	99	72	67	28	-23	?	INFRINGEMEN	24	5	25		8	40	
c:\ELRDB\B112N\000766GK.sc0	33	133	244	245	95	88	71	81	45	-12	?	INFRINGEMEN	24	5	25		9	40	
c:\ELRDB\B112N\000771GK.sc0	103	147	243	252	66	99	72	86	39	21	?	CLEAR	24	5	25		10	40	
c:\ELRDB\B112N\000776GK.sc0	130	183	266	259	61	99	81	90	218	55	?	CLEAR	24	5	25		11	40	
c:\ELRDB\B112N\000781GK.sc0	129	182	289	266	69	103	95	264	213	51	?	CLEAR	24	5	25		12	40	
c:\ELRDB\B112N\000786GK.sc0	148	197	275	249	78	135	119	281	236	27	?	CLEAR	24	5	25		13	40	
c:\ELRDB\B112N\000791GK.sc0	132	196	305	259	36	111	124	80	111	-16	?	INFRINGEMEN	24	5	25		14	40	
c:\ELRDB\B112N\000796GK.sc0	133	194	304	241	69	140	130	214	252	71	?	CLEAR	24	5	25		15	40	
c:\ELRDB\B112N\000801GK.sc0	37	169	280	233	63	154	123	141	263	77	?	CLEAR	24	5	25		16	40	

Vehicle List Track 1

c:\Vehicles Feb 15\Tube Static - C4 SPmin Tunnel and Platform Offside
Maximum vehicle speed is: Not Known

C4 SP (Below 171mm)
C4 SP Tunnel and Platfrom Offside (Above 171mm) END
C4 SP Tunnel & Platform Offside (Above 171mm) CENTRE

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iv. Southbound Clearance Assessment

Clearance Log Track 1	Local Database																	
Job Number	Description B111 SB																	
Machine																		
User LU Track Engineering																		
Software Build Code 7.7.26																		
Run Date 05/11/2015																		
Normal Speed Clearance Profile	24	C1 Structures																
Heights mm ARL	>2250	2250 -1000	1000 -700	700 -500	<500	>2250	2250 -1000	1000 -700	700 -500	<500								
Normal Clearances mm	0	0	0	0	0	0	0	0	0	0								
Failed Clearances mm	0	0	0	0	0	0	0	0	0	0								
High Speed Clearance Profile	24	C1 Structures																
Heights mm ARL	>2250	2250 -1000	1000 -700	700 -500	<500	>2250	2250 -1000	1000 -700	700 -500	<500								
Normal Clearances mm	0	0	0	0	0	0	0	0	0	0								
Failed Clearances mm	0	0	0	0	0	0	0	0	0	0								
Run Start Time 14:10:07																		
Run Finish Date/Time 05/Nov/2015 14:12:43																		
Side	LH Side					RH Side												
Height	>2250	2250 -100	1000 -700	700 -500	<500	>2250	2250 -100	1000 -700	700 -500	<500	Val	Check	Cl Pro	Accurac	Lat Tols	Ageing	Seq	kph
Segment	1	2	3	4	5	6	7	8	9	10								
Filename																		
c:\ELRDB\B111S\000000JK.sc0	25	24	14	10	26	32	39	226	-44	-45	?	INFRINGEMEN	24	5	25	1	40	
c:\ELRDB\B111S\000005JK.sc0	21	2	-25	-34	-2		-7	18	-70	-76	?	INFRINGEMEN	24	5	25	2	40	
c:\ELRDB\B111S\000010JK.sc0	29	4	-21	-31	-3				-49	-92	?	INFRINGEMEN	24	5	25	3	40	
c:\ELRDB\B111S\000015JK.sc0	33	9	-13	-21	-3				-51	-73	?	INFRINGEMEN	24	5	25	4	40	
c:\ELRDB\B111S\000020JK.sc0	29	9	-13	-25	0				-55	-99	?	INFRINGEMEN	24	5	25	5	40	
c:\ELRDB\B111S\000025JK.sc0	35	5	-17	-25	-3				-55	-80	?	INFRINGEMEN	24	5	25	6	40	
c:\ELRDB\B111S\000030JK.sc0	36	-1	-14	-17	8				-56	-84	?	INFRINGEMEN	24	5	25	7	40	
c:\ELRDB\B111S\000035JK.sc0	36	3	3	-4	26		633	838	-43	-73	?	INFRINGEMEN	24	5	25	8	40	
c:\ELRDB\B111S\000040JK.sc0	61	22	8	2	18	772			-44	-70	?	INFRINGEMEN	24	5	25	9	40	
c:\ELRDB\B111S\000045JK.sc0	54	23	12	5	-8				-45	-75	?	INFRINGEMEN	24	5	25	10	40	
c:\ELRDB\B111S\000050JK.sc0	48	26	8	1	22	910			-50	-73	?	INFRINGEMEN	24	5	25	11	40	
c:\ELRDB\B111S\000055JK.sc0	12	6	-10	-15	9				-48	-73	?	INFRINGEMEN	24	5	25	12	40	
c:\ELRDB\B111S\000060JK.sc0	9	-12	-26	-34	-10				-46	-74	?	INFRINGEMEN	24	5	25	13	40	
c:\ELRDB\B111S\000065JK.sc0	15	1	-19	-28	-2	524			-43	-91	?	INFRINGEMEN	24	5	25	14	40	
c:\ELRDB\B111S\000070JK.sc0	-5	-10	-20	-27	-21				-43	-73	?	INFRINGEMEN	24	5	25	15	40	
c:\ELRDB\B111S\000075JK.sc0	2	-17	-27	-33	-13				-45	-97	?	INFRINGEMEN	24	5	25	16	40	
c:\ELRDB\B111S\000080JK.sc0	3	-6	-21	-29	-11				-47	-73	?	INFRINGEMEN	24	5	25	17	40	
c:\ELRDB\B111S\000085JK.sc0	17	3	-19	-28	4				-47	-87	?	INFRINGEMEN	24	5	25	18	40	
c:\ELRDB\B111S\000090JK.sc0	19	10	-16	-22	3				-53	-107	?	INFRINGEMEN	24	5	25	19	40	
c:\ELRDB\B111S\000095JK.sc0	21	5	-16	-21	8				-59	-126	?	INFRINGEMEN	24	5	25	20	40	
c:\ELRDB\B111S\000100JK.sc0	13	6	-11	-16	18				-53	-77	?	INFRINGEMEN	24	5	25	21	40	
c:\ELRDB\B111S\000105JK.sc0	1	-8	-27	-30	-1				-55	-87	?	INFRINGEMEN	24	5	25	22	40	
c:\ELRDB\B111S\000110JK.sc0	-2	-10	-26	-33	-6				-56	-87	?	INFRINGEMEN	24	5	25	23	40	
c:\ELRDB\B111S\000115JK.sc0	-1	-11	-16	-24	1	810			-56	-115	?	INFRINGEMEN	24	5	25	24	40	
c:\ELRDB\B111S\000120JK.sc0	-12	-24	-29	-33	7				-51	-75	?	INFRINGEMEN	24	5	25	25	40	
c:\ELRDB\B111S\000125JK.sc0	-13	-38	-32	-36	5		-8	16	-64	-118	?	INFRINGEMEN	24	5	25	26	40	
c:\ELRDB\B111S\000130JK.sc0	-10	-47	-30	-36	-7	269	305	342	-61	-88	?	INFRINGEMEN	24	5	25	27	40	
Vehicle List Track 1																		
c:\Vehicles Feb 15\Tube Static - C4 SPmin Tunnel and Platform Offside																		
Maximum vehicle speed is: Not Known																		
	C4 SP (Below 171mm)																	
	C4 SP Tunnel and Platfrom Offside (Above 171mm) END																	
	C4 SP Tunnel & Platform Offside (Above 171mm) CENTRE																	

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Clearance Log Track 1	**Local Database**																	
Job Number	**Description B112 SB**																	
Machine																		
User LU Track Engineering																		
Software Build Code 7.7.26																		
Run Date 05/11/2015																		
Normal Speed Clearance Profile	24 C1 Structures																	
Heights mm ARL	>2250	2250 -1000	1000 -700	700 -500	<500	>2250	2250 -1000	1000 -700	700 -500	<500								
Normal Clearances mm	0	0	0	0	0	0	0	0	0	0								
Failed Clearances mm	0	0	0	0	0	0	0	0	0	0								
High Speed Clearance Profile	24 C1 Structures																	
Heights mm ARL	>2250	2250 -1000	1000 -700	700 -500	<500	>2250	2250 -1000	1000 -700	700 -500	<500								
Normal Clearances mm	0	0	0	0	0	0	0	0	0	0								
Failed Clearances mm	0	0	0	0	0	0	0	0	0	0								
Run Start Time 14:50:00																		
Run Finish Date/Time 05/Nov/2015 14:54:11																		
Side	**LH Side**					**RH Side**												
Height	**>2250**	**2250 -10(**	**1000 -70(**	**700 -500**	**<500**	**>2250**	**2250 -10(**	**1000 -70(**	**700 -500**	**<500**	**Val**	**Check**	**Cl**	**Pro**	**Accurac**	**Lat Tols**	**Ageing**	**Seq**	**kph**
Segment	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**									
Filename																			
c:\ELRDB\B112S\000002JK.SC0	23	13	33	-6	26	53	34	194	-38	-72	?	INFRINGEMEN	24	5	25		1	40	
c:\ELRDB\B112S\000007JK.SC0	28	103	145	193	47	54	91	288	234	53	?	CLEAR	24	5	25		2	40	
c:\ELRDB\B112S\000012JK.SC0	46	104	151	191	50	35	64	263	209	-43	?	INFRINGEMEN	24	5	25		3	40	
c:\ELRDB\B112S\000017JK.SC0	61	132	177	209	44	62	89	56	74	-41	?	INFRINGEMEN	24	5	25		4	40	
c:\ELRDB\B112S\000022JK.SC0	29	95	149	186	38	51	92	260	196	47	?	CLEAR	24	5	25		5	40	
c:\ELRDB\B112S\000027JK.SC0	6	89	149	200	54	50	89	119	103	58	?	CLEAR	24	5	25		6	40	
c:\ELRDB\B112S\000032JK.SC0	18	89	141	186	37	37	86	214	82	58	?	CLEAR	24	5	25		7	40	
c:\ELRDB\B112S\000037JK.SC0	72	108	157	193	36	83	84	217	86	52	?	CLEAR	24	5	25		8	40	
c:\ELRDB\B112S\000042JK.SC0	27	100	148	180	32	62	72	218	103	61	?	CLEAR	24	5	25		9	40	
c:\ELRDB\B112S\000047JK.SC0	61	103	155	194	41	75	78	221	103	51	?	CLEAR	24	5	25		10	40	
c:\ELRDB\B112S\000052JK.SC0	29	72	142	183	41	66	66	166	108	47	?	CLEAR	24	5	25		11	40	
c:\ELRDB\B112S\000057JK.SC0	49	97	145	183	37	90	80	135	63	39	?	CLEAR	24	5	25		12	40	
c:\ELRDB\B112S\000062JK.SC0	51	81	131	177	34	68	99	125	58	55	?	CLEAR	24	5	25		13	40	
c:\ELRDB\B112S\000067JK.SC0	35	47	139	180	36	92	90	131	63	62	?	CLEAR	24	5	25		14	40	
c:\ELRDB\B112S\000072JK.SC0	53	97	121	175	35	82	86	117	47	38	?	CLEAR	24	5	25		15	40	
c:\ELRDB\B112S\000077JK.SC0	61	54	147	193	32	29	99	105	94	71	?	CLEAR	24	5	25		16	40	
c:\ELRDB\B112S\000082JK.SC0	27	100	146	169	41	44	84	226	99	63	?	CLEAR	24	5	25		17	40	
Vehicle List Track 1																			
c:\Vehicles Feb 15\Tube Static - C4 SPmin Tunnel and Platform Offside																			
Maximum vehicle speed is: Not Known																			
	C4 SP (Below 171mm)																		
	C4 SP Tunnel and Platfrom Offside (Above 171mm) END																		
	C4 SP Tunnel & Platform Offside (Above 171mm) CENTRE																		

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v. Northbound Twist & Wheel Unload

Wheel Unload Monitoring - Track Stations @ 2M Intervals

Input by	AV	Input Date	25/11/2015				
Checked		Checked					

Trigger values							
Wheel unload constants		12	166.7	35	286	40	5
2 metre	2.611	20	100	37	270.27	85	7
10 metre	0.650	25	80	40	250	100	10

	Cant		Twist					Vertical
Point No.	Cant (mm)	L/R	2m Track		10m Track		Wheel Unload (%)	Difference in level from baseline. Deviations over 5m (absolute) (mm)
			Twist (mm)	Gradient 1 in	Twist (mm)	Gradient 1 in		
1	59	R	*		*			
2	55	R	-4.0	*	*			
3	56	R	1.0	*	*			
4	54	R	-2.0	*	*			0.0
5	52	R	-2.0	*	*			0.0
6	56	R	4.0	500.0	-3.0	*	9.8	0.0
7	57	R	1.0	*	2.0	*	3.9	0.0
8	56	R	-1.0	*	0.0	*	-5.9	0.0
9	55	R	-1.0	*	1.0	*	-6.5	0.0
10	56	R	1.0	*	4.0	*	5.2	0.0
11	55	R	-1.0	*	-1.0	*	-7.8	0.0
12	52	R	-3.0	*	-5.0	*	-12.4	0.0
13	51	R	-1.0	*	-5.0	*	-7.8	0.0
14	49	R	-2.0	*	-6.0	*	-10.4	0.0
15	48	R	-1.0	*	-8.0	*	-10.4	0.0
16	47	R	-1.0	*	-8.0	*	-12.4	0.0
17	45	R	-2.0	*	-7.0	*	-15.6	0.0
18	43	R	-2.0	*	-8.0	*	-15.6	0.0
19	41	R	-2.0	*	-8.0	*	-16.3	0.0
20	36	R	-5.0	400.0	-12.0	*	-22.8	0.0
21	32	R	-4.0	*	-15.0	*	-22.1	0.0
22	29	R	-3.0	*	-16.0	*	-18.9	0.0
23	27	R	-2.0	*	-16.0	*	-17.6	0.0
24	24	R	-3.0	*	-17.0	*	-19.5	0.0
25	21	R	-3.0	*	-15.0	*	-19.5	0.0
26	14	R	-7.0	285.7	-18.0	*	-30.0	0.0
27	12	R	-2.0	*	-17.0	*	-16.3	0.0
28	8	R	-4.0	*	-19.0	*	-22.8	0.0
29	6	R	-2.0	*	-18.0	*	-16.9	0.0
30	3	R	-3.0	*	-18.0	*	-19.5	0.0
31	0		3.0	*	14.0	*	16.9	0.0
32	1	R	1.0	*	-11.0	*	5.2	0.0
33	0		1.0	*	8.0	*	7.8	0.0

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34	6	L	6.0	333.3	12.0	*	23.5	0.0
35	9	L	3.0	*	12.0	*	15.6	0.0
36	8	L	-1.0	*	8.0	*	-8.5	0.0
37	3	L	-5.0	400.0	4.0	*	-15.7	0.0
38	2	R	-5.0	400.0	2.0	*	-13.7	0.0
39	2	R	0.0	*	-8.0	*	-5.2	0.0
40	0		2.0	*	9.0	*	11.1	0.0
41	1	R	1.0	*	-9.0	*	3.3	0.0
42	1	R	0.0	*	-4.0	*	-2.6	0.0
43	1	R	0.0	*	-1.0	*	1.3	0.0
44	0		1.0	*	2.0	*	3.9	0.0
45	0		0.0	*	0.0	*	0.7	0.0
46	0		0.0	*	1.0	*	0.7	0.0
47	0		0.0	*	1.0	*	1.3	0.0
48	1	L	1.0	*	2.0	*	3.9	0.0
49	1	L	0.0	*	1.0	*	-1.3	0.0
50	1	L	0.0	*	1.0	*	-2.6	0.0
51	1	L	0.0	*	1.0	*	-3.2	0.0
52	2	L	1.0	*	2.0	*	3.9	0.0
53	2	L	0.0	*	1.0	*	0.7	0.0
54	1	R	-3.0	*	-2.0	*	-9.1	0.0
55	3	R	2.0	*	-4.0	*	7.8	0.0
56	4	R	1.0	*	-5.0	*	0.7	0.0
57	1	R	-3.0	*	-3.0	*	-9.8	0.0
58	2	L	3.0	*	0.0	*	7.8	0.0
59	3	L	1.0	*	4.0	*	5.2	0.0
60	1	L	-2.0	*	4.0	*	-4.6	0.0
61	1	R	-2.0	*	-3.0	*	-7.2	0.0
62	2	R	1.0	*	1.0	*	3.9	0.0
63	1	R	-1.0	*	-3.0	*	-4.6	0.0
64	0		1.0	*	3.0	*	4.6	0.0
65	0		0.0	*	1.0	*	1.9	0.0
66	0		0.0	*	1.0	*	0.7	0.0
67	0		0.0	*	2.0	*	1.3	0.0
68	1	R	1.0	*	0.0	*	3.9	0.0
69	2	R	1.0	*	2.0	*	5.2	0.0
70	3	R	1.0	*	3.0	*	6.5	0.0
71	1	R	-2.0	*	1.0	*	-4.6	0.0
72	0		1.0	*	0.0	*	3.9	0.0
73	1	L	1.0	*	2.0	*	3.9	0.0
74	2	L	1.0	*	4.0	*	5.2	0.0
75	3	L	1.0	*	6.0	*	6.5	0.0
76	1	L	-2.0	*	2.0	*	-7.8	0.0
77	2	R	-3.0	*	2.0	*	-8.5	0.0
78	3	R	1.0	*	-4.0	*	1.3	0.0
79	3	R	0.0	*	-5.0	*	-3.2	0.0
80	3	R	0.0	*	-6.0	*	-3.9	0.0
81	3	R	0.0	*	-4.0	*	-2.6	0.0
82	1	R	-2.0	*	-1.0	*	-5.9	0.0
83	1	R	0.0	*	-2.0	*	3.2	0.0
84	0		1.0	*	3.0	*	4.6	0.0
85	2	R	2.0	*	-1.0	*	6.5	0.0
86	0		2.0	*	3.0	*	7.2	0.0
87	3	L	3.0	*	4.0	*	10.4	0.0
88	4	L	1.0	*	5.0	*	5.9	0.0

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89	1	L	-3.0	*	1.0	*	-7.8	0.0
90	0		1.0	*	2.0	*	4.6	0.0
91	0		0.0	*	0.0	*	2.6	0.0
92	2	R	2.0	*	-5.0	*	7.2	0.0
93	2	R	0.0	*	-6.0	*	-3.9	0.0
94	1	L	3.0	*	0.0	*	7.8	0.0
95	3	L	2.0	*	3.0	*	7.2	0.0
96	4	L	1.0	*	4.0	*	5.2	0.0
97	1	L	-3.0	*	3.0	*	-15.6	0.0
98	1	L	0.0	*	3.0	*	-10.4	0.0
99	2	R	-3.0	*	-3.0	*	-9.8	0.0
100	4	R	2.0	*	-7.0	*	22.8	0.0
101	7	R	3.0	*	-11.0	*	29.3	0.0
102	11	R	4.0	*	-12.0	*	30.6	0.0
103	15	R	4.0	*	-16.0	*	29.9	0.0
104	22	R	7.0	285.7	20.0	*	37.1	0.0
105	31	R	9.0	222.2	27.0	370.4	41.0	0.0
106	40	R	9.0	222.2	33.0	303.0	44.9	0.0
107	42	R	2.0	*	31.0	322.6	25.4	0.0
108	45	R	3.0	*	30.0	333.3	27.3	0.0
109	51	R	6.0	333.3	29.0	344.8	34.5	0.0
110	54	R	3.0	*	23.0	434.8	22.8	0.0
111	60	R	6.0	333.3	20.0	500.0	28.7	0.0
112	59	R	-1.0	*	17.0	*	8.4	0.0
113	61	R	2.0	*	16.0	*	15.6	0.0
114	63	R	2.0	*	12.0	*	13.0	0.0

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vi. Southbound Twist & Wheel Unload

Wheel Unload Monitoring - Track Stations @ 2M Intervals

Input by	AV		Input Date	25/11/2015					
Checked			Checked						
Trigger values									
	Wheel unload constants		12	166.7	35	286	40	5	
	2 metre	2.611	20	100	37	270.27	85	7	
	10 metre	0.650	25	80	40	250	100	10	

	Cant		Twist					Vertical
Point No.	Cant (mm)	L/R	2m Track		10m Track		Wheel Unload (%)	Difference in level from baseline. Deviations over 5m (absolute) (mm)
			Twist (mm)	Gradient 1 in	Twist (mm)	Gradient 1 in		
1	41	L	*		*			
2	42	L	1.0	*	*			
3	43	L	1.0	*	*			
4	40	L	-3.0	*	*			0.0
5	46	L	6.0	333.3	*			0.0
6	41	L	-5.0	400.0	0.0	*	-13.1	0.0
7	41	L	0.0	*	-1.0	*	-0.7	0.0
8	43	L	2.0	*	0.0	*	5.2	0.0
9	45	L	2.0	*	5.0	*	8.5	0.0
10	43	L	-2.0	*	-3.0	*	-7.2	0.0
11	42	L	-1.0	*	1.0	*	-2.0	0.0
12	41	L	-1.0	*	0.0	*	-2.6	0.0
13	41	L	0.0	*	-2.0	*	1.3	0.0
14	41	L	0.0	*	-4.0	*	3.2	0.0
15	43	L	2.0	*	0.0	*	6.5	0.0
16	44	L	1.0	*	2.0	*	3.9	0.0
17	41	L	-3.0	*	0.0	*	-7.8	0.0
18	43	L	2.0	*	2.0	*	6.5	0.0
19	46	L	3.0	*	5.0	*	11.1	0.0
20	45	L	-1.0	*	2.0	*	-2.6	0.0
21	42	L	-3.0	*	-2.0	*	-9.1	0.0
22	41	L	-1.0	*	0.0	*	-2.6	0.0
23	43	L	2.0	*	0.0	*	7.8	0.0
24	44	L	1.0	*	-2.0	*	4.6	0.0
25	45	L	1.0	*	0.0	*	3.3	0.0
26	44	L	-1.0	*	2.0	*	-3.3	0.0
27	45	L	1.0	*	4.0	*	5.2	0.0
28	47	L	2.0	*	4.0	*	7.8	0.0
29	47	L	0.0	*	3.0	*	-3.9	0.0
30	46	L	-1.0	*	1.0	*	-8.5	0.0
31	43	L	-3.0	*	-1.0	*	-14.3	0.0
32	42	L	-1.0	*	-3.0	*	-6.5	0.0
33	41	L	-1.0	*	-6.0	*	-6.5	0.0

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34	41	L	0.0	*	-6.0	*	-3.9	0.0
35	37	L	-4.0	*	-9.0	*	-16.3	0.0
36	33	L	-4.0	500.0	-10.0	*	-16.9	0.0
37	36	L	3.0	*	-6.0	*	3.9	0.0
38	39	L	3.0	*	-2.0	*	6.5	0.0
39	37	L	-2.0	*	-4.0	*	-7.8	0.0
40	29	L	-8.0	250.0	-8.0	*	-26.1	0.0
41	27	L	-2.0	*	-6.0	*	-9.1	0.0
42	29	L	2.0	*	-7.0	*	6.5	0.0
43	30	L	1.0	*	-9.0	*	3.3	0.0
44	33	L	3.0	*	-4.0	*	6.5	0.0
45	33	L	0.0	*	4.0	*	2.6	0.0
46	33	L	0.0	*	6.0	*	3.9	0.0
47	31	L	-2.0	*	2.0	*	-5.2	0.0
48	31	L	0.0	*	1.0	*	2.6	0.0
49	31	L	0.0	*	-2.0	*	1.9	0.0
50	30	L	-1.0	*	-3.0	*	-4.6	0.0
51	30	L	0.0	*	-3.0	*	-1.9	0.0
52	31	L	1.0	*	0.0	*	2.6	0.0
53	35	L	4.0	*	4.0	*	13.0	0.0
54	34	L	-1.0	*	3.0	*	-2.6	0.0
55	33	L	-1.0	*	3.0	*	-2.6	0.0
56	30	L	-3.0	*	0.0	*	-7.8	0.0
57	29	L	-1.0	*	-2.0	*	-3.9	0.0
58	31	L	2.0	*	-4.0	*	7.2	0.0
59	34	L	3.0	*	0.0	*	7.8	0.0
60	33	L	-1.0	*	0.0	*	-3.9	0.0
61	30	L	-3.0	*	0.0	*	-7.8	0.0
62	34	L	4.0	*	5.0	*	13.7	0.0
63	34	L	0.0	*	3.0	*	-2.6	0.0
64	31	L	-3.0	*	-3.0	*	-10.4	0.0
65	31	L	0.0	*	-2.0	*	-2.6	0.0
66	35	L	4.0	*	5.0	*	13.7	0.0
67	36	L	1.0	*	2.0	*	-5.8	0.0
68	30	L	-6.0	333.3	-4.0	*	-18.9	0.0
69	27	L	-3.0	*	-4.0	*	-10.4	0.0
70	27	L	0.0	*	-4.0	*	-2.6	0.0
71	24	L	-3.0	*	-11.0	*	-15.0	0.0
72	23	L	-1.0	*	-13.0	*	-11.1	0.0
73	25	L	2.0	*	-5.0	*	7.2	0.0
74	27	L	2.0	*	0.0	*	7.2	0.0
75	28	L	1.0	*	1.0	*	3.9	0.0
76	29	L	1.0	*	5.0	*	5.9	0.0
77	29	L	0.0	*	6.0	*	3.9	0.0
78	28	L	-1.0	*	3.0	*	-3.9	0.0
79	30	L	2.0	*	3.0	*	7.2	0.0
80	30	L	0.0	*	2.0	*	-3.9	0.0
81	29	L	-1.0	*	0.0	*	-5.9	0.0
82	28	L	-1.0	*	-1.0	*	-3.3	0.0
83	26	L	-2.0	*	-2.0	*	-6.5	0.0
84	24	L	-2.0	*	-6.0	*	-9.1	0.0
85	24	L	0.0	*	-6.0	*	-3.9	0.0
86	24	L	0.0	*	-5.0	*	3.9	0.0
87	27	L	3.0	*	-1.0	*	10.4	0.0
88	28	L	1.0	*	2.0	*	5.9	0.0
89	28	L	0.0	*	4.0	*	2.6	0.0

90	28	L	0.0	*	4.0	*	2.6	0.0
91	30	L	2.0	*	6.0	*	9.1	0.0
92	31	L	1.0	*	4.0	*	5.2	0.0
93	33	L	2.0	*	5.0	*	8.5	0.0
94	31	L	-2.0	*	3.0	*	-5.9	0.0
95	28	L	-3.0	*	0.0	*	-7.8	0.0
96	28	L	0.0	*	-2.0	*	3.2	0.0
97	29	L	1.0	*	-2.0	*	2.6	0.0
98	27	L	-2.0	*	-6.0	*	-9.1	0.0
99	30	L	3.0	*	-1.0	*	7.2	0.0
100	33	L	3.0	*	5.0	*	11.1	0.0
101	33	L	0.0	*	5.0	*	3.2	0.0
102	29	L	-4.0	*	0.0	*	-11.1	0.0
103	28	L	-1.0	*	1.0	*	-2.6	0.0
104	29	L	1.0	*	-1.0	*	2.6	0.0
105	30	L	1.0	*	-3.0	*	2.6	0.0
106	30	L	0.0	*	-3.0	*	-1.9	0.0
107	28	L	-2.0	*	-1.0	*	-5.9	0.0
108	28	L	0.0	*	0.0	*	0.7	0.0
109	29	L	1.0	*	0.0	*	2.6	0.0
110	30	L	1.0	*	0.0	*	2.6	0.0
111	29	L	-1.0	*	-1.0	*	-3.3	0.0
112	31	L	2.0	*	3.0	*	7.2	0.0
113	29	L	-2.0	*	1.0	*	-5.2	0.0
114	29	L	0.0	*	0.0	*	0.0	0.0

APPENDIX F RESULTS OF MEASURED MONITORING OF TUNNEL AND STATION